# CHAPTER 4
# SHORT-TERM ENVIRONMENTAL CONSEQUENCES

Chapter 4 presents the potential short-term impacts on the existing natural and human environment and on human health of implementing reasonable alternatives for each of the following: (1) tank waste retrieval, treatment, and disposal and single-shell tank system closure at the Hanford Site (Hanford); (2) decommissioning of the Fast Flux Test Facility and auxiliary facilities and disposition of Hanford's inventory of radioactively contaminated bulk sodium; and (3) management of waste resulting from other Hanford activities and limited volumes from other U.S. Department of Energy sites. Impact analyses of the alternatives and options considered for each of the three sets of proposed actions are presented separately in Sections 4.1, 4.2, and 4.3, respectively. Impacts analyses are grouped first by resource area or discipline (e.g., land resources) and then by alternative so that impacts can be meaningfully compared across alternatives. All disciplines were analyzed in a manner commensurate with their importance and the expected level of impact on them under a specific alternative—the sliding-scale assessment approach. The combined impacts of implementing selected alternatives from each of the three sets of proposed actions are presented in Section 4.4. Cumulative impacts associated with the alternative combinations are presented in Chapter 6. Mitigation measures to reduce the potential for environmental impacts are summarized in Chapter 7, Section 7.1. Analyses of comparative impacts across the alternatives are presented in Chapter 7, Sections 7.2 through 7.4. A detailed discussion of each alternative is provided in Chapter 2, Section 2.5, and a comparison of the environmental effects between alternatives is presented in Chapter 2, Section 2.7.

## 4.1 TANK CLOSURE ALTERNATIVES

This section describes the potential short-term environmental and human health impacts associated with implementation of each of the 11 Tank Closure alternatives considered in this *Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (TC & WM EIS)* for retrieving and treating the tank waste inventory generated during the defense production years at the Hanford Site (Hanford). The impact analyses also consider different closure scenarios associated with the single-shell tank (SST) system.

**Dates for Alternatives**

The dates referenced in this environmental impact statement (EIS) for the alternatives were selected to support relationships between, and durations for, activities, thus allowing comparisons of the alternatives. They do not necessarily represent the current dates. For example, this EIS used a Waste Treatment Plant (WTP) startup date of 2018; the current WTP startup date is 2022. Note that the durations, rather than the startup dates, of the activities evaluated in this EIS are of the most significance. As this EIS evaluates modeling from 1944 through 11,944, the dates provide a reference for past, current, and future activities.

Tank Closure Alternative 1: No Action reflects the environmental baseline against which the impacts of the other action alternatives can be compared. Under Alternative 1, the U.S. Department of Energy (DOE) assumes for analysis purposes that construction of the River Protection Project Waste Treatment Plant (WTP) would be terminated in 2008. Therefore, it is expected that short-term incremental impacts would peak in the 2006–2008 timeframe during WTP construction. It is also expected that subsequent incremental impacts would be very small for most of the disciplines analyzed over the ensuing 100-year administrative control period assumed in the analysis. During this period, proposed activities would be conducted at existing facilities in developed areas; no new land disturbance would take place; proposed activities would be consistent with current operations; and routine gaseous and effluent emissions would generally continue in accordance with governing regulatory requirements, resulting in little incremental impact.

In contrast, Alternatives 2 through 6 would involve the construction, subsequent operation, and eventual deactivation of new facilities over varying timeframes (ranging from 34 years to 161 years) in the 200-East and 200-West Areas of Hanford to support tank waste retrieval, treatment, and disposal. Except for Alternative 2A, each of these alternatives also analyzes closure of the Hanford SST system by means of either landfill closure (i.e., construction of a surface barrier) or selective or full clean closure

(i.e., removal) of the SST system and associated waste and contaminated soils. Each of the 11 Tank Closure alternatives (Alternatives 1 through 6C) is described in detail in Chapter 2, Section 2.5.

### 4.1.1 Land Resources

In contrast to Alternative 1, Alternatives 2 through 6C would involve the construction, subsequent operation, and eventual deactivation of new facilities over varying timeframes in the 200-East and 200-West Areas of Hanford to support tank waste retrieval, treatment, and disposal. The major new project facilities and infrastructure components that would be constructed or upgraded to support the implementation of each Tank Closure alternative are summarized in Table 4–1. Facility locations and affected Hanford areas are depicted in Figures 4–1 and 4–2.

**Table 4–1. Summary of Major New Facilities Required to Support Tank Closure Alternatives**

| Facility | Alternative | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2A | 2B | 3A | 3B | 3C | 4 | 5 | 6A | 6B | 6C |
| Bulk Vitrification Facility (200-East Area) | | | | X | | | | | | | |
| Bulk Vitrification Facility (200-West Area) | | | | X | | | X | X | | | |
| Canister Storage Building completion | (a) | X | X | X | X | X | X | X | X | X | X |
| Cast Stone Facility (200-East Area) | | | | | X | | X | X | | | |
| Cast Stone Facility (200-West Area) | | | | | X | | | | | | |
| Cesium and Strontium Capsule Processing Facility | | X | X | X | X | X | X | X | X | X | X |
| Chemical wash system | | | | | | | X | | X | X | |
| CH-Mixed TRU Waste Facilities | | | | X | X | X | X | X | | | |
| Containment structures | | | X | X | X | X | X | | X | X | X |
| Double-shell tanks (new) | | | | | | | | X | | | |
| Double-shell tank replacement(s) | | X[b] | | | | | | | X[c] | | |
| Effluent Treatment Facility replacement(s) | | X[b] | X | X | X | X | X | X | X[c] | X[d] | X |
| Hanford landfill barrier | | | | | | | | X | | | |
| HLW Debris Storage Facilities | | | | | | | | | X | X | |
| HLW Melter Interim Storage Facilities | | X | X | X | X | X | X | X | X | X | X |
| IHLW Interim Storage Modules | | X | X | X | X | X | X | X | X | X | X |
| IHLW Interim Storage Module replacement(s) | | | | | | | | | X[c] | | |
| IHLW Shipping/Transfer Facility | | X | X | X | X | X | X | X | X | X | X |
| IHLW Shipping/Transfer Facility replacement(s) | | | | | | | | | X[c] | | |
| ILAW Interim Storage Facilities | | | | | | | | | | X | X |
| LAW Vitrification Facility expansion | | | X | | | | | | | X | X |
| Mobile retrieval systems | | X | X | X | X | X | X | X | X | X | X |
| Modified RCRA Subtitle C barrier[e] | | | X | X | X | X | X | | X | | X |
| Modified sluicing retrieval systems | | X | X | X | X | X | | X | | | X |
| Preprocessing Facility | | | | | | | X | | X | X | |
| RH-Mixed TRU Waste Facility | | | | X | X | X | X | X | | | |
| Solid-Liquid Separations Facility (200-West Area) | | | | X | X | X | X | X | | | |
| Steam Reforming Facility (200-West Area) | | | | | | X | | | | | |
| Steam Reforming Facility (200-East Area) | | | | | | X | | | | | |
| Sulfate Removal Facility | | | | | | | | X | | | |
| TRU Waste Interim Storage Facility | | | | X | X | X | X | X | | | |
| Underground transfer lines | | X | X | X | X | X | X | X | X | X | X |
| Underground transfer line replacement | | X[b] | | | | | | | X[c] | | |

**Table 4–1. Summary of Major New Facilities Required to Support Tank Closure Alternatives (*continued*)**

| Facility | Alternative | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2A | 2B | 3A | 3B | 3C | 4 | 5 | 6A | 6B | 6C |
| Vacuum-based retrieval systems | | X | X | X | X | X | X | X | X | X | X |
| Waste receiver facilities | | | X | X | X | X | X | X | | X | X |
| Waste Treatment Plant completion[f] | (a) | X | X | X | X | X | X | X | X | X | X |
| Waste Treatment Plant replacement(s) | | X[b] | | | | | | | X[c] | | |
| 242-A Evaporator replacement(s) | | X[b] | X | X | X | X | X | X | X[c] | X | X |

[a] Construction of the Waste Treatment Plant and Canister Storage Building would be terminated, and no tank waste would be retrieved and treated under this alternative.

[b] The operating timeframe under this alternative requires a one-time total replacement of these facilities and associated infrastructure, except for two replacements of the Effluent Treatment Facility.

[c] The operating timeframe under this alternative (Base and Option Cases) requires two replacements of the Waste Treatment Plant, three replacements of the IHLW Shipping/Transfer Facility and IHLW Interim Storage Modules, three replacements of 28 double-shell tanks, five replacements of the Effluent Treatment Facility, one replacement of the underground transfer lines and associated infrastructure, and six replacements of the 242-A Evaporator.

[d] The operating timeframe under this alternative (Base and Option Cases) requires three replacements of the Effluent Treatment Facility.

[e] The engineered landfill closure barrier would be a surface structure constructed in five "lobes"—three in the 200-West Area covering tank farms (1) T, TY, and TX (T Barrier); (2) U (U Barrier); and (3) SY, S, and SX (S Barrier), and two much larger lobes in the 200-East Area covering tank farms (4) B, BY, and BX (B Barrier); and (5) AN, AZ, AX, AY, A, AW, AP, and C (A Barrier). The barriers would also cover six sets of cribs and trenches (ditches) including the B Cribs, BX Trenches, BY Cribs, T Cribs, T Trenches, TX Trenches, and TY Cribs, with the T and TX Trenches considered one set. Under Alternative 6A, the modified RCRA Subtitle C barrier would be constructed under only the Base Option.

[f] The completed Waste Treatment Plant would consist of two HLW and two LAW melters under Alternatives 2A, 3A, 3B, and 4; two HLW and three LAW melters under Alternative 5; two HLW and six LAW melters under Alternatives 2B, 6B, and 6C; and five HLW melters under Alternative 6A.

**Note:** See Figures 4–1 and 4–2 for locations.

**Key:** CH=contact-handled; Hanford=Hanford Site; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; RCRA=Resource Conservation and Recovery Act; RH=remote-handled; TRU=transuranic.

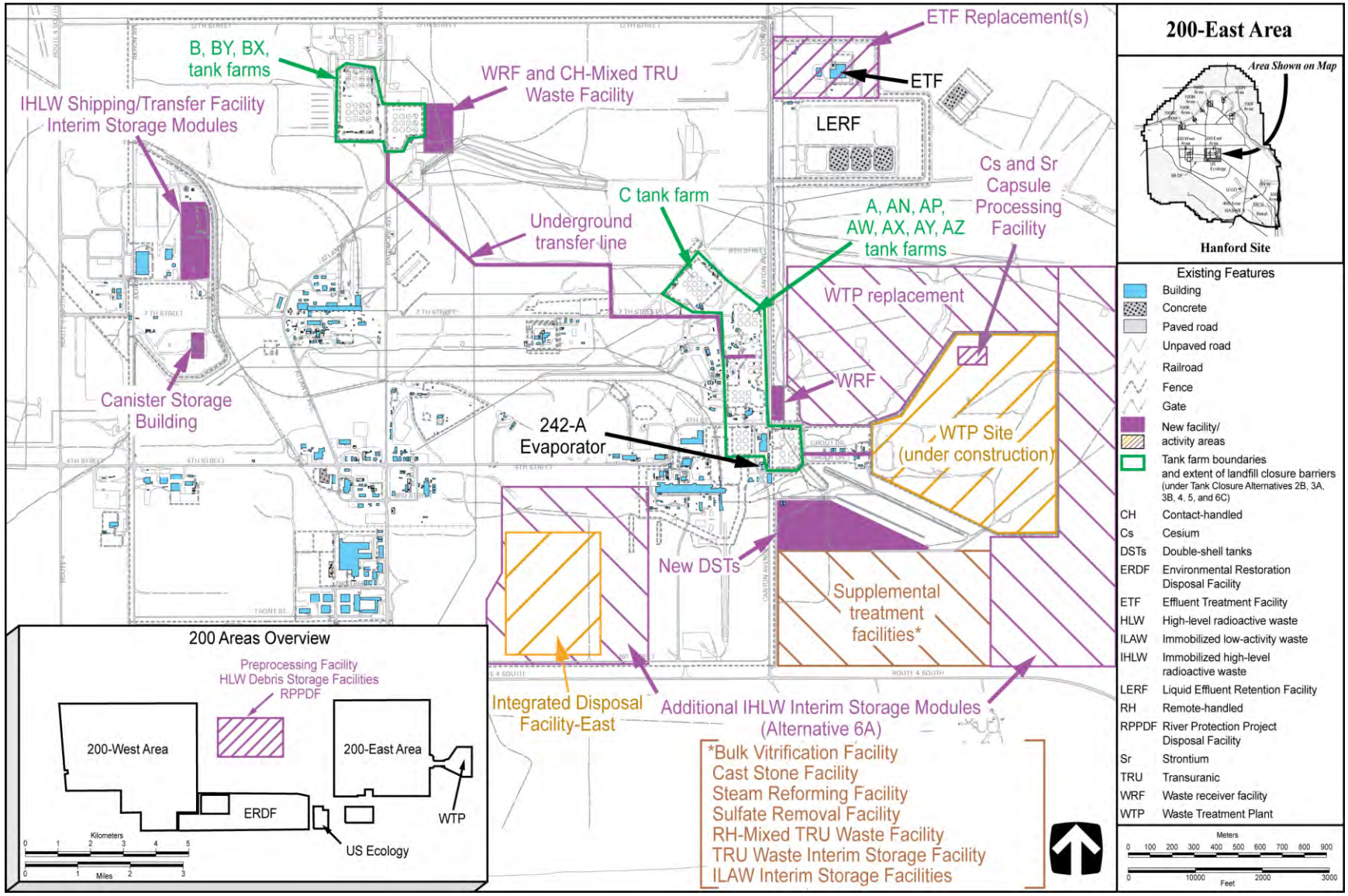


**Figure 4–1. 200-East Area New Facility Locations and Affected Areas**

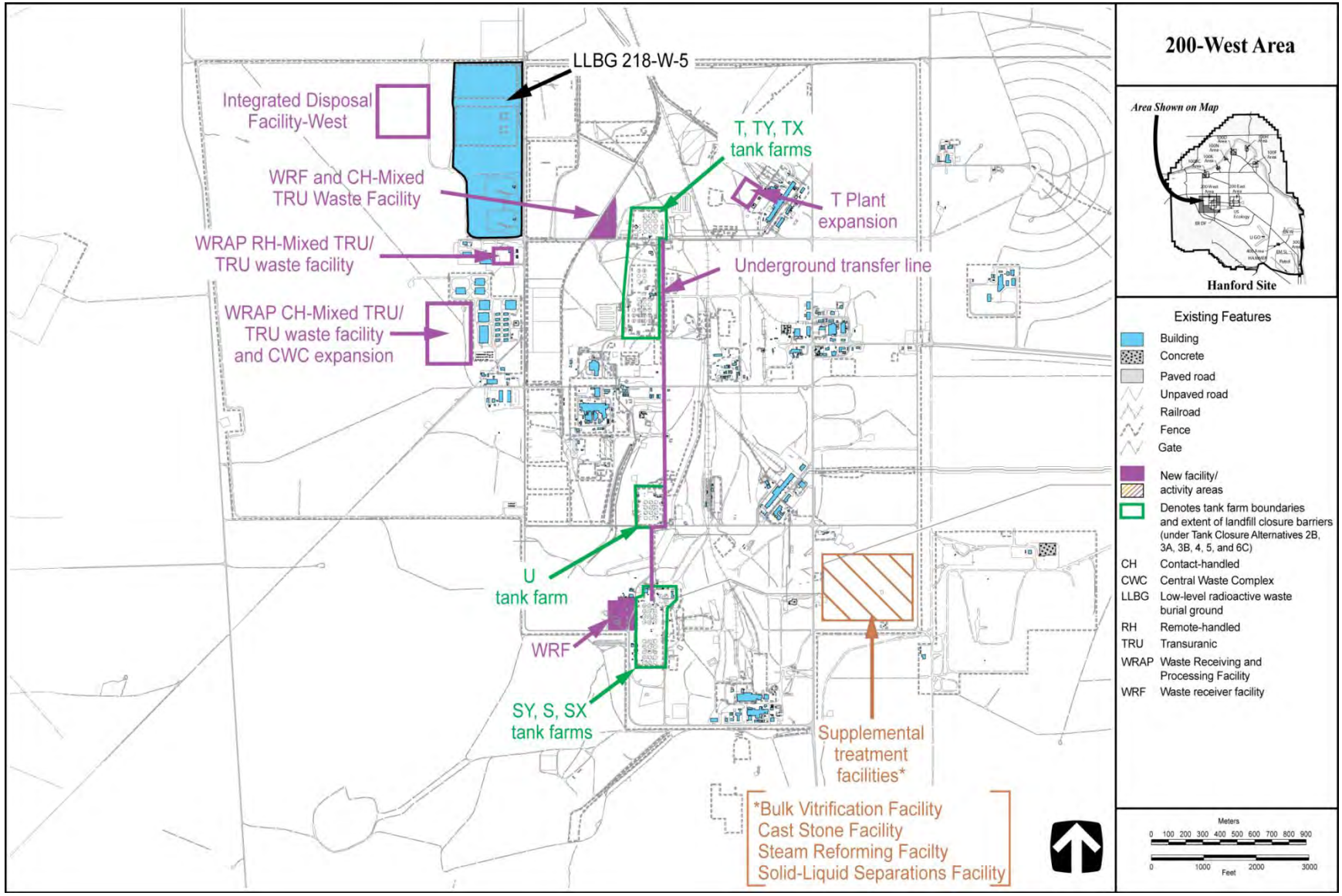


**Figure 4–2. 200-West Area New Facility Locations and Affected Areas**

#### 4.1.1.1 Alternative 1: No Action

##### 4.1.1.1.1 Land Use

Under the No Action Alternative, no new facility construction would be initiated within either the 200-East or 200-West Area. Construction of the WTP and Canister Storage Building would be terminated (see Chapter 2, Section 2.5.2.1). Ongoing tank system upgrades within existing facilities and related construction projects would also end. Thus, the present industrial status of the 200 Areas would remain unchanged, as would its land use designation as Industrial-Exclusive.

Implementation of this alternative would entail a long-term commitment of land within the 200 Areas. The 17 hectares (42 acres) of land encompassing the existing 18 tank farms and six sets of cribs and trenches (ditches) (i.e., B Cribs, BX Trenches, BY Cribs, T Cribs and Trenches, TX Trenches, and TY Cribs) would be indefinitely committed to waste management use following the DOE 100-year administrative control period, as no tank waste would be retrieved, treated, or disposed of under this alternative.

The No Action Alternative would require that geologic material be excavated from the 926.3-hectare (2,289-acre) Borrow Area C for use in activities such as tank stabilization and WTP closure. The amount of material required would necessitate the development of 2 hectares (5 acres) of Borrow Area C. Borrow Area C has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement (Hanford Comprehensive Land-Use Plan EIS)*, including the 2008 supplement analysis (DOE 1999, 2008) and Records of Decision (RODs) (64 FR 61615; 73 FR 55824).

##### 4.1.1.1.2 Visual Resources

Implementation of the No Action Alternative would not result in new construction within the 200 Areas. Accordingly, the industrial appearance of the 200-East and 200-West Areas from State Route 240 and nearby higher elevations (i.e., Gable Mountain, Gable Butte, and Rattlesnake Mountain) would remain unchanged, as would the U.S. Bureau of Land Management (BLM) Visual Resource Management Class IV rating.

As noted above, 2 hectares (5 acres) of Borrow Area C would be excavated under the No Action Alternative. Although development would not dominate the view from State Route 240 or nearby higher elevations, it would attract the attention of the viewer. Thus, the BLM visual resource management rating of Borrow Area C and the vicinity would change from Class II to Class III.

#### 4.1.1.2 Alternative 2A: Existing WTP Vitrification; No Closure

##### 4.1.1.2.1 Land Use

In addition to completion of the WTP, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. All of these facilities would be located either within or immediately adjacent to the 200-East or 200-West Area. In all cases, they would be located within the 5,064-hectare (12,513-acre) area of the 200 Area Plateau designated Industrial-Exclusive. In total, new facilities would occupy 33.9 hectares (83.8 acres), all but 3.2 hectares (8 acres) of which would be located within or adjacent to the 200-East Area (see Figures 4–1 and 4–2). Thus, about 0.7 percent of the land within the Industrial-Exclusive land area would be affected. During operations, impacts on land use would be minimal, as all activities would take place within the Industrial-Exclusive area.

Implementation of this alternative would entail a commitment of land within the area designated as Industrial-Exclusive over the long term. In addition to the 33.9 hectares (83.8 acres) of land that would be required for new facilities and infrastructure, 17 hectares (42 acres) of the land encompassing the existing 18 tank farms (including the six sets of cribs and trenches [ditches]) would be indefinitely committed to waste management use following the DOE 100-year administrative control period, as no SST system closure would take place under this alternative. Taken together, this would entail a total land commitment of 50.9 hectares (126 acres), or 1 percent of the area designated as Industrial-Exclusive.

Alternative 2A would require excavation of geologic material from Borrow Area C for use in activities associated with new construction, tank waste disposal activities, and tank stabilization. The amount of material required would necessitate the development of 29.1 hectares (72 acres), or 3.1 percent of the area. Borrow Area C has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.2.2 Visual Resources

As all construction and operational activities associated with this alternative would occur either within or immediately adjacent to the 200-East and 200-West Areas, which are already developed as industrial sites, there would be little change in their overall visual character. There would be a negligible impact on the view from State Route 240, as the changes in the 200-East Area would not be visible from the roadway, and the only change in the 200-West Area would be construction of an underground transfer line. The views from nearby higher elevations (i.e., Gable Mountain, Gable Butte, and Rattlesnake Mountain), which are important to American Indians with cultural ties to Hanford, would also remain largely unchanged. Further, the overall BLM Visual Resource Management Class IV rating of the 200 Areas would not change under this alternative.

As noted above, 29.1 hectares (72 acres) of Borrow Area C would be excavated under this alternative. Development of Borrow Area C would be readily visible from State Route 240 and Rattlesnake Mountain and would result in the BLM visual resource management rating changing from Class II to Class IV. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact.

### 4.1.1.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

#### 4.1.1.3.1 Land Use

In addition to completion of the WTP with expanded low-activity waste (LAW) vitrification capacity, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. The 18 tank farms and six sets of cribs and trenches (ditches) would also be covered by modified Resource Conservation and Recovery Act (RCRA) Subtitle C landfill barriers (see Chapter 2, Section 2.5.2.2.2). All of these facilities would be located either within or immediately adjacent to the 200-East or 200-West Area and would be within the area designated as Industrial-Exclusive. In total, new facilities would occupy 16.7 hectares (41.3 acres)—13 hectares (32.2 acres) in or adjacent to the 200-East Area and 3.7 hectares (9.1 acres) in the 200-West Area (see Figures 4–1 and 4–2). Thus, about 0.3 percent of the land within the Industrial-Exclusive area would be affected. During the operational and closure phases of the project, impacts on land use would be minimal, as all activities would take place within the Industrial-Exclusive area.

Implementation of this alternative would entail a commitment of land designated as Industrial-Exclusive over the long term. In addition to the 16.7 hectares (41.3 acres) of land that would be committed to new facilities and infrastructure, an additional 84.2 hectares (208 acres) of land encompassed by the

boundaries of the five modified RCRA Subtitle C barriers would be indefinitely committed to waste management use following the DOE 100-year postclosure care period. Taken together, this would entail a total land commitment of 101 hectares (249 acres), or 2 percent of the area designated as Industrial-Exclusive.

Alternative 2B would require excavation of geologic material from Borrow Area C for use in activities associated with construction of new facilities, disposal of tank waste, and placement of the modified RCRA Subtitle C barriers. The amount of material required would necessitate the development of 95.1 hectares (235 acres), or about 10 percent of the area. Although development of Borrow Area C would represent a change in the current land use, this area has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.3.2 Visual Resources

In general, impacts on visual resources would be similar to those described in Section 4.1.1.2.2 under Alternative 2A; however, as part of landfill closure, containment structures would be built over the BX and SX tank farms in the 200-East and 200-West Areas to support removal of the upper 4.6 meters (15 feet) of contaminated soil. Upon completion of activities in these tank farms, both structures would be removed. Closure would also result in the tank farms being covered with modified RCRA Subtitle C barriers. The 200-East Area containment structure and closure barriers would be visible only from nearby higher elevations, while the 200-West Area containment structure and closure barriers would be visible from State Route 240 and nearby higher elevations. However, as the 200 Areas are currently industrial sites, the BLM Visual Resource Management Class IV rating would not change under this alternative.

Under this alternative, 95.1 hectares (235 acres) of Borrow Area C would be excavated. Development of Borrow Area C would be readily visible from State Route 240 and Rattlesnake Mountain and would result in the BLM visual resource management rating changing from Class II to Class IV. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact.

### 4.1.1.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

#### 4.1.1.4.1 Land Use

In addition to completion of the WTP, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. A modified RCRA Subtitle C landfill barrier also would be constructed over all 18 tank farms and six sets of cribs and trenches (ditches) (see Chapter 2, Section 2.5.2.3.1). Similar to the previously described alternatives, all facilities would be located within or adjacent to the 200-East and 200-West Areas and would be within the area designated as Industrial-Exclusive. In total, new facilities would occupy 16.3 hectares (40.4 acres)—12.2 hectares (30.1 acres) in or adjacent to the 200-East Area and 4.2 hectares (10.3 acres) in the 200-West Area (see Figures 4–1 and 4–2). Thus, about 0.3 percent of the land within the Industrial-Exclusive area would be affected. As all activities would take place within the Industrial-Exclusive area and only a small part of the area would be affected, the impacts of this alternative on land use would be minimal.

Implementation of this alternative would entail a commitment of land designated as Industrial-Exclusive over the long term. In addition to the 16.3 hectares (40.4 acres) of land that would be committed to new facilities and infrastructure, an additional 84.2 hectares (208 acres) of land encompassed by the boundaries of the five modified RCRA Subtitle C barriers would be indefinitely committed to waste management use following the DOE 100-year postclosure care period. Taken together, this would entail

a total land commitment of 100 hectares (248 acres), or 2 percent of the area designated as Industrial-Exclusive.

Under this alternative, it would be necessary to supply geologic material from Borrow Area C for the construction of facilities, the disposal of tank waste, and the placement of the modified RCRA Subtitle C barriers. In total, 100 hectares (247 acres), or about 11 percent of the land within Borrow Area C, would be excavated. Borrow Area C has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.4.2 Visual Resources

Impacts on visual resources would be similar to those described in Section 4.1.1.3.2 under Alternative 2B. Construction, operations, and closure activities associated with this alternative would not greatly change the industrial nature of the view from State Route 240 or nearby higher elevations. Thus, the BLM Visual Resource Management Class IV rating for the 200 Areas would not change. Although an additional 4.9 hectares (12 acres) of land within Borrow Area C would be disturbed under this alternative, the visual impacts of developing the site would be similar to those described under Alternative 2B.

### 4.1.1.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

#### 4.1.1.5.1 Land Use

Under this alternative, new facilities would be similar to those under Alternative 3A, except the Cast Stone Facilities would be built instead of Bulk Vitrification Facilities (see Table 4–1 and Chapter 2, Section 2.5.2.3.2). Similar to the previously described alternatives, all facilities would be located within or adjacent to the 200-East and 200-West Areas and would be within the area designated as Industrial-Exclusive. In total, new facilities under this alternative would occupy 17.2 hectares (42.6 acres)—12.6 hectares (31.2 acres) in or adjacent to the 200-East Area and 4.6 hectares (11.4 acres) in the 200-West Area (see Figures 4–1 and 4–2). Thus, about 0.3 percent of the land within the Industrial-Exclusive area would be affected.

Implementation of this alternative would entail a commitment of land designated as Industrial-Exclusive over the long term. In addition to the 17.2 hectares (42.6 acres) of land that would be committed to new facilities and infrastructure, an additional 84.2 hectares (208 acres) encompassed by the boundaries of the five modified RCRA Subtitle C barriers would be indefinitely committed to waste management use following the DOE 100-year postclosure care period. Taken together, this would entail a total land commitment of 102 hectares (251 acres), or 2 percent of the area designated Industrial-Exclusive.

Under Alternative 3B, 92.3 hectares (228 acres), or about 10 percent of Borrow Area C, would be excavated to supply the geologic material needed for new facilities' construction, tank waste disposal activities, and placement of the modified RCRA Subtitle C barriers. Although development of Borrow Area C would represent a change in the current land use, this area has been designated as Conservation (Mining), and its use as a borrow pit would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.5.2 Visual Resources

Impacts on visual resources would be similar to those described in Section 4.1.1.4.2 under Alternative 3A. Construction, operations, deactivation, and closure activities associated with this

alternative would not greatly change the industrial nature of the view from State Route 240 or nearby higher elevations. Thus, the BLM Visual Resource Management Class IV rating for the 200 Areas would not change. Although the land requirement in Borrow Area C would be somewhat less (i.e., 7.7 hectares [19 acres]) under Alternative 3B, visual impacts generally would be similar to those described under Alternative 3A.

#### 4.1.1.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

##### 4.1.1.6.1 Land Use

Under this alternative, new facilities would be similar to those under Alternative 3A, except the Steam Reforming Facilities would be built instead of Bulk Vitrification Facilities (see Table 4–1 and Chapter 2, Section 2.5.2.3.3). All facilities would be located within or adjacent to the 200-East and 200-West Areas and would be within the area designated as Industrial-Exclusive. In total, new facilities under this alternative would occupy 17.2 hectares (42.4 acres)—12.8 hectares (31.7 acres) in or adjacent to the 200-East Area and 4.3 hectares (10.7 acres) in the 200-West Area (see Figures 4–1 and 4–2). Thus, about 0.3 percent of the land within the Industrial-Exclusive area would be affected.

Implementation of this alternative would entail a commitment of land designated as Industrial-Exclusive over the long term. In addition to the 17.2 hectares (42.4 acres) of land that would be committed to new facilities and infrastructure, an additional 84.2 hectares (208 acres) encompassed by the boundaries of the five modified RCRA Subtitle C barriers would be indefinitely committed to waste management use following the DOE 100-year postclosure care period. Taken together, this would entail a total land commitment of 101 hectares (250 acres), or 2 percent of the area designated as Industrial-Exclusive.

Alternative 3C would require excavation of geologic material from Borrow Area C for use in activities associated with construction of new facilities, disposal of tank waste, and placement of the modified RCRA Subtitle C barriers. The amount of material required would necessitate the development of 92.7 hectares (229 acres), or about 10 percent of the area. Borrow Area C has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

##### 4.1.1.6.2 Visual Resources

Impacts on visual resources would be similar to those described in Section 4.1.1.4.2 under Alternative 3A. Construction, operations, deactivation, and closure activities associated with this alternative would not greatly change the industrial nature of the view from State Route 240 or nearby higher elevations. Thus, the BLM Visual Resource Management Class IV rating for the 200 Areas would not change. Because nearly the same amount of geologic material would be required under Alternative 3C (92.7 hectares [229 acres]) as under Alternative 3B (92.3 hectares [228 acres]), visual impacts would be similar to those described under Alternative 3B.

#### 4.1.1.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

##### 4.1.1.7.1 Land Use

In addition to completing the WTP, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. Additionally, modified RCRA Subtitle C landfill barriers would be placed over the 10 tank farms that would not be clean-closed and the six sets of cribs and trenches (ditches) (see Chapter 2, Section 2.5.2.4). While most facilities would be located within or adjacent to

the 200-East and 200-West Areas and would be within the area designated as Industrial-Exclusive, the high-level radioactive waste (HLW) Preprocessing Facility (PPF) would be located between the 200-East and 200-West Areas. In total, new facilities under this alternative would occupy 19.8 hectares (48.9 acres)—13.7 hectares (33.8 acres) in or adjacent to the 200-East Area, 4.2 hectares (10.3 acres) in the 200-West Area, and 1.9 hectares (4.8 acres) between the 200-East and 200-West Areas (see Figures 4–1 and 4–2). Thus, about 0.4 percent of the land within the Industrial-Exclusive land use designation would be affected. This loss would be slightly offset by the clean closure of the BX and SX tank farms, which would be potentially available for future use consistent with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824). As all activities would take place within the dedicated Industrial-Exclusive area and only a small part of the area would be affected, impacts of this alternative on land use would be minimal.

Implementation of this alternative would entail a commitment of land designated as Industrial-Exclusive over the long term. In addition to the 19.8 hectares (48.9 acres) of land that would be committed to new facilities and infrastructure, an additional 60.7 hectares (150 acres) of land encompassed by the boundaries of the modified RCRA Subtitle C barriers would be indefinitely committed to waste management use following the DOE 100-year postclosure care period. Taken together, this would entail a total land commitment of 80.5 hectares (199 acres), or about 1.6 percent of the area designated as Industrial-Exclusive.

Alternative 4 would require excavation of geologic material from Borrow Area C for use in activities associated with construction of new facilities, disposal of tank waste, clean closure of the BX and SX tank farms, and placement of the modified RCRA Subtitle C barriers. The amount of material required would necessitate the development of 102 hectares (252 acres), or 11 percent of the area. Although development of Borrow Area C would represent a change in the current land use, this area has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.7.2 Visual Resources

Impacts on visual resources would be similar to those described in Section 4.1.1.3.2 under Alternative 2B. Construction, operations, deactivation, and closure activities associated with this alternative would not greatly change the industrial nature of the view from State Route 240 or nearby higher elevations. Thus, the BLM Visual Resource Management Class IV rating for the 200 Areas would not change. Although an additional 2 hectares (5 acres) of land would be disturbed within Borrow Area C under this alternative, visual impacts also would be similar to those described under Alternative 3A.

### 4.1.1.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

#### 4.1.1.8.1 Land Use

In addition to completion of the WTP, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. Additionally, Hanford landfill barriers would be placed over all 18 tank farms and six sets of cribs and trenches (ditches) (see Chapter 2, Section 2.5.2.5). Similar to the previously described alternatives, all facilities would be located within or adjacent to the 200-East and 200-West Areas and would be within the area designated as Industrial-Exclusive. In total, new facilities would occupy 20.2 hectares (49.9 acres)—16 hectares (39.6 acres) in or adjacent to the 200-East Area and 4.2 hectares (10.3 acres) in the 200-West Area (see Figures 4–1 and 4–2). Thus, about 0.4 percent of the land within the Industrial-Exclusive area would be affected. During the operational and closure phases of

the project, impacts on land use would be minimal, as all activities would take place within the Industrial-Exclusive area.

Implementation of this alternative would entail a commitment of land designated as Industrial-Exclusive over the long term. In addition to the 20.2 hectares (49.9 acres) of land that would be committed to new facilities and infrastructure, an additional 84.2 hectares (208 acres) of land encompassed by the boundaries of the five Hanford barriers would be indefinitely committed to waste management use following the DOE 100-year postclosure care period. Taken together, this would entail a total land commitment of 104 hectares (258 acres), or 2.1 percent of the area designated as Industrial-Exclusive.

This alternative would require excavation of geologic material from Borrow Area C for use in activities associated with construction of new facilities, disposal of tank waste, and placement of the Hanford barriers. The amount of material required would necessitate the development of 117 hectares (290 acres), or about 13 percent of the area. Borrow Area C has been designated Conservation (Mining) and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.8.2 Visual Resources

Impacts on visual resources would be similar to those described in Section 4.1.1.3.2 under Alternative 2B. Construction, operations, deactivation, and closure activities associated with this alternative would not greatly change the industrial nature of the view from State Route 240 or nearby higher elevations. Thus, the BLM Visual Resource Management Class IV rating for the 200 Areas would not change.

Under this alternative, 117 hectares (290 acres) of Borrow Area C would be excavated. Development of Borrow Area C would be readily visible from State Route 240 and Rattlesnake Mountain and would result in the BLM visual resource management rating changing from Class II to Class IV. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact.

### 4.1.1.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.1.9.1 Land Use

#### 4.1.1.9.1.1 Base Case

In addition to completion of the WTP with expanded HLW vitrification capacity, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. Most of these facilities would be located within or adjacent to the 200-East Area and within the existing boundaries of the 200-West Area, although the PPF and HLW Debris Storage Facility would be located between the 200-East and 200-West Areas. While most facilities would be located within the area designated as Industrial-Exclusive, a portion of the area needed for immobilized high-level radioactive waste (IHLW) Interim Storage Modules (i.e., 86.2 hectares [213 acres]) would be located outside of this area to the east. These facilities have been located in this area to facilitate movement of IHLW on site. In total, new facilities would occupy approximately 210 hectares (519 acres), consisting of 153 hectares (377 acres) within or adjacent to the 200-East Area, 3.2 hectares (8 acres) in the 200-West Area, and 54.2 hectares (134 acres) between the 200-East and 200-West Areas (see Figures 4–1 and 4–2). Excluding the land located outside of the Industrial-Exclusive area needed for the IHLW Interim Storage Modules, about 2.4 percent of the Industrial-Exclusive area would be affected under this alternative.

Although clean closure would permit unrestricted use of the tank farm sites, a 25.4-hectare (62.7-acre) modified RCRA Subtitle C landfill barrier would be placed over the six sets of cribs and trenches

(ditches). Taken together with the land required for facility construction, this would entail a total land commitment of 236 hectares (582 acres). Excluding the land needed for the IHLW Interim Storage Modules located outside of the Industrial-Exclusive area, about 2.9 percent of the area designated as Industrial-Exclusive would be affected under this alternative. Actions taken under this alternative would not change the Industrial-Exclusive designation of the 200 Areas. It is possible that the remediated tank farm areas could be used for construction of the HLW Debris Storage Facilities required under this alternative, with the balance of these facilities constructed in the area just to the west of the 200-East Area; however, the land values provided above assume these facilities would all be built between the 200-East and 200-West Areas.

To supply geologic material for use in activities associated with construction of new facilities, clean closure of the tank farms, disposal of tank waste, and placement of the modified RCRA Subtitle C landfill barrier, 381 hectares (942 acres) of Borrow Area C would have to be excavated. This level of development would represent about 41 percent of Borrow Area C. Borrow Area C has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.9.1.2 Option Case

Impacts on land use would generally be similar to, although slightly greater (i.e., 2 hectares [5 acres]) than, those described under Alternative 6A, Base Case. However, under the Option Case, a 25.4-hectare (62.7-acre) modified RCRA Subtitle C landfill barrier would not be used to cover the six sets of cribs and trenches (ditches), because they would be removed and their deep plumes would be remediated, making this area available for alternative uses in the future. Thus, a total land commitment of 212 hectares (524 acres) would be required. However, about 2.5 percent of the area designated as Industrial-Exclusive would be affected under the Option Case. This excludes the land needed for the IHLW Interim Storage Modules (86.2 hectares [213 acres]) located outside of the Industrial-Exclusive area. In addition, remediation of the deep plumes would necessitate the use of more fill material. Thus, it would be necessary to excavate more geologic material from Borrow Area C (specifically, 458 hectares [1,131 acres]), or about 49 percent of the area would have to be developed.

### 4.1.1.9.2 Visual Resources

#### 4.1.1.9.2.1 Base Case

As noted in Section 4.1.1.9.1.1, 210 hectares (519 acres) of land would be converted to industrial use under Alternative 6A, Base Case, with all but 3.2 hectares (8 acres) in or adjacent to the 200-East Area or between the 200-East and 200-West Areas. Thus, although the overall appearance of the 200-West Area would not noticeably change, that of the 200-East Area and the area between the 200-East and 200-West Areas would. In terms of size, the most noticeable aboveground structures would be the HLW Debris Storage Facilities (52.2 hectares [129 acres]) and IHLW Interim Storage Modules (89.4 hectares [221 acres]), which would be located to the west and just to the east of the 200-East Area, respectively. These facilities would noticeably add to the overall industrial nature of the 200 Areas and would be visible from nearby higher elevations. The viewscape from these higher elevations is important to American Indians with cultural ties to Hanford. Closure activities would involve constructing containment structures over the tank farms. Structures within the 200-West Area would be visible from State Route 240 and nearby higher elevations, while those between the 200-East and 200-West Areas and within and adjacent to the 200-East Area would be visible only from higher elevations. Containment structures would be removed upon completion of clean closure activities. Although there would be an overall increase in the industrial appearance of the 200 Areas, the BLM Visual Resource Management Class IV rating would not change.

As noted above, 381 hectares (942 acres) of Borrow Area C would be excavated under this alternative. Development of Borrow Area C would be readily visible from State Route 240 and Rattlesnake Mountain and would change the BLM visual resource management rating from Class II to Class IV. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact.

#### 4.1.1.9.2.2 Option Case

Impacts on visual resources under the Option Case would be similar to those discussed above for the Base Case because the area disturbed would be nearly the same. Although land occupied by the cribs and trenches (ditches) would be available for alternative uses in the future, following their removal and remediation, the overall appearance of the 200 Areas from State Route 240 or nearby higher elevations would not change significantly; thus, the BLM Visual Resource Management Class IV rating would not change.

Compared with Alternative 6A, Base Case, remediation of the deep plumes associated with the cribs and trenches (ditches) would require excavation of an additional 76.5 hectares (189 acres) of Borrow Area C. This excavation would further impact the view of the area from State Route 240 and nearby higher elevations, changing the BLM visual resource management rating from Class II to Class IV (as would be the situation for the Base Case). Similar to the Base Case, excavations in Borrow Area C would be recontoured and revegetated upon completion of work associated with this alternative.

### 4.1.1.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.1.10.1 Land Use

#### 4.1.1.10.1.1 Base Case

In addition to completion of the WTP with expanded LAW vitrification capacity, a number of new facilities would be constructed under this alternative (see Table 4–1). As would be the case under Alternative 6A (see Section 4.1.1.9.1), most facilities would be located within or adjacent to the 200-East and 200-West Areas; however, the PPF and the HLW Debris Storage Facility would be located between the 200-East and 200-West Areas. All facilities would be within the area designated as Industrial-Exclusive. In total, new facilities would occupy 119 hectares (294 acres)—61 hectares (151 acres) in or adjacent to the 200-East Area, 3.7 hectares (9.1 acres) in the 200-West Area, and 54.2 hectares (134 acres) between the 200-East and 200-West Areas (see Figures 4–1 and 4–2). Thus, about 2.3 percent of the land within the Industrial-Exclusive land use zone would be affected. During operations, impacts on land use would be minimal, as all activities would take place within the dedicated Industrial-Exclusive area.

Although clean closure would permit unrestricted use of the tank farm sites, the six sets of cribs and trenches [ditches] would still have a 25.4-hectare (62.7-acre) modified RCRA Subtitle C landfill barrier placed over them. Taken together with the land required for facility construction, this would entail a total land commitment of 144 hectares (357 acres), or 2.9 percent of the land designated as Industrial-Exclusive. Actions taken under this alternative would not result in a change in the designation of the 200 Areas from Industrial-Exclusive. It is possible that the remediated tank farm areas could be used for construction of the HLW Debris Storage Facilities required under this alternative, with the balance of these facilities constructed in the area just to the west of the 200-East Area; however, the land values provided above assume these facilities would all be built between the 200-East and 200-West Areas.

This alternative would require excavation of geologic material from Borrow Area C for use in activities associated with new facility construction, clean closure of the tank farms, and placement of the modified RCRA Subtitle C landfill barrier. The amount of material required would necessitate the development of 240 hectares (592 acres), or about 26 percent of the area. Although development of Borrow Area C would represent a change in the current land use, this area has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

#### 4.1.1.10.1.2 Option Case

Impacts on land use under Alternative 6B, Option Case, would generally be similar to, although slightly greater (i.e., 2 hectares [5 acres]) than, those described above for Alternative 6B, Base Case (see Section 4.1.1.10.1.1). However, under the Option Case, a 25.4-hectare (62.7-acre) modified RCRA Subtitle C landfill barrier would not be used to cover the six sets of cribs and trenches (ditches), because they would be removed and their deep plumes would be remediated, making this area available for alternative uses in the future. Thus, a total land commitment of 121 hectares (299 acres), or about 2.4 percent of the area designated as Industrial-Exclusive, would be required. However, remediation of the deep plumes would necessitate the use of more geologic material. Thus, the size of the excavated area within Borrow Area C would increase to 316 hectares (781 acres), or about 34 percent of the area, compared with 240 hectares (592 acres) under Alternative 6B, Base Case.

### 4.1.1.10.2 Visual Resources

#### 4.1.1.10.2.1 Base Case

Impacts on visual resources under Alternative 6B, Base Case, would be similar to, but less than, those under Alternative 6A, Base Case (see Section 4.1.1.9.2.1). This is because about one-half as much land within the 200 Areas would be converted to industrial use under this alternative. Although the industrial appearance of the 200 Areas would increase overall as a result of actions taken under this case, the BLM Visual Resource Management Class IV rating would not change.

As noted above, 240 hectares (592 acres) of Borrow Area C would be excavated under this alternative. Development of Borrow Area C would be readily visible from State Route 240 and Rattlesnake Mountain, changing the BLM visual resource management rating from Class II to Class IV. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact.

#### 4.1.1.10.2.2 Option Case

Impacts on visual resources under Alternative 6B, Option Case, would be similar to those discussed above for the Base Case. Although land occupied by the cribs and trenches (ditches) would be available for alternative uses in the future following their removal and remediation, the overall appearance of the 200 Areas from State Route 240 or nearby higher elevations would not change significantly; thus, the BLM Visual Resource Management Class IV rating would not change.

Remediation of the deep plumes associated with the cribs and trenches (ditches) under this case would require excavation of an additional 76.5 hectares (189 acres) from Borrow Area C compared with Alternative 6B, Base Case. This excavation would further impact the view of the area from State Route 240 and nearby higher elevations, changing the BLM visual resource management rating from Class II to Class IV (as would be the situation under the Base Case). Upon completion of work associated with the Option Case, excavations in Borrow Area C would be recontoured and revegetated.

#### 4.1.1.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

##### 4.1.1.11.1 Land Use

In addition to completion of the WTP with expanded HLW vitrification capacity, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. All of these facilities would be located within or adjacent to the 200-East Area and within the existing boundaries of the 200-West Area. In all cases, the facilities would be located within areas designated as Industrial-Exclusive. In total, new facilities would occupy 61.5 hectares (152 acres)—57.9 hectares (143 acres) within or adjacent to the 200-East Area and 3.7 hectares (9.1 acres) in the 200-West Area (see Figures 4–1 and 4–2). Thus, 1.2 percent of the land within the Industrial-Exclusive land use designation would be affected. Implementation of this alternative would entail a commitment of land within the Industrial-Exclusive area over the long term. In addition to the 61.5 hectares (152 acres) of land that would be committed to new facilities and infrastructure, an additional 84.2 hectares (208 acres) of land encompassed by the boundaries of the five modified RCRA Subtitle C barriers would be indefinitely committed to waste management use. Taken together, this would entail a total land commitment of 146 hectares (360 acres), or about 2.9 percent of the Industrial-Exclusive area. Actions taken under this alternative would not result in a change in the 200 Areas' Industrial-Exclusive designation. It is possible that the remediated tank farms could be used for construction of the HLW Debris Storage Facilities required under this alternative, with the balance of these facilities constructed in the area just to the west of the 200-East Area; however, the land values provided above assume these facilities would all be built between the 200-East and 200-West Areas.

Alternative 6C would require excavation of geologic material from Borrow Area C for use in activities associated with new facility construction, closure of the BX and SX tank farms, and placement of a modified RCRA Subtitle C landfill barrier over the 18 tank farms and six sets of cribs and trenches (ditches). The amount of material required would necessitate the development of 104 hectares (258 acres), or about 11 percent of the area. Borrow Area C has been designated Conservation (Mining), and its use for this purpose would be consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615; 73 FR 55824).

##### 4.1.1.11.2 Visual Resources

As noted above, 61.5 hectares (152 acres) of land would be converted to industrial use under this alternative, with all but 3.7 hectares (9.1 acres) in or adjacent to the 200-East Area. Thus, the overall appearance of the 200-East Area and vicinity would change, but that of the 200-West Area would not. In terms of size, the most noticeable aboveground structures would be the IHLW Interim Storage Modules (44.9 hectares [111 acres]). These facilities would add to the overall industrial nature of the 200-East Area and would be visible from nearby higher elevations (the viewscape from these higher elevations is important to American Indians with cultural ties to Hanford). Closure activities would involve constructing containment structures over the tank farms. Structures within the 200-West Area would be visible from State Route 240 and nearby higher elevations, while those within and adjacent to the 200-East Area would be visible only from higher elevations. Containment structures would be removed upon completion of clean closure activities. Although there would be an overall increase in the industrial appearance of the 200 Areas, the BLM Visual Resource Management Class IV rating would not change.

As noted above, 104 hectares (258 acres) of Borrow Area C would be excavated under this alternative. Development of Borrow Area C would be readily visible from State Route 240 and Rattlesnake Mountain and would result in the BLM visual resource management rating changing from Class II to Class IV. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact.

### 4.1.2 Infrastructure

This subsection presents the potential impacts of the Tank Closure alternatives on key utility infrastructure resources, including projected activity demands for electricity, fuel, and water, over the timeframe considered for each alternative. For analysis purposes, project timeframes for each alternative include the active project phase (during which construction, operations, deactivation, and closure activities were assumed to be ongoing) and extend through the 100-year administrative control, institutional control, or postclosure care period, as applicable. Total and peak annual utility infrastructure requirements were projected for each Tank Closure alternative, as well as for component project phases (i.e., construction, operations, deactivation, and closure, as applicable).

Assumptions for electricity demand include power to operate portable demolition equipment, work area lighting, and other items as part of facility construction, as well as power to meet the much larger demands of operational facilities. During construction, deactivation, and closure, electric power may be provided either via direct service connections and temporary connections, or via portable diesel- or gasoline-fired generators, especially in outlying portions of the 200 Areas. The projections include fuel consumption to power fuel-fired generators and heavy and mobile equipment to support all project phases under each alternative. It was assumed for analysis purposes that liquid fuels are not capacity-limiting resources, as supplies would be replenished from offsite sources to support each alternative and provided at the point of use on an as-needed basis. Facility operations would consume liquid fuels primarily to produce steam and hot water for facility processes, to provide space heating, and, to a lesser degree, to operate backup generators. In particular, the WTP steam plant would utilize diesel fuel for the production of high-pressure steam as part of the waste vitrification processes.

Water would be required during construction for soil compaction, dust control, and possibly work surface and equipment washdown. Standard construction practices dictate that, at least initially, construction water would be trucked to construction locations on an as-needed basis for these uses until water supply and wastewater treatment utilities are in place. Concrete and grout would be produced in onsite batch plants, which would require large volumes of water. By comparison, relatively little water would be required to meet the potable and sanitary needs of the construction workforce. During operations, water would be required to support process makeup requirements and facility cooling, as well as the potable and sanitary needs of the operations workforce and other uses. To stabilize and partially decontaminate waste treatment, retrieval, and disposal facilities, water would also be used during facility deactivation activities; however, this requirement would be relatively small compared with those for operational and construction demands and for many closure activities, including construction of surface barriers.

Hanford's site utility infrastructure is described in Chapter 3, Section 3.2.2. Table 4–2 summarizes the projected utility infrastructure resource requirements under the Tank Closure alternatives. Projected demands for key utility infrastructure resources and impacts on the respective utility systems from implementation of each of the Tank Closure alternatives are further discussed in the following sections.

**Table 4–2. Tank Closure Alternatives – Summary of Utility Infrastructure Requirements**

| Alternative | Activity Phase | Electricity (M megawatt-hours) | Diesel Fuel[a] (M liters) | Gasoline (M liters) | Water (M liters) |
|---|---|---|---|---|---|
| 1 | Construction | 0.11 | 29.5 | 2.96 | 3,270 |
| | Operations | 0.000000015 | 5.93 | 0.0 | 0.0 |
| | Deactivation[b] | 0.0104 | 0.47 | 1.65 | 29.5 |
| | Closure | N/A | N/A | N/A | N/A |
| | **Total[c]** | **0.12** | **35.9** | **4.61** | **3,300** |
| | **Peak (Year)** | **0.035 (2008)** | **11.8 (2008)** | **1.0 (2008)** | **1,090 (2008)** |

**Table 4–2. Tank Closure Alternatives – Summary of Utility Infrastructure Requirements (*continued*)**

| Alternative | Activity Phase | Electricity (M megawatt-hours) | Diesel Fuel[a] (M liters) | Gasoline (M liters) | Water (M liters) |
|---|---|---|---|---|---|
| 2A | Construction | 0.91 | 345 | 48.7 | 32,800 |
| | Operations | 34.2 | 4,380 | 160 | 170,000 |
| | Deactivation | 0.48 | 227 | 12.6 | 5,150 |
| | Closure | 0.0 | 1.89 | 0.005 | 29.3 |
| | **Total[c]** | **35.6** | **4,960** | **221** | **208,000** |
| | **Peak (Year)** | **0.56 (2078–2079)** | **112 (2078–2079)** | **5.36 (2023–2024)** | **3,720 (2065–2067)** |
| 2B | Construction | 0.55 | 178 | 30.4 | 13,200 |
| | Operations | 15.9 | 3,480 | 107 | 70,600 |
| | Deactivation | 1.42 | 194 | 4.78 | 1,870 |
| | Closure | 0.022 | 185 | 14.5 | 677 |
| | **Total[c]** | **17.9** | **4,040** | **156** | **86,300** |
| | **Peak (Year)** | **1.18 (2040)** | **271 (2040)** | **8.23 (2040)** | **3,590 (2040)** |
| 3A | Construction | 0.48 | 172 | 29.0 | 13,200 |
| | Operations | 12.1 | 1,390 | 66.0 | 60,500 |
| | Deactivation | 1.48 | 114 | 6.40 | 2,590 |
| | Closure | 0.022 | 185 | 14.5 | 677 |
| | **Total[c]** | **14.1** | **1,860** | **116** | **77,000** |
| | **Peak (Year)** | **0.79 (2040)** | **80.8 (2035–2036)** | **5.03 (2035–2036)** | **2,200 (2039)** |
| 3B | Construction | 0.48 | 172 | 28.8 | 13,200 |
| | Operations | 10.8 | 1,400 | 66.0 | 60,600 |
| | Deactivation | 0.84 | 114 | 6.40 | 2,590 |
| | Closure | 0.022 | 185 | 14.5 | 677 |
| | **Total[c]** | **12.1** | **1,870** | **116** | **77,000** |
| | **Peak (Year)** | **0.48 (2039)** | **81.2 (2035–2036)** | **5.03 (2035–2036)** | **2,200 (2039)** |
| 3C | Construction | 0.49 | 173 | 29.5 | 13,200 |
| | Operations | 18.7 | 1,500 | 66.0 | 60,900 |
| | Deactivation | 0.89 | 114 | 6.40 | 2,610 |
| | Closure | 0.022 | 185 | 14.5 | 677 |
| | **Total[c]** | **20.1** | **1,980** | **116** | **77,300** |
| | **Peak (Year)** | **0.84 (2039)** | **86.1 (2035–2036)** | **5.03 (2035–2036)** | **2,210 (2039)** |
| 4 | Construction | 0.49 | 183 | 28.4 | 13,200 |
| | Operations | 12.6 | 1,560 | 71.0 | 65,800 |
| | Deactivation | 0.84 | 114 | 5.81 | 2,590 |
| | Closure | 0.88 | 190 | 27.9 | 655 |
| | **Total[c]** | **14.8** | **2,050** | **133** | **82,200** |
| | **Peak (Year)** | **0.55 (2038–2039)** | **76.2 (2038–2039)** | **10.9 (2043)** | **2,180 (2020–2021)** |

**Table 4–2. Tank Closure Alternatives – Summary of Utility Infrastructure Requirements (*continued*)**

| Alternative | Activity Phase | Electricity (M megawatt-hours) | Diesel Fuel[a] (M liters) | Gasoline (M liters) | Water (M liters) |
|---|---|---|---|---|---|
| 5 | Construction | 0.50 | 176 | 29.2 | 13,200 |
| | Operations | 10.5 | 3,550 | 68.9 | 76,000 |
| | Deactivation | 1.14 | 114 | 6.26 | 2,610 |
| | Closure | 0.025 | 268 | 19.2 | 760 |
| | **Total[c]** | **12.2** | **4,110** | **124** | **92,500** |
| | **Peak (Year)** | **0.63 (2033)** | **229 (2029–2032)** | **5.89 (2029–2032)** | **3,830 (2033)** |
| 6A, Base Case | Construction | 1.80 | 491 | 69.1 | 28,300 |
| | Operations | 175 | 21,300 | 598 | 597,000 |
| | Deactivation | 6.0 | 718 | 22.2 | 17,300 |
| | Closure | 2.09 | 400 | 24.8 | 1,110 |
| | **Total[c]** | **185** | **23,000** | **714** | **643,000** |
| | **Peak (Year)** | **1.93 (2138)** | **232 (2138)** | **8.92 (2149–2150)** | **6,570 (2138)** |
| 6A, Option Case | Construction | 1.80 | 491 | 69.1 | 28,300 |
| | Operations | 175 | 21,300 | 598 | 597,000 |
| | Deactivation | 6.0 | 718 | 22.2 | 17,300 |
| | Closure | 5.38 | 501 | 22.0 | 1,350 |
| | **Total[c]** | **188** | **23,100** | **711** | **643,000** |
| | **Peak (Year)** | **1.97 (2078)** | **235 (2078)** | **7.49 (2163)** | **6,580 (2138)** |
| 6B, Base Case | Construction | 0.58 | 207 | 38.6 | 13,300 |
| | Operations | 16.3 | 3,560 | 146 | 76,200 |
| | Deactivation | 1.43 | 196 | 5.05 | 1,910 |
| | Closure | 2.85 | 400 | 25.6 | 1,150 |
| | **Total[c]** | **21.1** | **4,360** | **216** | **92,600** |
| | **Peak (Year)** | **1.25 (2040)** | **255 (2040)** | **6.61 (2040)** | **3,530 (2040)** |
| 6B, Option Case | Construction | 0.58 | 207 | 38.6 | 13,300 |
| | Operations | 16.3 | 3,560 | 146 | 76,200 |
| | Deactivation | 1.43 | 196 | 5.05 | 1,910 |
| | Closure | 5.48 | 481 | 22.0 | 1,350 |
| | **Total[c]** | **23.8** | **4,440** | **212** | **92,800** |
| | **Peak (Year)** | **1.30 (2040)** | **259 (2040)** | **6.63 (2040)** | **3,530 (2040)** |
| 6C | Construction | 0.55 | 180 | 30.4 | 13,200 |
| | Operations | 15.9 | 3,480 | 107 | 70,600 |
| | Deactivation | 1.42 | 194 | 4.78 | 1,870 |
| | Closure | 0.022 | 185 | 14.5 | 677 |
| | **Total[c]** | **17.9** | **4,040** | **156** | **86,300** |
| | **Peak (Year)** | **1.18 (2040)** | **271 (2040)** | **8.23 (2040)** | **3,590 (2040)** |

**Table 4–2. Tank Closure Alternatives – Summary of Utility Infrastructure Requirements (*continued*)**

[a] Assumed to be inclusive of all Number 2 diesel fuel, including road diesel and heating fuel oil.
[b] Reflects activities during the 100-year administrative control period for the No Action Alternative only.
[c] Totals may not equal the sum of the contributions due to rounding.
**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate. To convert liters to gallons, multiply by 0.26417.
**Key:** M=million; N/A=not applicable.
**Source:** SAIC 2010a.

#### 4.1.2.1 Alternative 1: No Action

Under Alternative 1, peak utility infrastructure demand would occur over the first 3 years of the project period (assumed to be 2006–2008), and construction of the WTP and related activities would be ongoing. Following termination of these activities at the end of 2008, the predicted demand from tank farm routine operations and related monitoring activities during the administrative control period provides the baseline against which the other alternatives can be most meaningfully compared. Table 4–2 above summarizes the projected infrastructure resource requirements under Alternative 1.

##### 4.1.2.1.1 Electricity

Under Alternative 1, peak annual electrical energy demand in 2008 would remain well within the 1.74-million-megawatt-hour annual capacity (based on a peak load capacity of 199 megawatts) of the Hanford electric power transmission system. Annual electrical energy demand over the subsequent 100-year administrative control period of 0.0001 million megawatt-hours would be a very small fraction (about 0.06 percent) of the 0.17 million megawatt-hours of electricity currently used annually at Hanford.

##### 4.1.2.1.2 Fuel

Annualized liquid fuel consumption (diesel fuel and gasoline) of about 0.02 million liters (0.005 million gallons) during the 100-year administrative control period would be a small fraction (about 0.5 percent) of the 4.3 million liters (1.1 million gallons) of liquid fuels currently used annually at Hanford.

##### 4.1.2.1.3 Water

Peak annual water requirements in 2008 would be well within the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System. Annualized water demands over the ensuing 100-year administrative control period of about 0.29 million liters (0.08 million gallons) would also be a very small fraction (about 0.04 percent) of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford.

#### 4.1.2.2 Alternative 2A: Existing WTP Vitrification; No Closure

Alternative 2A would involve construction, operation, and subsequent deactivation, as appropriate, of a number of new facilities, including replacement facilities, over an extended timeframe. The active project phase under Alternative 2A would run about 90 years, from 2006 through completion of WTP deactivation activities in 2095, excluding the subsequent 100-year administrative control period. Table 4–2 in Section 4.1.2 summarizes the projected infrastructure resource requirements under Alternative 2A. The annual average is the sum of the resource requirement divided by the duration of the alternative (in years).

#### 4.1.2.2.1 Electricity

Electrical energy requirements under Alternative 2A would be dominated by operation of the WTP replacement, along with deactivation of the first WTP, in the 2078–2079 timeframe. The peak electrical energy demand of 0.56 million megawatt-hours (approximating an electric load of 64 megawatts) would be about 32 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.2.2 Fuel

Peak diesel fuel consumption under Alternative 2A would total 112 million liters (29.6 million gallons) in 2078–2079, with demand driven by deactivation of the first WTP. Gasoline demand would peak earlier, in 2023–2024, due to operation of the WTP and other facilities along with Effluent Treatment Facility (ETF) replacement construction.

#### 4.1.2.2.3 Water

Water requirements under Alternative 2A would peak in the 2065–2067 timeframe, primarily to support ongoing WTP operations, WTP replacement construction, and Borrow Area C operations. The projected peak water demand of 3,720 million liters (983 million gallons) would be about 20 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 16 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

### 4.1.2.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

The construction, operation, and deactivation of an expanded WTP, in concert with landfill closure activities under this alternative, would place the most demand on utility infrastructure. The active project phase under Alternative 2B would run about 40 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2045, excluding the subsequent 100-year postclosure (landfill) care period. Table 4–2 in Section 4.1.2 summarizes the projected infrastructure resource requirements under Alternative 2B.

#### 4.1.2.3.1 Electricity

Operation of the WTP and Cesium and Strontium Capsule Processing Facility, coinciding with grout facility operations and construction of surface barrier lobes for landfill closure, would dominate the electrical energy requirements. The peak electrical energy demand of 1.18 million megawatt-hours (approximating an electric load of 135 megawatts) in 2040 would be about 68 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.3.2 Fuel

Peak liquid fuel consumption under Alternative 2B would total about 279 million liters (73.7 million gallons) in 2040; demands would be driven by the activities described above.

#### 4.1.2.3.3 Water

Peak water requirements would also occur in 2040, dominated by peak operations coinciding with landfill closure activities. The projected peak water demand of 3,590 million liters (947 million gallons) would be about 19 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford

Export Water System and about 16 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

#### 4.1.2.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Alternative 3A would involve construction, operation, and subsequent deactivation, as appropriate, of a number of new facilities over a 30-year timeframe. Construction, operation, and deactivation of the WTP, including the various waste retrieval and supplemental treatment facilities, in concert with landfill closure activities, would place the highest demand on utility infrastructure. The timeframe of the active project phase under Alternative 3A would run about 37 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2042, excluding the subsequent 100-year postclosure (landfill) care period. Table 4–2 in Section 4.1.2 summarizes the projected infrastructure resource requirements under Alternative 3A.

##### 4.1.2.4.1 Electricity

Operation of the Cesium and Strontium Capsule Processing Facility, combined with deactivation of the bulk vitrification and separations facilities and construction of surface barrier lobes for landfill closure, would dominate the peak electrical energy requirements. The peak electrical energy demand of 0.79 million megawatt-hours (approximating an electric load of 90 megawatts) in 2040 would be about 45 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

##### 4.1.2.4.2 Fuel

Peak liquid fuel consumption under Alternative 3A would total about 85.8 million liters (22.7 million gallons) within the 2035–2036 timeframe. Peak demands would be driven by the WTP, supplemental treatment facility, and Borrow Area C operations, along with surface barrier construction activities.

##### 4.1.2.4.3 Water

Peak water requirements would occur in 2039 under Alternative 3A, with demands dominated by facility operations and Borrow Area C operations and surface barrier construction. The projected peak water demand of 2,200 million liters (581 million gallons) would be about 12 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 10 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

#### 4.1.2.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Construction, operation, and deactivation of the WTP, including the various waste retrieval and supplemental treatment facilities, in concert with landfill closure activities, would place the highest demand on utility infrastructure. The active project phase under Alternative 3B would run about 37 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2042, excluding the subsequent 100-year postclosure (landfill) care period. Overall, utility demands under this alternative would be very similar to those under Alternative 3A. Table 4–2 in Section 4.1.2 summarizes the projected infrastructure resource requirements under Alternative 3B.

#### 4.1.2.5.1 Electricity

Total electrical energy requirements for implementation of Alternative 3B were projected to be somewhat less than those under Alternative 3A. Although total electrical energy requirements would be dominated by facility operations, led by the WTP and its subsequent deactivation, the nonthermal supplemental treatment facilities under this alternative would have a lower operational demand than the thermal supplemental treatment facilities considered under Alternative 3A. Peak projected electrical energy demand would occur over the 2039 period, driven by ongoing operation of the WTP, Cast Stone Facilities, and Solid-Liquid Separations Facility, coinciding with grout facility operations and construction of landfill closure surface barrier lobes. The peak electrical energy demand of 0.48 million megawatt-hours (approximating an electric load of 55 megawatts) would be about 28 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.5.2 Fuel

Peak liquid fuel consumption under Alternative 3B would total about 86.2 million liters (22.8 million gallons) in the 2035–2036 timeframe. Peak demands would be driven by WTP and other facility operations along with Borrow Area C operations and surface barrier construction activities.

#### 4.1.2.5.3 Water

Peak water requirements would occur in 2039 under Alternative 3B. Peak demands under this alternative would correspond to facility operation activities coinciding with Borrow Area C operations and surface barrier construction activities. The projected peak water demand of 2,200 million liters (581 million gallons) would be about 12 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 10 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

### 4.1.2.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Similar to Alternatives 3A and 3B, construction, operation, and deactivation of the WTP, including the various waste retrieval and supplemental treatment facilities, in concert with landfill closure activities, would place the highest demand on utility infrastructure. The active project phase under Alternative 3C would run about 37 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2042, excluding the subsequent 100-year postclosure (landfill) care period. Table 4–2 in Section 4.1.2 summarizes the projected infrastructure resource requirements under Alternative 3C.

#### 4.1.2.6.1 Electricity

Total and peak electrical energy demands under this alternative would largely be dominated by operation of the WTP, Steam Reforming Facilities, Solid-Liquid Separations Facility, and grout facility; construction of landfill closure surface barrier lobes would be secondary contributors in the peak timeframe. Power demand would be greater under this alternative than under Alternative 3A or 3B because of the relatively greater energy demands of steam reforming supplemental treatment versus either bulk vitrification or cast stone supplemental treatments. The peak electrical energy demand of 0.84 million megawatt-hours (approximating an electric load of 96 megawatts) over the 2039 timeframe would be about 48 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.6.2 Fuel

Peak liquid fuel consumption under Alternative 3C would total about 91.1 million liters (24.1 million gallons) in 2035–2036. As under Alternatives 3A and 3B, liquid fuel requirements would be driven by the facility and Borrow Area C operation requirements coinciding with surface barrier construction activities.

#### 4.1.2.6.3 Water

Peak water requirements would also occur in the 2039 timeframe, driven by facility operations, with construction of landfill closure surface barrier lobes as an additional large contributor. The projected peak water demand of 2,210 million liters (581 million gallons) would be about 12 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 10 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

### 4.1.2.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

Construction, operation, and deactivation of the WTP, including the various waste retrieval and supplemental treatment facilities, would place the highest demand on utility infrastructure. This alternative also represents a hybrid supplemental treatment approach relative to Alternatives 3A through 3C, involving both thermal and nonthermal treatment technologies. However, unlike the previously discussed alternatives, requirements for clean closure of just the BX and SX tank farms would increase usage of some utility resources and slightly extend the demand for utility infrastructure resources further into the future. The active project phase under Alternative 4 would run about 40 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2045, excluding the subsequent 100-year postclosure (landfill) care period. Table 4–2 in Section 4.1.2 summarizes the projected total and annual average infrastructure resource requirements under Alternative 4.

#### 4.1.2.7.1 Electricity

Electrical energy demand for various tank farm closure activities, including operation of the PPF to support clean closure of the BX and SX tank farms and facility operations, led by the WTP, would result in peak requirements in 2038–2039. The peak electrical energy demand of 0.55 million megawatt-hours (approximating an electric load of 63 megawatts) would be about 32 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.7.2 Fuel

Peak diesel fuel consumption under Alternative 4 would total 76.2 million liters (20.1 million gallons) in 2038–2039. Peak demands would be driven by operation of the WTP and PPF, along with clean closure activities. Gasoline consumption would peak later, in 2043, due to operation of the Cesium and Strontium Capsule Processing Facility at the same time as PPF deactivation, as well as concurrent construction of surface barriers for landfill closure of the tank farms that would not be clean-closed.

#### 4.1.2.7.3 Water

Peak water requirements would occur in 2020–2021 under this alternative due to facility operations coinciding with PPF construction. The projected peak water demand of 2,180 million liters (576 million gallons) would be about 12 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of

the Hanford Export Water System and about 10 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

#### 4.1.2.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

Construction and operation of an expanded WTP on an accelerated schedule and supplemental treatment facilities, in concert with landfill closure activities, would place the highest demand on utility infrastructure. The active project phase under Alternative 5 would run about 34 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2039, excluding the subsequent 100-year postclosure (landfill) care period. Table 4–2 summarizes the projected total and annual average infrastructure resource requirements under Alternative 5.

##### 4.1.2.8.1 Electricity

Facility operations, led by the WTP and Sulfate Removal Facility, would dominate the electrical energy requirements under Alternative 5; the peak electrical energy demand occurring in 2033 would coincide with the projected startup of SST grouting operations and with WTP and supplemental treatment facility operations. The peak electrical energy demand of 0.63 million megawatt-hours (approximating an electric load of 71 megawatts) would be about 36 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

##### 4.1.2.8.2 Fuel

Peak liquid fuel consumption under Alternative 5 would total about 235 million liters (62.1 million gallons) in the 2029–2032 timeframe, with demands driven by the activities described above, as well as Hanford surface barrier construction activities.

##### 4.1.2.8.3 Water

Peak water requirements would occur over the 2033 timeframe, driven by facility operations, led by the WTP, along with Hanford surface barrier construction activities. The projected peak water demand of 3,830 million liters (1,010 million gallons) would be about 21 percent of the 18,500-million-liter (4,890-million-gallon) current annual capacity of the Hanford Export Water System and about 17 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

#### 4.1.2.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

Under this alternative, three WTP facilities would be constructed, operated, and deactivated sequentially. A replacement facility would be under construction while the previous facility is still operating. Likewise, deactivation of the previous facility would occur when the replacement facility begins operation. These overlapping activities, along with clean closure activities, would compound utility infrastructure resource demands, and peak activities would occur over a much longer timeframe than under the previously discussed alternatives. The active project phase under Alternative 6A would run about 161 years, from 2006 through completion of deactivation of the third WTP, completion of closure activities, and most other activities in 2166 under both the Base and Option Cases, excluding the subsequent 100-year institutional control period. The two cases (Base and Option Cases) considered under Alternative 6A differ as to closure of six sets of cribs and trenches (ditches) in the B and T Areas; landfill closure under the Base Case versus removal and clean closure under the Option Case. Table 4–2 in Section 4.1.2 summarizes the projected total and annual average infrastructure resource requirements under Alternative 6A.

#### 4.1.2.9.1 Electricity

##### 4.1.2.9.1.1 Base Case

As with the alternatives discussed previously, WTP activities would dominate the overall electrical energy requirements. The peak electrical energy demand under Alternative 6A, Base Case, would occur in 2138. This peak would be primarily due to ongoing WTP operations and construction of the second WTP replacement coinciding with deactivation of the first WTP replacement. The peak electrical energy demand of 1.93 million megawatt-hours (approximating an electric load of 220 megawatts) in 2138 would be about 111 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system. Total electricity consumption would also be much higher under Alternative 6A due to the much longer operating period of key facilities.

##### 4.1.2.9.1.2 Option Case

Electrical energy requirements under Alternative 6A, Option Case, would be somewhat higher than those under the Base Case, with peak demands occurring in 2078. The difference would be due to the higher electricity demand to support concurrent WTP operations, WTP replacement construction, and WTP deactivation, plus the added demand of removing the B Area cribs and trenches (ditches) in the same timeframe under this option. The peak electrical energy demand of 1.97 million megawatt-hours (approximating an electric load of 225 megawatts) would be about 113 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.9.2 Fuel

##### 4.1.2.9.2.1 Base Case

Peak diesel fuel consumption under Alternative 6A, Base Case, would total up to 232 million liters (61.3 million gallons) in 2138, corresponding with ongoing WTP operations and WTP replacement construction and coinciding with deactivation of the first WTP replacement. Gasoline consumption would peak later, in 2149–2150, due to WTP operations combined with surface barrier construction for landfill closure of the B and T Area cribs and trenches (ditches).

##### 4.1.2.9.2.2 Option Case

Peak and total liquid fuel consumption under Alternative 6A, Option Case, would be somewhat higher than consumption under the Base Case, with peak diesel fuel demands also occurring in 2078 at 235 million liters (62.1 million gallons). Gasoline consumption would peak later, in 2163, driven by Cesium and Strontium Capsule Processing Facility operations and deactivation of the PPF.

#### 4.1.2.9.3 Water

##### 4.1.2.9.3.1 Base Case

Peak water requirements under Alternative 6A, Base Case, would also occur in 2138, as described for the other utility resources. The projected peak water demand of up to 6,570 million liters (1,740 million gallons) in 2138 would be about 36 percent of the 18,500-million-liter (4,890-million-gallon) current annual capacity of the Hanford Export Water System and about 29 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

#### 4.1.2.9.3.2 Option Case

Peak and total water demand under Alternative 6A, Option Case, is projected to be nearly identical to that under the Base Case in magnitude and timing, except the water requirements for closure activities would be slightly higher.

### 4.1.2.10 Alternative 6B: All Vitrification with Separations; Clean Closure

The primary difference between Alternative 6A and Alternative 6B is that Alternative 6B would accomplish waste processing in a shorter timeframe using an expanded WTP and without requiring WTP replacements. The construction, operation, and deactivation of an expanded WTP, in concert with clean closure activities under this alternative, would place the most demand on utility infrastructure. The active project phase under Alternative 6B would run about 95 years, from 2006 through completion of deactivation of the PPF, completion of clean closure activities, and most other activities in 2100 under both the Base and Option Cases, excluding the subsequent 100-year institutional control period. The two cases (Base and Option Cases) considered under Alternative 6B differ as to closure of six sets of cribs and trenches (ditches) in the B and T Areas: landfill closure under the Base Case versus removal and clean closure under the Option Case. Table 4–2 in Section 4.1.2 summarizes the projected infrastructure resource requirements under Alternative 6B.

#### 4.1.2.10.1 Electricity

#### 4.1.2.10.1.1 Base Case

Facility operations, led by the WTP and the Cesium and Strontium Capsule Processing Facility, coinciding with clean closure activities, would result in peak electrical energy demands in 2040 under Alternative 6B, Base Case. The peak electrical energy demand of 1.25 million megawatt-hours (approximating an electric load of 143 megawatts) in 2040 would be about 72 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.10.1.2 Option Case

Electrical energy requirements under Alternative 6B, Option Case, would be somewhat higher than those under the Base Case, but peak demands would also occur in 2040. The difference would occur because of the higher electricity demand required to support the addition of clean closure of the six sets of cribs and trenches (ditches) under this option. The peak electrical energy demand of 1.30 million megawatt-hours (approximating an electric load of 148 megawatts) would be about 75 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.10.2 Fuel

#### 4.1.2.10.2.1 Base Case

Peak liquid fuel consumption under Alternative 6B, Base Case, would total about 262 million liters (69.2 million gallons) in 2040, with demands driven by the activities described above for electricity.

#### 4.1.2.10.2.2 Option Case

Peak and total liquid fuel consumption under Alternative 6B, Option Case, would be somewhat higher than consumption under the Base Case, with peak fuel demands also occurring in 2040 at 266 million liters (70.3 million gallons).

#### 4.1.2.10.3 Water

##### 4.1.2.10.3.1 Base Case

Peak water requirements under Alternative 6B, Base Case, would occur in 2040, with the timing of the peak based on the activities discussed above. The projected peak water demand of up to 3,530 million liters (933 million gallons) in 2040 would be about 19 percent of the 18,500-million-liter (4,890-million-gallon) current annual capacity of the Hanford Export Water System and about 15 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

##### 4.1.2.10.3.2 Option Case

Peak and total water demand under Alternative 6B, Option Case, is projected to be nearly identical to that under the Base Case in magnitude and timing, except the water requirements for closure activities would be slightly higher.

### 4.1.2.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

The construction, operations, and deactivation of an expanded WTP, in concert with landfill closure activities, would place greater demands on utility infrastructure. Infrastructure requirements under this alternative would mirror those under Alternative 2B, except additional immobilized low-activity waste (ILAW) storage facilities would be needed. The active project phase under Alternative 6C would run about 40 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2045, excluding the subsequent 100-year postclosure (landfill) care period. Table 4–2 in Section 4.1.2 summarizes the projected total and annual average infrastructure resource requirements under Alternative 6C.

#### 4.1.2.11.1 Electricity

WTP and Cesium and Strontium Capsule Processing Facility operations, coinciding with grout facility operations and construction of surface barrier lobes for landfill closure, would dominate the electrical energy requirements under Alternative 6C. The peak electrical energy demand of 1.18 million megawatt-hours (approximating an electric load of 135 megawatts) in 2040 would be about 68 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

#### 4.1.2.11.2 Fuel

Peak liquid fuel consumption under Alternative 6C would total about 279 million liters (73.7 million gallons) in 2040, with demands driven by the activities described above.

#### 4.1.2.11.3 Water

Peak water requirements would occur in 2040, dominated by peak operations coinciding with landfill closure activities. The projected peak water demand of 3,590 million liters (940 million gallons) would be about 19 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 16 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

### 4.1.3 Noise and Vibration

Facility construction, operations, deactivation, and closure activities, as applicable to each alternative, would result in minor noise impacts of operation of employee vehicles, trucks, construction equipment, generators, and other equipment. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary. Heavy diesel equipment used for construction under most of the alternatives is expected to cause the highest noise levels. For example, if 150 items of construction equipment were operating at the WTP construction site with a sound pressure level of 88 decibels A-weighted (dBA) at 15 meters (50 feet), the contribution to the sound level at the nearest site boundary would be 18 dBA (SAIC 2010a). During a normal daytime shift, the estimated maximum sound level at the site boundary would be well below the Washington State standard daytime maximum noise level limit of 60 dBA for industrial sources impacting residential receptors (WAC 173-60).

**Perceived Change in Sound Level**

| Change in Level | Perceived Change to the Human Ear |
|---|---|
| ± 1 dB | Not perceptible |
| ± 3 dB | Threshold of perception |
| ± 5 dB | Clearly noticeable |
| ± 10 dB | Twice (or half) as loud |
| ± 20 dB | Fourfold change |

**Key:** dB=decibel. **Source:** MPCA 1999:9.

Some disturbance of wildlife near the 200 Areas could occur as a result of heavy machinery noise during construction, deactivation, and closure activities, as applicable to each alternative. Noise from operational activities is expected to be similar to existing activities in these areas, resulting in little change in noise levels and impacts on wildlife. Mitigation of impacts on threatened and endangered species is discussed in Section 4.1.7.

The number of employee vehicles and trucks delivering materials for various phases of tank closure activities would vary over the duration of the project and by alternative. The increase in the number of employee vehicle and truck trips is expected to result in a minor increase in traffic noise levels along routes to the site.

Activities at Hanford associated with Tank Closure alternatives that would involve excavation, earthmoving, transportation of fill material, and other vehicle traffic through Hanford could result in ground vibration that could affect operations of the Laser Interferometer Gravitational-Wave Observatory (LIGO). Most of the activities identified to have impacts on this facility would be those that require the use of heavy vehicles or large construction equipment. It is expected that blasting would also have an impact on this facility if it is required for mining. Although DOE would coordinate vibration-producing activities with LIGO, the impacts of such activities under the Tank Closure alternatives are expected to interfere to some degree with the operations of this facility.

#### 4.1.3.1 Alternative 1: No Action

Under Tank Closure Alternative 1, some routine operations and monitoring activities would continue. Activities under this Tank Closure alternative would result in some noise impacts of operation of employee vehicles, trucks, and construction equipment. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be minor due to the distance to the Hanford boundary. Noise levels from tank closure activities would be reduced from the current levels. No additional noise-related disturbance of wildlife is expected near the 200 Areas under this Tank Closure alternative.

#### 4.1.3.2 Alternative 2A: Existing WTP Vitrification; No Closure

Construction, operation, and deactivation of facilities under this Tank Closure alternative would result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur from 2078 through 2079 during WTP operations and deactivation (SAIC 2010a). The increase in the number of employee vehicles and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This increase in employee and truck traffic (discussed in Section 4.1.9) was compared with the existing average traffic volume (see Chapter 3, Section 3.2.9.4). For the purpose of comparing the alternatives, the increase in traffic noise level can be estimated from the ratio of the projected traffic volume to the existing traffic volume (see Appendix F, Section F.3).

#### 4.1.3.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be minor due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2040 during WTP operations and vacuum-based retrieval (VBR) system construction (SAIC 2010a). The increased number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2035 during WTP operations and VBR system construction (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2035 during WTP operations and VBR system construction (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2035 during WTP operations and VBR system construction (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2019 during WTP operations and construction of the PPF and mobile retrieval system (MRS) (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur from 2029 through 2032 during WTP operation and VBR system construction and operations (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic

noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

##### 4.1.3.9.1 Base Case

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2141 during WTP operations and PPF construction (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

##### 4.1.3.9.2 Option Case

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2041 during WTP operations, HLW Interim Storage Facility operations, and PPF construction (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.10 Alternative 6B: All Vitrification with Separations; Clean Closure

##### 4.1.3.10.1 Base Case

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur from 2021 through 2022 during PPF construction and MRS and WTP operations (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

#### 4.1.3.10.2 Option Case

Facility construction, operation, and deactivation and tank farm closure activities under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee traffic and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur from 2021 through 2022 during PPF construction and MRS and WTP operations (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

### 4.1.3.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Facility construction, operation, and deactivation and tank farm closure under this Tank Closure alternative would cause minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment, as discussed above. The offsite noise levels from activities at the WTP and 200-East and 200-West Areas would be negligible due to the distance to the Hanford boundary.

Employee traffic and truck traffic to deliver materials for various phases of tank closure activities would vary over the duration of the project. The highest number of employee trips is expected to occur in 2040 during WTP operations, routine operations, VBR system construction and operations, and modified RCRA Subtitle C barrier construction (SAIC 2010a). The increase in the number of employee vehicle and truck trips is expected to cause a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described under Alternative 2A (see Section 4.1.3.2).

## 4.1.4 Air Quality

Activities under the various Tank Closure alternatives would result in some air quality impacts due to air pollutant emissions from employee vehicles, trucks, and construction equipment and, as applicable under most Tank Closure alternatives, heating equipment, generators, and process equipment. Criteria pollutant concentrations for the activities associated with each Tank Closure alternative were modeled, and the year with peak concentrations for each alternative, pollutant, and averaging time was identified (see Appendix G). Comparisons of these concentrations with the ambient standards are reflected in Table 4–3. The maximum concentrations resulting from these activities under each Tank Closure alternative would be below the ambient standards for the 8-hour carbon monoxide concentrations, annual concentrations of nitrogen dioxide and $PM_{10}$ [particulate matter with an aerodynamic diameter less than or equal to 10 micrometers], and all sulfur dioxide averaging-period concentrations. Standards would be exceeded for the 24-hour concentrations of particulate matter (PM) under all Tank Closure alternatives, the annual concentrations of $PM_{2.5}$ [PM with an aerodynamic diameter less than or equal to 2.5 micrometers] under the action alternatives, the 1-hour concentrations of nitrogen dioxide under all alternatives, and the 1-hour concentrations of carbon monoxide under several Tank Closure alternatives. The peak period identified under each alternative and the primary contributing activities are discussed for each Tank Closure alternative below. Maximum air quality impacts are expected to occur along State Route 240, along or near the Hanford boundary to the east and southeast, or along the Hanford Reach boundary to the west and southwest. The concentration estimates of PM would be high as a result of the correspondingly high estimated emissions. PM concentrations would be reduced by applying appropriate dust control measures (see Chapter 7, Section 7.1).

## Table 4–3. Tank Closure Alternatives – Maximum Incremental Criteria Pollutant Concentrations

| Pollutant and Averaging Period | Standard[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alternatives | | | | | | | | | | | | |
| | | 1 | 2A | 2B | 3A | 3B | 3C | 4 | 5 | 6A, Base Case | 6A, Option Case | 6B, Base Case | 6B, Option Case | 6C |
| **Carbon Monoxide** | | | | | | | | | | | | | | |
| 8-hour | 10,000[b] | 3,410 | 6,500 | 6,330 | 9,360 | 9,640 | 9,600 | 6,030 | 8,100 | 5,650 | 4,180 | 5,770 | 5,770 | 6,120 |
| 1-hour | 40,000[b] | 23,300 | **44,900** | **40,500** | **60,900** | **62,000** | **61,900** | 40,000 | **51,600** | 35,100 | 26,100 | 38,500 | 38,500 | 37,900 |
| **Nitrogen Dioxide** | | | | | | | | | | | | | | |
| Annual | 100[b] | 8.19 | 18.3 | 20.5 | 17.9 | 18.1 | 18.1 | 13.6 | 21.2 | 18.7 | 15.8 | 14.2 | 15.6 | 20.5 |
| 1-hour | 188 | **15,200** | **36,500** | **35,200** | **37,800** | **38,000** | **38,000** | **28,400** | **38,600** | **36,400** | **27,000** | **33,200** | **26,200** | **35,300** |
| **$PM_{10}$[c]** | | | | | | | | | | | | | | |
| Annual | 50[d] | 5.08 | 16.2 | 35.0 | 34.9 | 34.9 | 34.9 | 23.9 | 35.7 | 39.0 | 39.1 | 37.0 | 16.2 | 35.5 |
| 24-hour | 150[b] | **546** | **1,990** | **4,910** | **4,910** | **4,910** | **4,910** | **3,360** | **5,320** | **5,150** | **3,880** | **5,510** | **2,080** | **4,960** |
| **$PM_{2.5}$[c]** | | | | | | | | | | | | | | |
| Annual | 15[d] | 5.08 | **16.2** | **35.0** | **34.9** | **34.9** | **34.9** | **23.9** | **35.7** | **39.0** | **39.1** | **37.0** | **16.2** | **35.5** |
| 24-hour | 35[b] | **546** | **1,990** | **4,910** | **4,910** | **4,910** | **4,910** | **3,360** | **5,320** | **5,150** | **3,880** | **5,510** | **2,080** | **4,960** |
| **Sulfur Dioxide** | | | | | | | | | | | | | | |
| Annual | 50[d] | 0.0128 | 0.0823 | 0.308 | 0.151 | 0.0945 | 0.0939 | 0.0946 | 0.153 | 0.0781 | 0.0767 | 0.292 | 0.298 | 0.308 |
| 24-hour | 260[d] | 1.37 | 4.6 | 9.26 | 10.9 | 6.17 | 6.11 | 7.1 | 10.1 | 4.41 | 3.35 | 6.91 | 7.31 | 9.26 |
| 3-hour | 1,300[b] | 8.00 | 26.9 | 52.4 | 50 | 33.3 | 33.1 | 31.5 | 46.1 | 23.4 | 19.3 | 40.9 | 42.6 | 52.4 |
| 1-hour | 197[e] | 24.0 | 70.7 | 105 | 132 | 88.2 | 87.6 | 77.9 | 112 | 58.9 | 47.4 | 71.5 | 76.4 | 105 |

[a] The more stringent of the Federal and Washington State standards is presented if both exist for the averaging period. The National Ambient Air Quality Standards (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The 24-hour $PM_{10}$ standard is attained when the expected number of days with a 24-hour average concentration above the standard is less than or equal to 1. The annual arithmetic mean $PM_{10}$ standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. The annual $PM_{2.5}$ standard is met when the 3-year average of the annual means is less than or equal to the standard. The 24-hour $PM_{2.5}$ standard is met when the 3-year average of the 98th percentile 24-hour averages is less than or equal to the standard. The 1-hour nitrogen dioxide standard is met when the 3-year average 98th percentile of the daily maximum 1-hour average does not exceed the standard value.

[b] Federal and Washington State standard.

[c] The Federal standards for $PM_{2.5}$ are 15 micrograms per cubic meter annual average and 35 micrograms per cubic meter 24-hour average. No specific data for $PM_{2.5}$ were available, but for the purpose of analysis concentrations were assumed to be the same as $PM_{10}$.

[d] Washington State standard.

[e] Federal standard.

**Note:** The National Ambient Air Quality Standards also include standards for lead and ozone. No sources of lead emissions have been identified for the alternatives evaluated. Washington State also has ambient standards for fluorides. Concentrations in **bold** text indicate potential exceedance of the standard.

**Key:** $PM_n$=particulate matter with an aerodynamic diameter less than or equal to *n* micrometers.

**Source:** Appendix G, Section G.3.

Construction activities considered in estimating PM emissions include general construction equipment activity, windblown particulates from disturbed areas, resuspension of road dust, fuel combustion in construction equipment, and concrete batch plant operations. The emission factor used for these estimates is intended to provide a gross estimate of total suspended particulate emissions when detailed engineering data that would allow for a more refined estimate are not available. For the purpose of this analysis, emissions of $PM_{10}$ and $PM_{2.5}$ from general construction activities were assumed to be the same as the total suspended particulate emissions. This results in a substantial overestimate of $PM_{10}$ and $PM_{2.5}$ emissions. Further, the analysis did not consider emission controls that could be applied in the construction areas, as discussed in Chapter 7, Section 7.1. A refined analysis of emissions based on more-detailed engineering of the construction activities and application of appropriate control technologies is expected to result in substantially lower estimates of emissions and ambient concentrations from the major construction activities under any of the Tank Closure alternatives.

The sulfur dioxide emission factor used for fuel-burning sources was based on equipment burning a distillate fuel with a sulfur content of about 0.0015 percent (15 parts per million [ppm]), which is being phased in beginning in 2007. No adjustment was made for more-restrictive emission standards for nitrogen dioxide and PM, which are also scheduled to be phased in beginning in 2007. In future years, pollutant emissions and impacts are expected to be smaller than estimated in this analysis as better fuels, combustion technologies, emission controls, and alternative energy sources are developed.

**Effects of Criteria Air Pollutants**

Criteria air pollutants can harm health and the environment and cause property damage. The following are the chief pollutants of concern:

**Carbon Monoxide –** A colorless, odorless, and tasteless gas that is produced naturally by the human body, where it serves various physiological purposes. At abnormally high levels, however, carbon monoxide is highly toxic to humans and animals because prolonged exposure by inhalation can reduce oxygen in the bloodstream, causing a variety of diseases, including neurodegenerations, hypertension, heart failure, and inflammation.

**Nitrogen Dioxide –** One of the main precursors to the formation of ground-level ozone, nitrogen dioxide also contributes to the formation of acid rain and toxic chemicals, deterioration of water quality, impairment of visibility, and global warming.

**Ozone –** The triatomic form of oxygen. In the stratosphere, ozone protects Earth from the Sun's ultraviolet rays, but in lower levels of the atmosphere, ozone is considered an air pollutant. Human or animal exposure to abnormally high levels of ozone can cause breathing difficulties such as aggravated asthma symptoms, as well as more-long-term respiratory illnesses such as lung irritation, reduced lung capacity, and permanent lung damage. High ozone levels also can make sensitive plants more susceptible to damage, affect the appearance of other plants, and reduce crop yields and forest growth.

**Particulate Matter –** Any finely divided solid or liquid material other than uncombined (i.e., pure) water. Inhalation of particulate matter can result in increased respiratory symptoms, decreased lung function, aggravated asthma, development of chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and premature death in people with heart or lung disease. Fine particulate ($PM_{2.5}$) is a major cause of reduced visibility. Particulate matter also can contribute to acidification of streams and lakes, changes in the nutrient balance of coastal waters and larger river basins, depletion of nutrients in soil, damage to forests and crops, and damage to stone and other building materials.

**Sulfur Dioxide –** A common air pollutant that contributes to the formation of acid rain, which damages trees, crops, and buildings and makes soils, lakes, and streams acidic. Sulfur dioxide also contributes to reduced visibility.

**Lead –** The primary sources of lead emissions are ore and metals processing and leaded aviation gasoline use. Exposure to lead can damage organs, including the kidneys, liver, brain, and nerves, especially in infants and young children; it is also harmful to animals and fish.

**Source:** EPA 2007.

The contributions to the total ambient concentrations from sources in the region and existing and reasonably anticipated sources at Hanford that are unrelated to tank closure are expected to change over the period of the activities evaluated in this environmental impact statement (EIS) and are addressed in

the cumulative impacts section. The existing contributions of Hanford sources and regional monitored concentrations are discussed in Chapter 3, Section 3.2.4.

The Clean Air Act, as amended, requires that Federal actions conform to the host state's "state implementation plan" (see Appendix G, Section G.4). The final rule, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans," requires a conformity determination for certain-size projects in nonattainment areas. Hanford is within an area currently designated as in attainment for criteria air pollutants. Therefore, a conformity determination for these Tank Closure alternatives is not necessary to meet the requirements of the final rule (40 CFR 93, Subpart B).

Both carcinogenic and noncarcinogenic toxic pollutant concentrations were evaluated. Potential exposure of members of the public to airborne pollutants would come from process emissions during operations and emissions from equipment used during construction, operations, deactivation, and closure. Selected air toxics were modeled because they represent toxic constituents associated with emissions from operation of gasoline- and diesel-fueled equipment. Ammonia was also selected for modeling because of its relatively high concentration compared with other toxic constituents in the tank vapor spaces. Ammonia's concentration, combined with its toxicity, makes it a good indicator constituent for analysis; that is, if ammonia is found to be within the acceptable source impact level, other toxics should be as well. Maximum concentrations under each alternative and the Washington State acceptable source impact levels are presented in Table 4–4. These concentrations were below the acceptable source impact levels for all Tank Closure alternatives, except for mercury under Alternatives 2B, 6B (Base and Option Cases), and 6C. The acceptable source impact levels used by the state in the permitting process represent concentrations that are sufficiently low to protect human health and safety from potential carcinogenic and other toxic effects (WAC 173-460).

For noninvolved workers at nearby facilities, the highest annual concentration of each toxic chemical was used to estimate the Hazard Quotient for each chemical, as described in Appendix G. The Hazard Quotients were summed to give the Hazard Index from noncarcinogenic chemicals associated with each Tank Closure alternative. A Hazard Index of less than 1 indicates that adverse health effects of non-cancer-causing agents are not expected. Hazard Indices for each alternative are summarized in Table 4–5. For carcinogens, the highest annual concentration was used to estimate the increased cancer risk from a chemical. Cancer risks from nonradioactive toxic pollutant emissions under each Tank Closure alternative are summarized in Table 4–6.

## Table 4–4. Tank Closure Alternatives – Maximum Incremental Toxic Chemical Concentrations

| Pollutant | Averaging Period | Acceptable Source Impact Level[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Alternatives | | | | | | | | | | | | |
| | | | 1 | 2A | 2B | 3A | 3B | 3C | 4 | 5 | 6A, Base Case | 6A, Option Case | 6B, Base Case | 6B, Option Case | 6C |
| Ammonia | 24-hour | 70.8 | 26.1 | 19.9 | 12.0 | 12.2 | 12.2 | 12.3 | 12.1 | 12.3 | 10.5 | 10.2 | 12.2 | 12.2 | 11.7 |
| Benzene | Annual | 0.0345 | 0.00252 | 0.00588 | 0.00459 | 0.00597 | 0.00622 | 0.00598 | 0.00354 | 0.00601 | 0.0048 | 0.00311 | 0.00460 | 0.0037 | 0.0046 |
| 1,3-Butadiene | Annual | 0.00588 | 0.000070 | 0.000159 | 0.000127 | 0.000146 | 0.000151 | 0.000146 | 0.000107 | 0.000151 | 0.000141 | 0.0000842 | 0.000133 | 0.000101 | 0.000127 |
| Formaldehyde | Annual | 0.167 | 0.00227 | 0.0052 | 0.0041 | 0.00488 | 0.00504 | 0.00488 | 0.00334 | 0.00498 | 0.0045 | 0.00272 | 0.00428 | 0.00327 | 0.0041 |
| Mercury | 24-hour | 0.09 | 0.0 | 0.00590 | **0.117** | 0.0169 | 0.00786 | 0.0129 | 0.0130 | 0.0182 | 0.00237 | 0.00236 | **0.117** | **0.117** | **0.117** |
| Toluene | 24-hour | 5,000 | 1.69 | 4.3 | 3.62 | 6 | 6.26 | 6 | 3 | 5.42 | 3.72 | 2.56 | 3.96 | 2.8 | 3.63 |
| Xylene | 24-hour | (b) | 0.506 | 1.29 | 1.1 | 1.78 | 1.86 | 1.78 | 0.896 | 1.62 | 1.14 | 0.747 | 1.2 | 0.84 | 1.11 |

[a] WAC 173-460. Acceptable source impact levels were updated in this environmental impact statement.
[b] Not listed in WAC 173-460.

**Note:** To convert cubic meters to cubic feet, multiply by 35.315. Concentrations in **bold** are above the acceptable source impact level.
**Source:** Appendix G, Section G.3.

**Table 4–5. Tank Closure Alternatives – Nonradioactive Airborne Toxic Chemical Hazard Index for the Nearest Noninvolved Worker**

| Chemical | Hazard Quotient | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Alternatives | | | | | | | | | | | | |
| | 1 | 2A | 2B | 3A | 3B | 3C | 4 | 5 | 6A, Base Case | 6A, Option Case | 6B, Base Case | 6B, Option Case | 6C |
| Ammonia | $7.9\times10^{-2}$ | $9.14\times10^{-2}$ | $5.42\times10^{-2}$ | $5.47\times10^{-2}$ | $5.50\times10^{-2}$ | $5.53\times10^{-2}$ | $5.37\times10^{-2}$ | $5.79\times10^{-2}$ | $6.90\times10^{-2}$ | $6.66\times10^{-2}$ | $6.67\times10^{-2}$ | $6.42\times10^{-2}$ | $5.33\times10^{-2}$ |
| Mercury | 0.00 | $3.02\times10^{-3}$ | $4.07\times10^{-2}$ | $3.72\times10^{-2}$ | $5.07\times10^{-3}$ | $1.91\times10^{-2}$ | $1.44\times10^{-2}$ | $1.64\times10^{-2}$ | $1.43\times10^{-3}$ | $1.41\times10^{-3}$ | $4.07\times10^{-2}$ | $4.07\times10^{-2}$ | $4.07\times10^{-2}$ |
| Toluene | $3.28\times10^{-5}$ | $7.03\times10^{-4}$ | $4.93\times10^{-4}$ | $5.27\times10^{-4}$ | $5.55\times10^{-4}$ | $5.70\times10^{-4}$ | $5.21\times10^{-4}$ | $6.45\times10^{-4}$ | $1.53\times10^{-3}$ | $1.44\times10^{-3}$ | $9.39\times10^{-4}$ | $8.49\times10^{-4}$ | $4.28\times10^{-4}$ |
| Xylene(s) | $4.92\times10^{-4}$ | $1.01\times10^{-2}$ | $7.22\times10^{-3}$ | $7.71\times10^{-3}$ | $8.10\times10^{-3}$ | $8.32\times10^{-3}$ | $7.66\times10^{-3}$ | $9.39\times10^{-3}$ | $2.23\times10^{-2}$ | $2.10\times10^{-2}$ | $1.38\times10^{-2}$ | $1.25\times10^{-2}$ | $6.62\times10^{-3}$ |
| Hazard Index | $7.95\times10^{-2}$ | $1.05\times10^{-1}$ | $1.03\times10^{-1}$ | $1.00\times10^{-1}$ | $6.87\times10^{-2}$ | $8.34\times10^{-2}$ | $7.63\times10^{-2}$ | $8.43\times10^{-2}$ | $9.43\times10^{-2}$ | $9.05\times10^{-2}$ | $1.22\times10^{-1}$ | $1.18\times10^{-1}$ | $1.01\times10^{-1}$ |

**Source:** Appendix G, Section G.3.

**Table 4–6. Tank Closure Alternatives – Nonradioactive Airborne Toxic Chemical Cancer Risk for the Nearest Noninvolved Worker**

| Chemical | Alternatives | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2A | 2B | 3A | 3B | 3C | 4 | 5 | 6A, Base Case | 6A, Option Case | 6B, Base Case | 6B, Option Case | 6C |
| Benzene | $2.04\times10^{-7}$ | $2.54\times10^{-6}$ | $2.32\times10^{-6}$ | $2.42\times10^{-6}$ | $2.56\times10^{-6}$ | $2.56\times10^{-6}$ | $2.36\times10^{-6}$ | $2.85\times10^{-6}$ | $6.69\times10^{-6}$ | $6.23\times10^{-6}$ | $4.85\times10^{-6}$ | $4.39\times10^{-6}$ | $2.19\times10^{-6}$ |
| 1,3-Butadiene | $2.18\times10^{-8}$ | $1.63\times10^{-7}$ | $2.02\times10^{-7}$ | $2.07\times10^{-7}$ | $2.14\times10^{-7}$ | $2.15\times10^{-7}$ | $2.37\times10^{-7}$ | $2.34\times10^{-7}$ | $5.46\times10^{-7}$ | $5.03\times10^{-7}$ | $4.58\times10^{-7}$ | $4.15\times10^{-7}$ | $1.97\times10^{-7}$ |
| Formaldehyde | $3.08\times10^{-7}$ | $2.62\times10^{-6}$ | $2.99\times10^{-6}$ | $3.06\times10^{-6}$ | $3.18\times10^{-6}$ | $3.20\times10^{-6}$ | $3.46\times10^{-6}$ | $3.51\times10^{-6}$ | $8.20\times10^{-6}$ | $7.58\times10^{-6}$ | $6.64\times10^{-6}$ | $6.01\times10^{-6}$ | $2.89\times10^{-6}$ |

**Source:** Appendix G, Section G.3.

#### 4.1.4.1 Alternative 1: No Action

Criteria pollutant concentrations from activities under Tank Closure Alternative 1 are presented in Table 4–3. Peak concentrations of carbon monoxide and nitrogen dioxide would occur in 2008. Peak concentrations of PM and sulfur dioxide would occur from 2006 through 2008. These peak period concentrations would result primarily from WTP construction activities and tank upgrade construction. The maximum air quality impacts of $PM_{10}$ emissions would occur south of State Route 240 and 1,000 meters (0.6 miles) southeast of the site boundary. Figure 4–3 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6. A Hazard Index of less than 1 indicates that adverse health effects of non-cancer-causing agents are not expected.

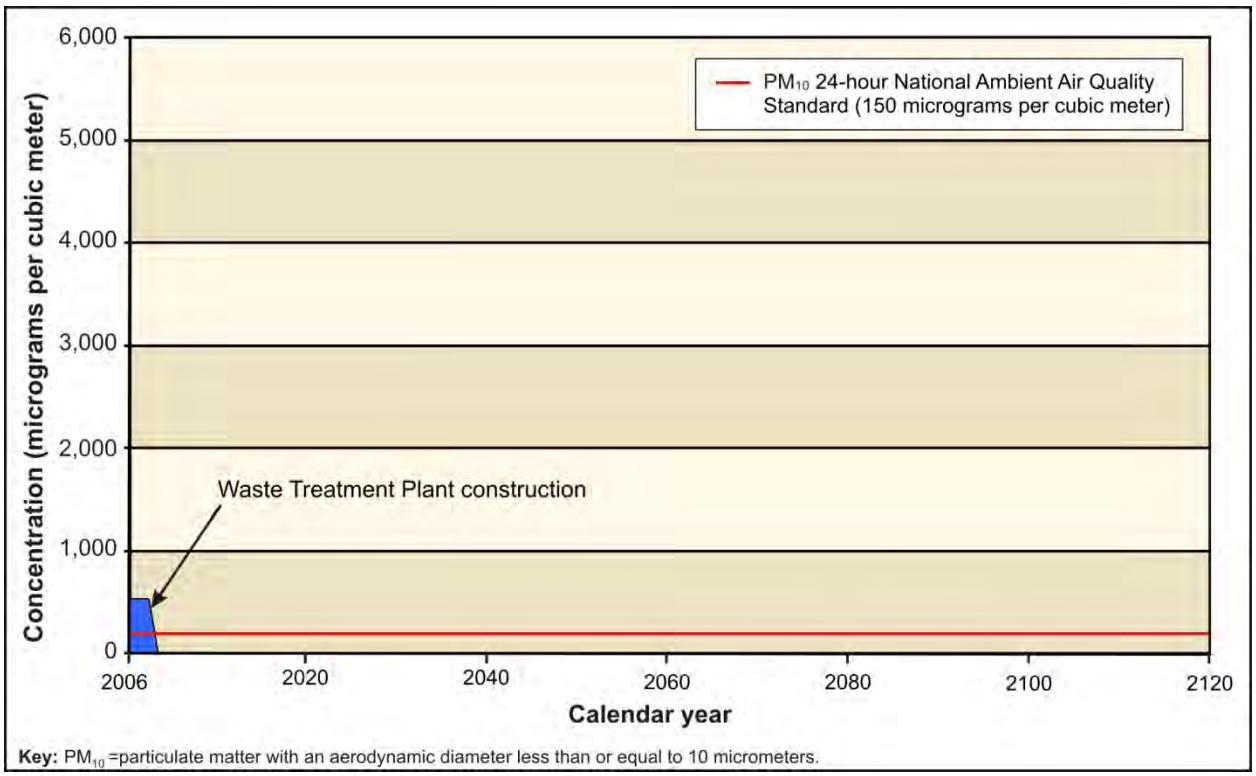


**Figure 4–3. Tank Closure Alternative 1 $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.2 Alternative 2A: Existing WTP Vitrification; No Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 2A are presented in Table 4–3. Peak concentrations of all criteria pollutants would occur from 2065 through 2066. These peak period concentrations would result primarily from WTP replacement construction and Borrow Area C operations, with two exceptions: sulfur dioxide would result from WTP operations and replacement construction, and carbon monoxide would result from WTP and 242-A Evaporator replacement construction. The maximum air quality impacts of $PM_{10}$ emissions would occur south of State Route 240 (24-hour average) and southeast near the site boundary. Figure 4–4 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

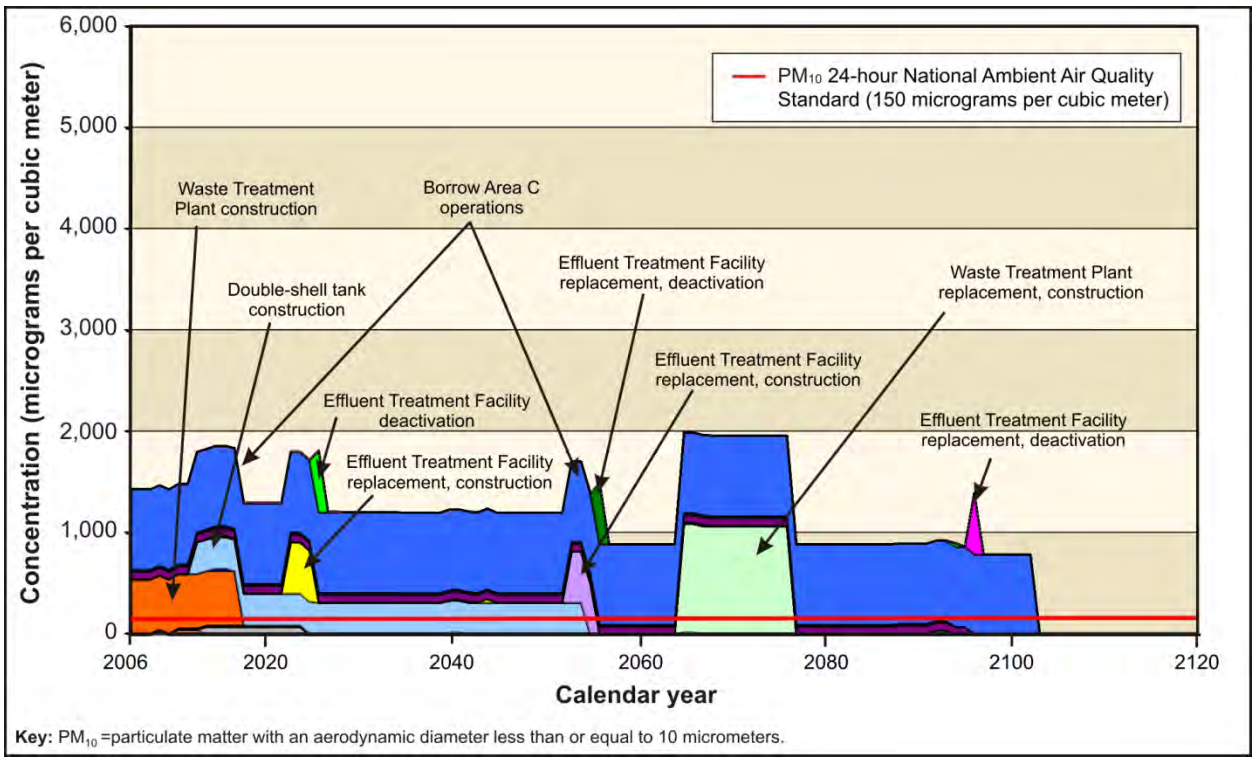


**Figure 4–4. Tank Closure Alternative 2A $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 2B are presented in Table 4–3. Peak concentrations of all criteria pollutants would occur in 2040, except for the carbon monoxide 1-hour average, for which the peak concentration would occur from 2015 through 2016. The peak period $PM_{10}$ concentration would result primarily from modified RCRA Subtitle C barrier placement and Borrow Area C operations. The maximum air quality impacts of $PM_{10}$ emissions would occur to the south along State Route 240 and to the southeast along the Hanford boundary. Figure 4–5 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative, except for mercury. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

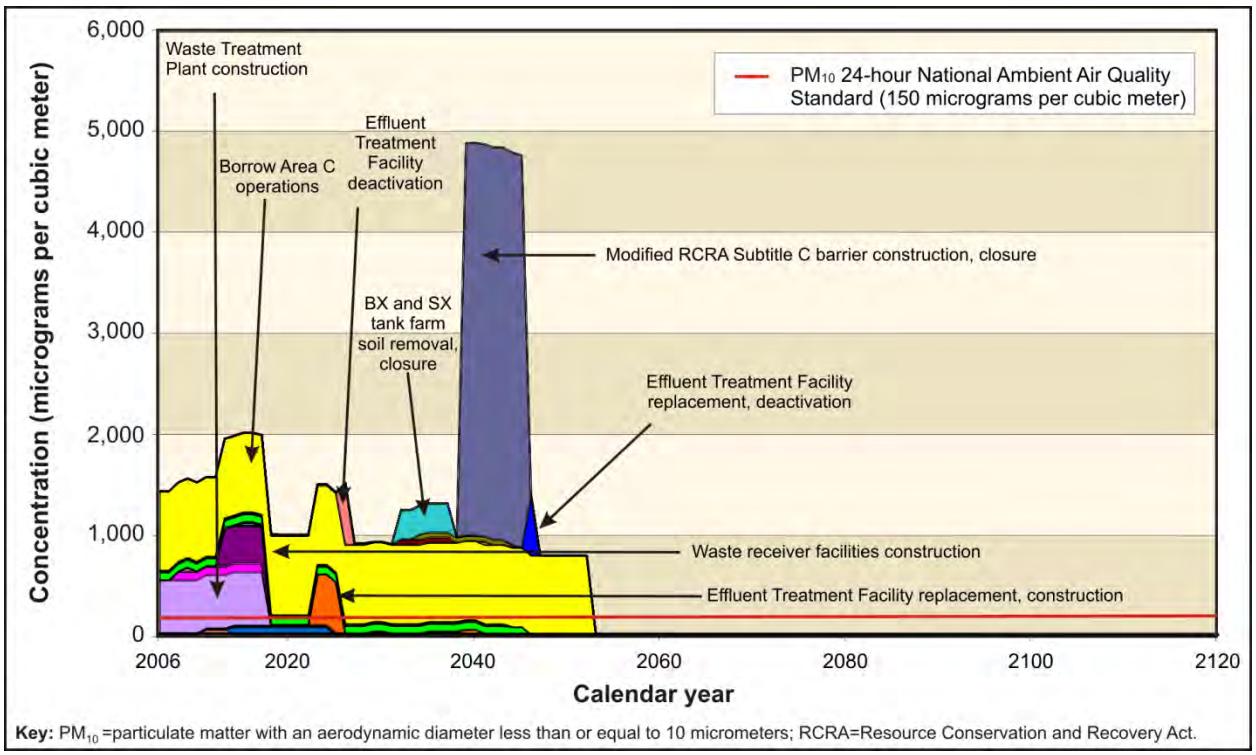


**Figure 4–5. Tank Closure Alternative 2B $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 3A are presented in Table 4–3. Peak concentrations of carbon monoxide, sulfur dioxide, and nitrogen dioxide would occur from 2035 through 2036. Peak concentrations of PM would occur in 2039. These peak period concentrations would result primarily from modified RCRA Subtitle C barrier construction (for nitrogen dioxide and PM); Cesium and Strontium Capsule Processing Facility construction and modified RCRA Subtitle C barrier construction (for carbon monoxide); and Cesium and Strontium Capsule Processing Facility construction, WTP operations, and Bulk Vitrification Facility operations (for sulfur dioxide). $PM_{10}$ concentrations would exceed ambient concentration standards periodically through the year 2052. Figure 4–6 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

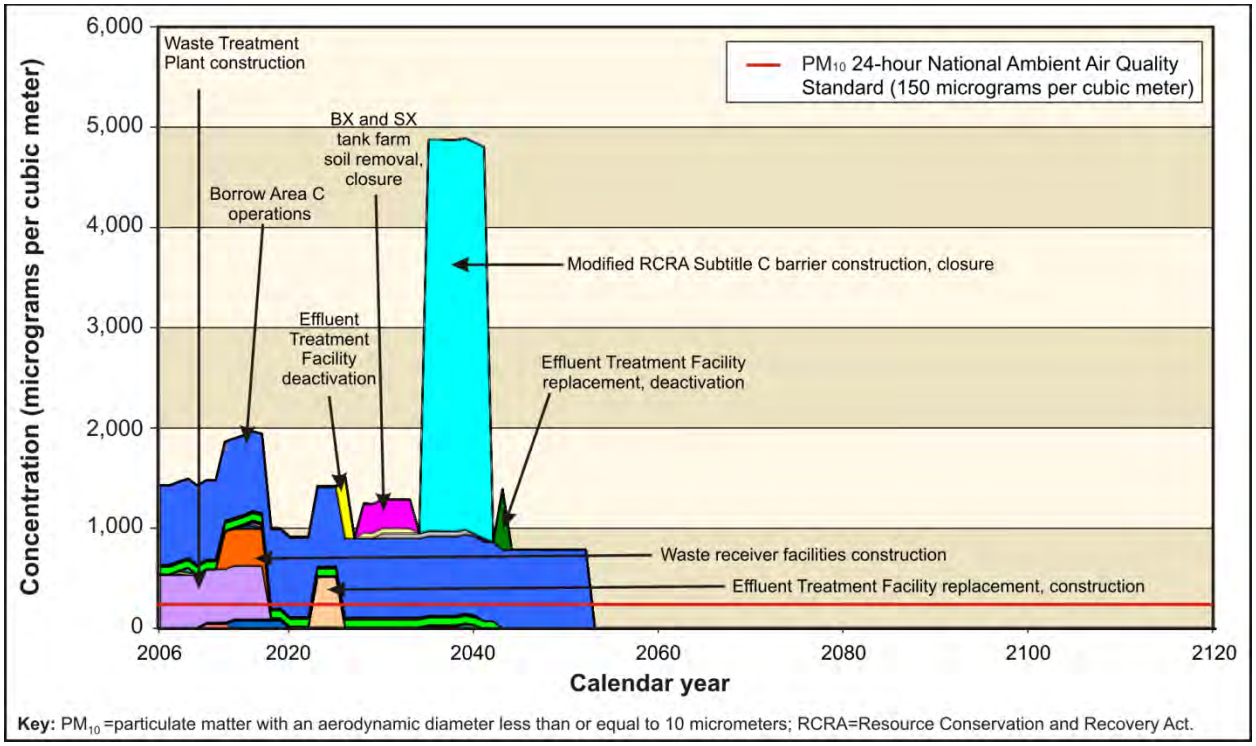


**Figure 4–6. Tank Closure Alternative 3A $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 3B are presented in Table 4–3. Peak concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide would occur from 2035 through 2036. Peak concentrations of PM would occur in 2039. These peak period concentrations would result primarily from modified RCRA Subtitle C barrier construction and Borrow Area C operations (for PM); Cesium and Strontium Capsule Processing Facility deactivation, WTP operations, and modified RCRA Subtitle C barrier construction (for sulfur dioxide); Cesium and Strontium Capsule Processing Facility construction and modified RCRA Subtitle C barrier construction (for carbon monoxide); and modified RCRA Subtitle C barrier construction (for nitrogen dioxide). $PM_{10}$ concentrations would exceed ambient concentration standards periodically from 2006 through 2052. Figure 4–7 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

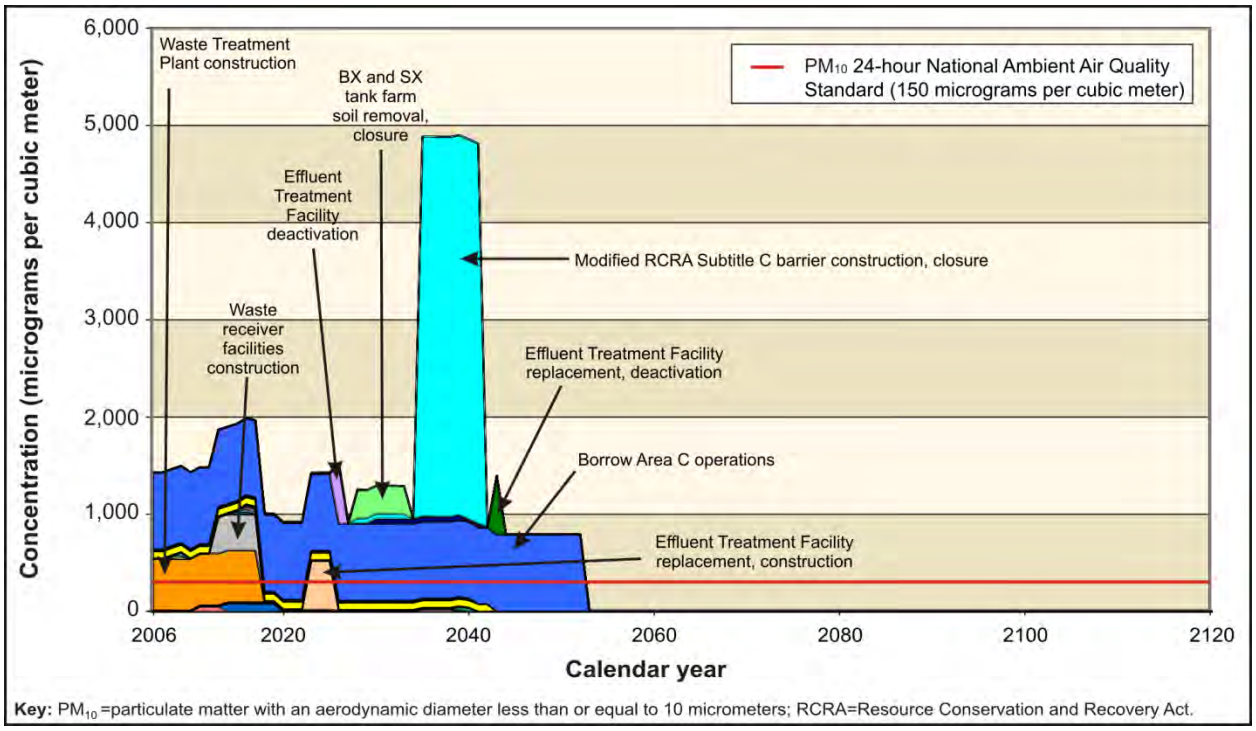


**Figure 4–7. Tank Closure Alternative 3B $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 3C are presented in Table 4–3. Peak concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide would occur from 2035 through 2036. Peak concentrations of PM would occur in 2039. These peak period concentrations would result primarily from modified RCRA Subtitle C barrier construction and Borrow Area C operations (for PM); Cesium and Strontium Capsule Processing Facility construction, WTP operations, and modified RCRA Subtitle C barrier construction (for sulfur dioxide); modified RCRA Subtitle C barrier construction (for nitrogen dioxide); and Cesium and Strontium Capsule Processing Facility construction and modified RCRA Subtitle C barrier construction (for carbon monoxide). The peak period concentration of sulfur dioxide would result primarily from WTP operations. $PM_{10}$ concentrations would exceed ambient concentration standards periodically from 2006 through 2052. Figure 4–8 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

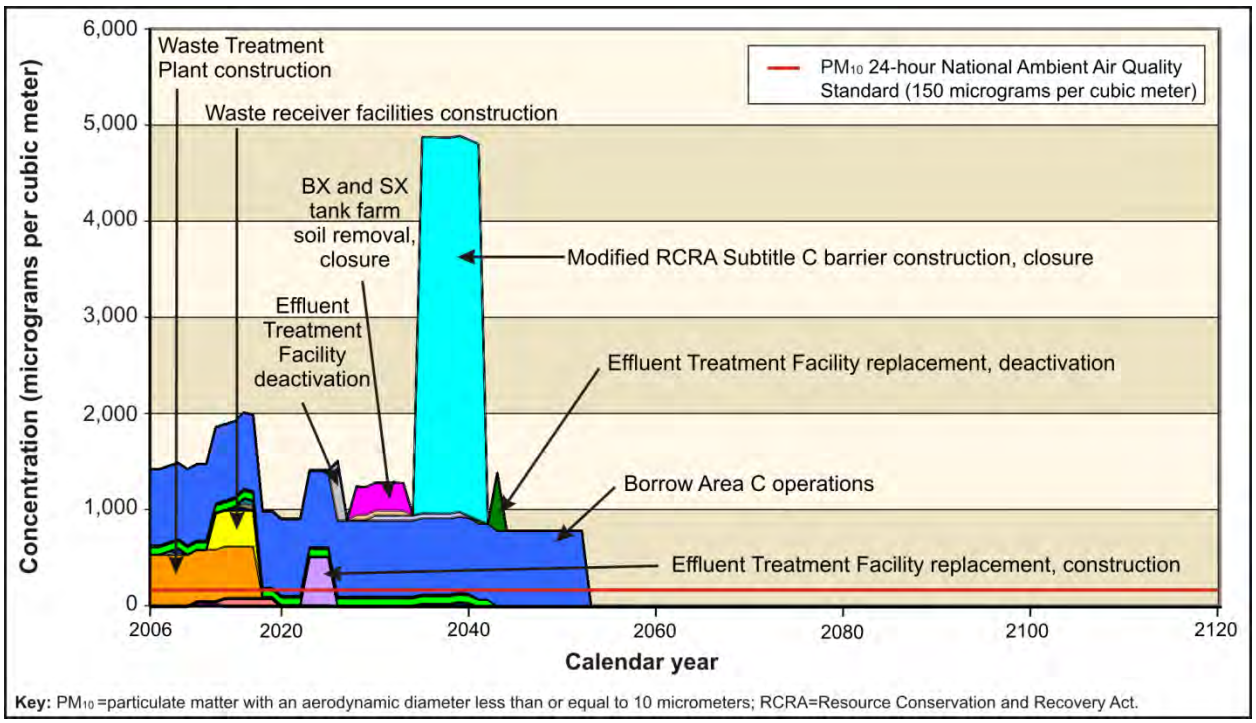


**Figure 4–8. Tank Closure Alternative 3C $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 4 are presented in Table 4–3. Peak concentrations of carbon monoxide would occur in 2016. Peak concentrations of nitrogen dioxide and sulfur dioxide would occur from 2038 through 2039. The peak concentration of PM would occur in 2042. These peak period concentrations would result primarily from WTP construction (for carbon monoxide), modified RCRA Subtitle C barrier construction (for nitrogen dioxide and PM), and WTP and Bulk Vitrification Facility operations and modified RCRA Subtitle C barrier construction (for sulfur dioxide). $PM_{10}$ concentrations would exceed ambient concentration standards periodically from 2006 through 2052. Figure 4–9 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

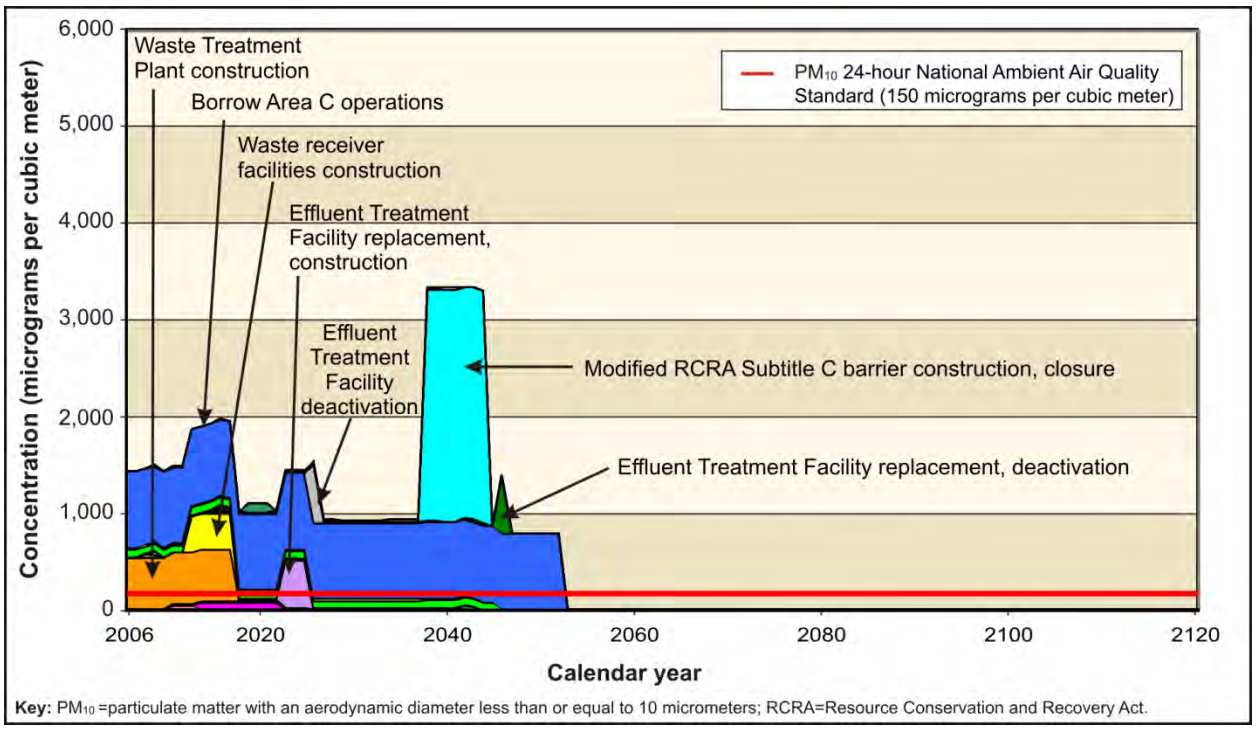


**Figure 4–9. Tank Closure Alternative 4 $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 5 are presented in Table 4–3. Peak concentrations of carbon monoxide (8-hour average), nitrogen dioxide, and sulfur dioxide would occur from 2029 through 2032. The peak concentration of carbon monoxide (1-hour average) would occur in 2016. The peak concentration of PM would occur in 2037. These peak period concentrations would result primarily from Hanford barrier construction (for carbon monoxide [8-hour average], nitrogen dioxide, and PM); WTP, tank upgrade, and Sulfate Removal Facility construction (for carbon monoxide [1-hour average]); and WTP and Bulk Vitrification Facility operations and Hanford barrier construction (for sulfur dioxide). $PM_{10}$ concentrations would exceed ambient concentration standards periodically through 2052. Figure 4–10 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

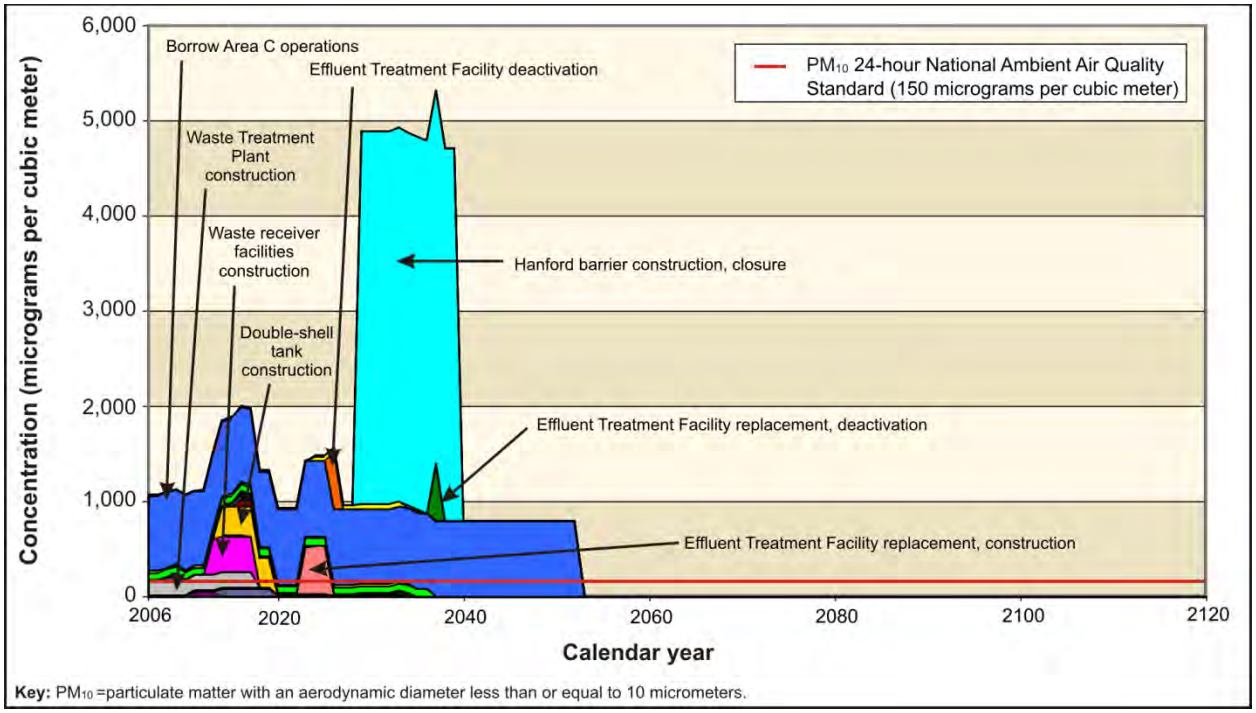


**Figure 4–10. Tank Closure Alternative 5 $PM_{10}$ Maximum 24-Hour Concentration**

### 4.1.4.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.4.9.1 Base Case

Criteria pollutant concentrations from activities under Tank Closure Alternative 6A, Base Case, are presented in Table 4–3. Peak concentrations of carbon monoxide, nitrogen dioxide, PM, and sulfur dioxide would occur from 2149 through 2150. These peak period concentrations would result primarily from modified RCRA Subtitle C barrier construction. $PM_{10}$ concentrations would exceed ambient concentration standards periodically through 2197. The peak period concentration for PM (annual) would result primarily from double-shell tank (DST) replacement construction and ETF replacement construction. Figure 4–11 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

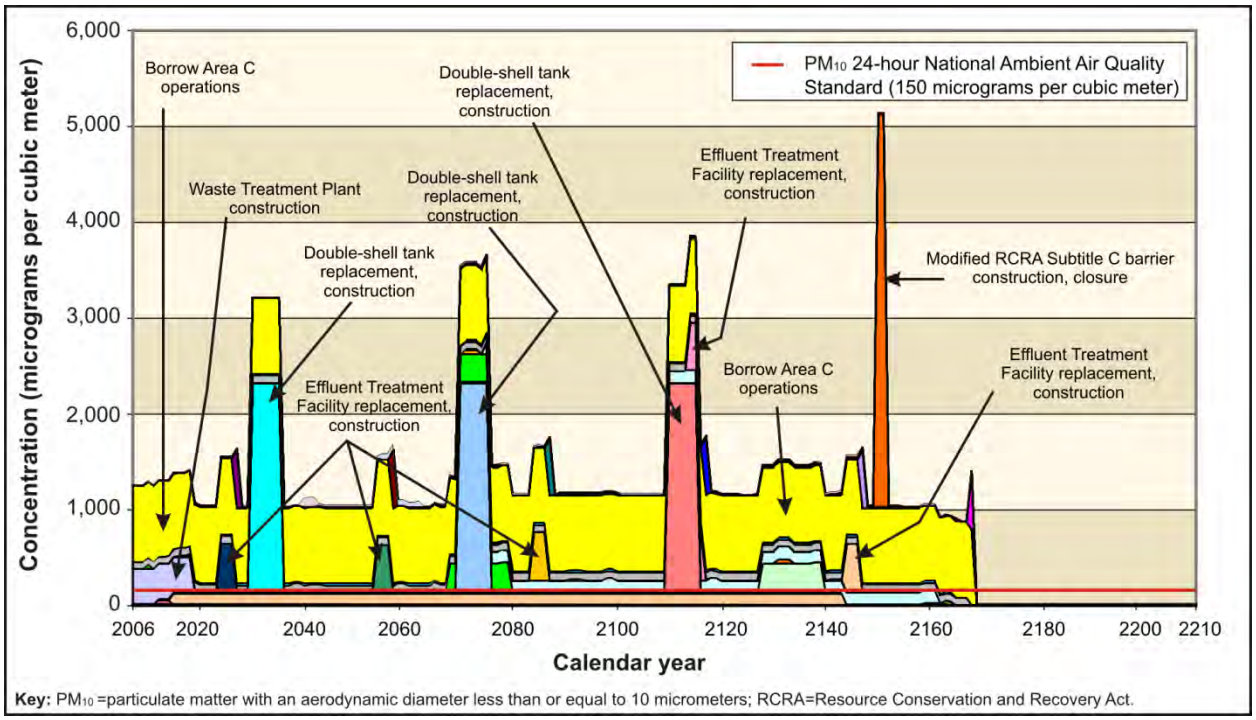


**Figure 4–11. Tank Closure Alternative 6A, Base Case, $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.9.2 Option Case

Criteria pollutant concentrations from activities under Tank Closure Alternative 6A, Option Case, are presented in Table 4–3. Peak concentrations of carbon monoxide and PM would occur from 2113 through 2114. Peak concentrations of sulfur dioxide (1-hour, 3-hour, and annual averages) would occur from 2158 through 2161. Peak concentrations of sulfur dioxide (24-hour average) would occur in 2115. Peak concentrations of nitrogen dioxide would occur from 2069 through 2074. These peak period concentrations would result primarily from ETF and DST replacement construction (for carbon monoxide and PM); ETF replacement construction and WTP operations (for sulfur dioxide [24-hour average]); WTP operations (for sulfur dioxide [1-hour, 3-hour, and annual averages]); and DST and WTP replacement construction and WTP operations (for nitrogen dioxide). $PM_{10}$ concentrations would exceed ambient concentration standards periodically through 2197. Figure 4–12 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

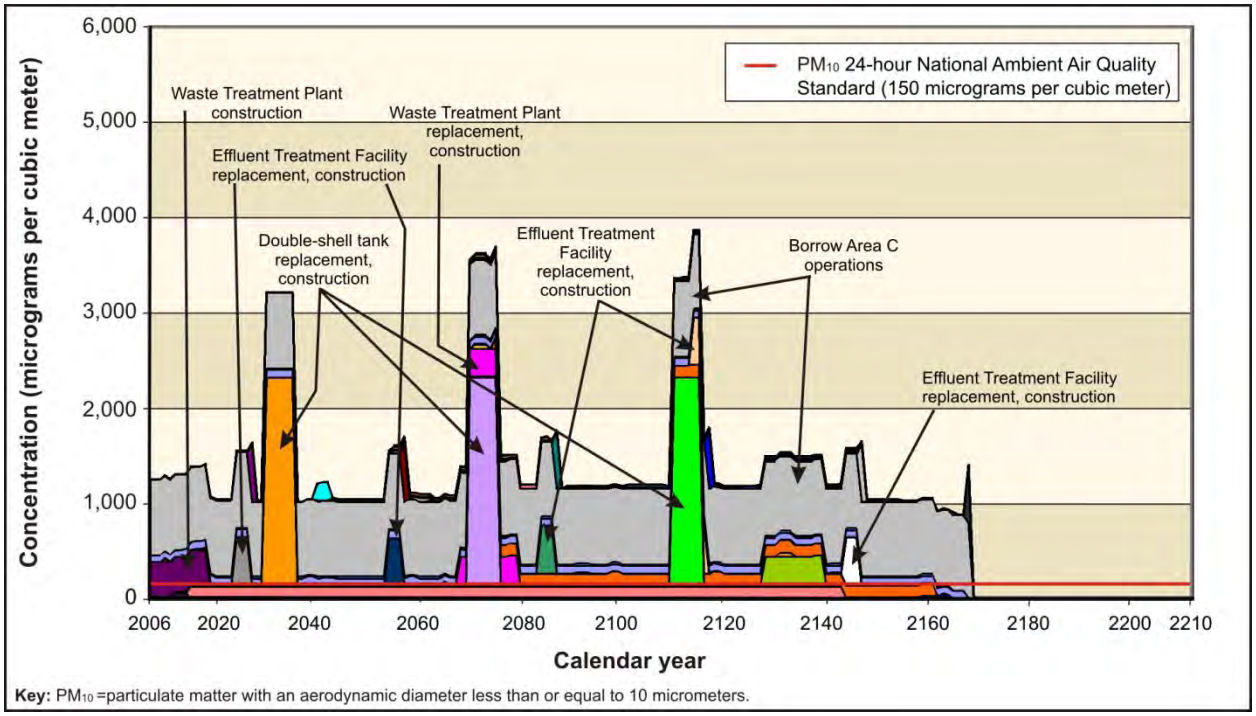


**Figure 4–12. Tank Closure Alternative 6A, Option Case, $PM_{10}$ Maximum 24-Hour Concentration**

### 4.1.4.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.4.10.1 Base Case

Criteria pollutant concentrations from activities under Tank Closure Alternative 6B, Base Case, are presented in Table 4–3. Peak concentrations of carbon monoxide would occur in 2016. Peak concentrations of nitrogen dioxide and PM would occur in 2101. Peak concentrations of sulfur dioxide would occur in 2040. These peak period concentrations would result primarily from WTP, tank upgrade, and 242-A Evaporator construction (for carbon dioxide); modified RCRA Subtitle C barrier construction (for nitrogen dioxide and PM); and WTP and Cesium and Strontium Capsule Processing Facility operations (for sulfur dioxide). $PM_{10}$ concentrations would exceed ambient concentration standards periodically through 2102. Figure 4–13 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative, except for mercury. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

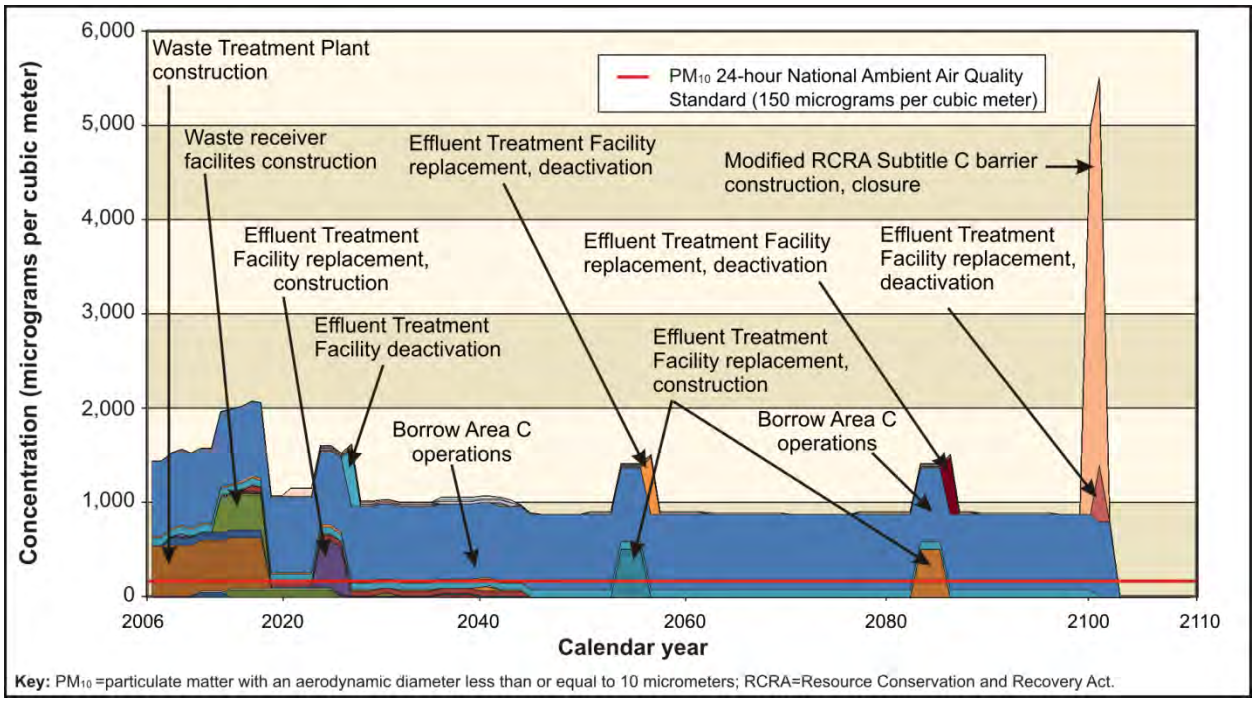


**Figure 4–13. Tank Closure Alternative 6B, Base Case, $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.10.2 Option Case

Criteria pollutant concentrations from activities under Tank Closure Alternative 6B, Option Case, are presented in Table 4–3. Peak concentrations of carbon monoxide and PM would occur in 2016. Peak concentrations of nitrogen dioxide and sulfur dioxide would occur in 2040. These peak period concentrations would result primarily from WTP construction (for carbon monoxide), WTP and waste receiver facility (WRF) construction and Borrow Area C operations (for PM), and WTP and Cesium and Strontium Capsule Processing Facility operations (for nitrogen dioxide and sulfur dioxide). $PM_{10}$ concentrations would exceed ambient concentration standards periodically through 2102. Figure 4–14 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative, except for mercury. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

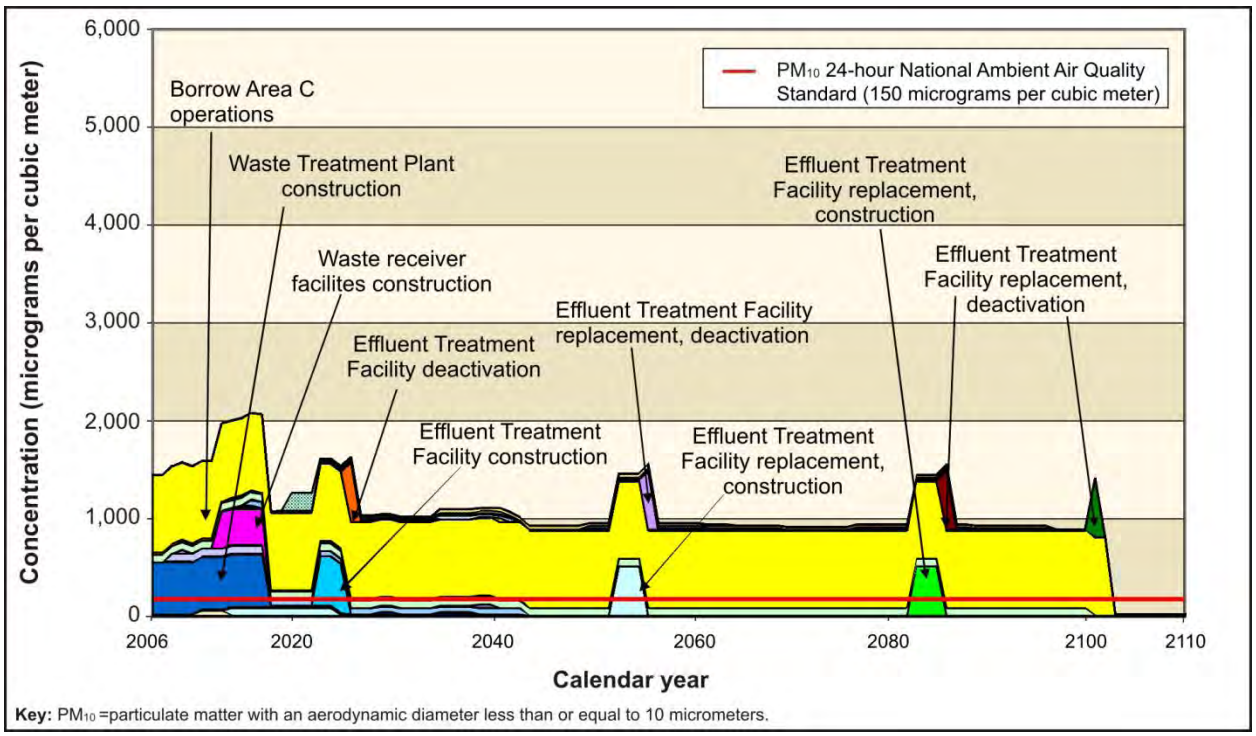


**Figure 4–14. Tank Closure Alternative 6B, Option Case, $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.1.4.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Criteria pollutant concentrations from activities under Tank Closure Alternative 6C are presented in Table 4–3. Peak concentrations of carbon monoxide, nitrogen dioxide, PM, and sulfur dioxide would occur in 2040. The peak period concentrations of carbon monoxide, nitrogen dioxide, and PM would result primarily from modified RCRA Subtitle C barrier construction. The peak period concentrations of sulfur dioxide would result primarily from WTP and Cesium and Strontium Capsule Processing Facility operations and modified RCRA Subtitle C barrier construction. $PM_{10}$ concentrations would exceed ambient concentration standards periodically through 2052. Figure 4–15 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities to these concentrations.

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated under this alternative, except for mercury. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

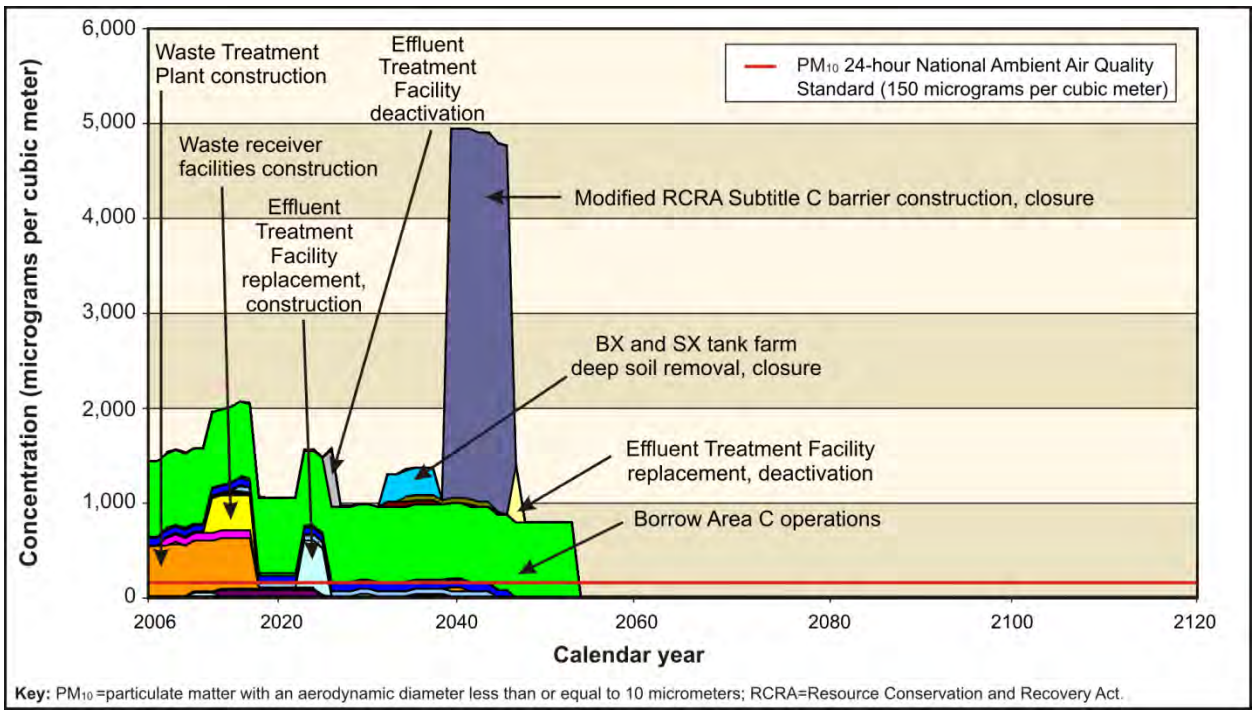


**Figure 4–15. Tank Closure Alternative 6C $PM_{10}$ Maximum 24-Hour Concentration**

### 4.1.5 Geology and Soils

Impacts on geology and soils under the Tank Closure alternatives generally are expected to be directly proportional to the total area of land disturbed by site grading, soil compaction, and depth of excavation associated with construction of new facilities to support tank farm closure activities. These impacts would be associated with site excavation work and grading in preparation for constructing building foundations, roadways, parking areas, and laydown areas. Impacts would also include disturbance from trenching and excavation work to install piping, utilities, and other conveyances between buildings and other facilities, as well as disturbance due to exhumation of contaminated soils and other media associated with tank closure.

Under the Tank Closure alternatives, excavation depths for facility construction are not expected to exceed about 12 meters (40 feet) and would be limited by the depth of excavation needed to pour concrete

for the walls and basements of the Vitrification Facility melter bays within the WTP. Excavation for most facilities is expected to be less than 3 meters (10 feet). The gravel, sand, and silt deposits of the Hanford formation, which compose the uppermost strata across the 200 Areas, are up to 65 meters (213 feet) thick across the 200 Areas, so the lateral and vertical extent of this unit would not be greatly impacted by facility construction. Uncontaminated soils and sediments excavated during facility construction would typically be stockpiled on site for future construction uses, such as foundation backfill.

Site construction for the WTP is ongoing, and the denuded surface soils and unconsolidated sediments resulting from excavations to support tank waste retrieval, treatment, and disposal, as well as the excavations and cut slopes required for other facilities' construction, would be subject to wind and water erosion if left exposed over an extended period of time. Adherence to standard best management practices for soil erosion and sediment control during construction would minimize soil erosion and loss. To reduce the risk from exposing contaminated soils, areas in which new facilities would be constructed under this alternative would be surveyed prior to any ground disturbance. Any contamination would be remediated as necessary. After construction, disturbed areas would either lie within the footprint of the new buildings or be covered by other impervious or semipervious surfaces; excavations would be backfilled and revegetated and would not be subject to long-term soil erosion.

Consumption of geologic resources (rock, minerals, and soils) to support facility construction, operations, and deactivation, as applicable, would constitute the major indirect impact on geologic and soil resources from implementation of Tank Closure alternatives, as summarized in Table 4–7. Varying quantities of geologic resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; and, most substantially, tank farm closure. Geologic resources, including relatively large volumes of gravel, sand, and silt, are available from the suprabasalt sediments and associated soils at Hanford. Rock, in the form of basalt, is also plentiful. As discussed in the *Environmental Assessment, Use of Existing Borrow Areas, Hanford Site, Richland, Washington* (DOE 2001a), a number of active gravel and sand pits and two rock quarries at Hanford have been identified for use in providing a continual supply of borrow materials for new facility construction, maintenance of existing facilities, and fill and capping material for remediation and other sites. Of the two active quarries on the site, quarry No. 2 (referred to as "Borrow Area C" in this EIS), located due south of the 200-West Area just south of State Route 240, has large volumes of basalt and sand (DOE 2001a:1-1, 3-1–3-4). This approximately 926.3-hectare (2,289-acre) borrow area has been designated as a source of materials such as rock riprap (basalt), aggregate (gravel and sand), and soil (silt and loam) that would be needed to support tank farm closure and supporting activities, as described in this EIS (DOE 2003a:5-3, 6-15, 6-21, 6-46, 6-73).

In addition, gravel pit No. 30, located between the 200-East and 200-West Areas, would continue to provide aggregate (gravel and sand) for operation of onsite concrete batch plants to support new facility construction, including those at the WTP adjacent to the 200-East Area. Cement (a product of limestone and other minerals) to feed the batch plants would continue to be procured via offsite sources. Additional borrow materials would also be required for site grading, backfilling excavations, and other uses and could be obtained from either Borrow Area C or gravel pit No. 30.

Geologic resources would also be required for the production of grout. Grout, which is principally composed of cement, fly ash, sand, and sodium bentonite clay mixed with water, would be used to varying degrees under all Tank Closure alternatives to fill and stabilize tanks and associated ancillary equipment within each tank farm and to fill ancillary equipment outside the landfill closure barrier lobes that would be constructed under all alternatives except Alternative 2A. The boxes into which removed ancillary equipment would be placed for disposal would also be filled with grout. Cement, fly ash, and sodium bentonite would be obtained off site from local, commercial sources. Sand for the grout mixture would be obtained from Borrow Area C (DOE 2003a:6-1–6-55).

**Table 4–7. Summary of Major Geologic and Soil Resource Impact Indicators and Requirements**

| Parameter/ Resource | Tank Closure Alternative | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2A** | **2B** | **3A** | **3B** | **3C** | **4** | **5** | **6A, Base Case, *Option Case*** | **6B, Base Case, *Option Case*** | **6C** |
| New, permanent land disturbance[a] | 2 | 63.1 | 112 | 116 | 110 | 110 | 122 | 138 | 591<br>*668* | 359<br>*437* | 166 |
| **Construction Materials** | | | | | | | | | | | |
| Concrete | 33,400 | 675,000 | 424,000 | 347,000 | 345,000 | 354,000 | 495,000 | 368,000 | 6,140,000<br>*6,260,000* | 1,410,000<br>*1,530,000* | 800,000 |
| Cement[b] | 8,270 | 162,000 | 102,000 | 83,500 | 83,200 | 85,100 | 120,000 | 87,800 | 1,500,000<br>*1,530,000* | 346,000<br>*374,000* | 195,000 |
| Sand[b] | 16,200 | 327,000 | 206,000 | 168,000 | 167,000 | 172,000 | 240,000 | 178,000 | 3,010,000<br>*3,070,000* | 685,000<br>*742,000* | 388,000 |
| Gravel[b] | 21,100 | 427,000 | 268,000 | 219,000 | 218,000 | 224,000 | 312,000 | 233,000 | 3,920,000<br>*4,000,000* | 889,000<br>*965,000* | 507,000 |
| **Other Borrow Materials[c]** | | | | | | | | | | | |
| Rock/basalt | 0 | 14,300 | 14,300 | 9,630 | 9,630 | 9,630 | 12,800 | 9,630 | 350,000<br>*350,000* | 14,300<br>*14,300* | 14,300 |
| Sand | 187 | 1,250 | 3,750 | 3,750 | 3,750 | 3,750 | 3,750 | 3,750 | 1,250<br>*1,250* | 1,250<br>*1,250* | 3,750 |
| Gravel | 246 | 5,630 | 8,470 | 8,470 | 8,470 | 8,470 | 11,400 | 8,470 | 11,000<br>*11,000* | 8,910<br>*8,910* | 8,470 |
| Soil (specification backfill) | 55,100 | 550,000 | 782,000 | 748,000 | 748,000 | 748,000 | 2,020,000 | 221,000 | 9,320,000<br>*13,100,000* | 8,550,000<br>*12,300,000* | 782,000 |
| **Operations Materials** | | | | | | | | | | | |
| Cement | 0 | 0 | 0 | 0 | 27,700[d] | 0 | 17,700[d] | 17,700[d] | 0 | 0 | 0 |
| Sand | 0 | 0 | 0 | 148,000[e] | 0 | 0 | 50,200[e] | 50,200[e] | 0 | 0 | 0 |
| Soil | 0 | 0 | 0 | 187,000[e] | 0 | 0 | 63,100[e] | 63,100[e] | 0 | 0 | 0 |
| Kaolin clay/iron oxide | 0 | 0 | 0 | 0 | 0 | 207,000[f] | 0 | 0 | 0 | 0 | 0 |

**Table 4–7. Summary of Major Geologic and Soil Resource Impact Indicators and Requirements (*continued*)**

| Parameter/ Resource | Tank Closure Alternative | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2A** | **2B** | **3A** | **3B** | **3C** | **4** | **5** | **6A, Base Case, *Option Case*** | **6B, Base Case, *Option Case*** | **6C** |
| **Closure-Specific Materials** | | | | | | | | | | | |
| Grout[g] | 0 | 100 | 796,000 | 796,000 | 796,000 | 796,000 | 721,000 | 791,000 | 237,000<br>*788,000* | 237,000<br>*788,000* | 796,000 |
| Cement | 0 | 10.0 | 13,200 | 13,000 | 13,200 | 13,200 | 20,500 | 12,600 | 28,000<br>*93,000* | 28,000<br>*93,000* | 13,200 |
| Sand[h] | 0 | 50.1 | 774,000 | 774,000 | 774,000 | 774,000 | 661,000 | 772,000 | 116,000<br>*384,000* | 116,000<br>*384,000* | 774,000 |
| Barrier materials | 0 | 0 | 2,300,000[i] | 2,300,000[i] | 2,300,000[i] | 2,300,000[i] | 1,280,000[i] | 3,830,000[j] | 689,000[k]<br>*0* | 689,000[k]<br>*0* | 2,300,000[i] |
| **Total[l]** | **92,800** | **1,320,000** | **4,360,000** | **4,570,000** | **4,240,000** | **4,230,000** | **4,650,000** | **5,380,000** | **17,400,000**<br>***20,900,000*** | **10,900,000**<br>***14,400,000*** | **4,780,000** |

[a] Reflects land area assumed to be permanently disturbed for new facilities. The value also includes land area excavated from Borrow Area C or elsewhere to supply geologic materials listed in the table.
[b] Component of concrete.
[c] Resources for miscellaneous uses not exclusively tied to facility construction, operations, or closure, such as site grading and backfill for excavations.
[d] Resources to support Cast Stone Facility operations in addition to fly ash and blast furnace slag additives that would not be procured from onsite deposits.
[e] Resources to support Bulk Vitrification Facility operations.
[f] Resources to support Steam Reforming Facility operations in addition to other materials; reported in total metric tons.
[g] Grout comprises cement, sand, fly ash, and other materials.
[h] Principal component of grout that would be obtained from onsite deposits.
[i] Volume includes soil, sand, gravel, rock, and asphalt for construction of modified Resource Conservation and Recovery Act Subtitle C barriers for landfill closure of all tank farms and six sets of cribs and trenches (ditches), except under Alternative 4, in which the BX and SX tank farms would be clean-closed rather than landfill-closed.
[j] Volume includes soil, sand, gravel, rock, and asphalt for construction of Hanford barriers for landfill closure of all tank farms and six sets of cribs and trenches (ditches).
[k] Volume includes soil, sand, gravel, rock, and asphalt for construction of modified Resource Conservation and Recovery Act Subtitle C barriers for landfill closure of the six sets of cribs and trenches (ditches) in the B and T Areas.
[l] Excludes concrete, cement, grout, and kaolin clay/iron oxide. Totals may not equal the sum of the contributions due to rounding.

**Note:** All values are expressed in cubic meters except land disturbance, which is in hectares. Values presented in the table have been rounded to no more than three significant digits, where appropriate. To convert cubic meters to cubic yards, multiply by 1.308; hectares to acres, by 2.471.

**Source:** SAIC 2010a.

Materials would also be required for construction of barriers for landfill closure of the Hanford tank farms. These engineered barriers would be composed of layers of topsoil in the upper part, underlain by layers of sand, gravel, asphalt, and/or riprap in the lower part. The structures would be constructed in lobes ranging from the approximately 2.7-meter-thick (9-foot-thick) modified RCRA Subtitle C barriers that would be constructed under Alternatives 2B, 3A–3C, 4, and 6C to the more robust, 4.6-meter-thick (15-foot-thick) Hanford barrier that would be constructed under Alternative 5. Under Alternatives 6A and 6B, Base Cases, a modified RCRA Subtitle C barrier of very limited extent would be constructed for landfill closure of just the six sets of cribs and trenches (ditches) in the B and T Areas. These structures are further described in Chapter 2, Section 2.3.4.1. For postclosure care of the landfills, sodium bentonite clay or grout would be required for completion of groundwater monitoring wells (DOE 2003a:6-86, 6-87).

Development of Borrow Area C using modern open-pit excavation techniques (with excavations averaging 4.6 meters [15 feet] deep) and allocation of 20 percent of the total site for cut-slope maintenance, haul roads, and stockpile and buffer areas could yield, conservatively, 34.3 million cubic meters (44.9 million cubic yards) of borrow material to address the geologic resource requirements discussed above. In addition, gravel pit No. 30, located between the 200-East and 200-West Areas, is an approximately 54-hectare (134-acre) borrow site containing a large quantity of aggregate suitable for multiple uses (DOE 2001a:3-4, A-3). Aggregate reserves at gravel pit No. 30 are estimated at 15.3 million cubic meters (20 million cubic yards) of material (DOE 1999:D-4), part of the estimated total of 49.6 million cubic meters (64.9 million cubic yards) of borrow materials available on site. To access Borrow Area C, a 2.0-kilometer-long (1.25-mile-long) paved haul road was completed in 2006 from State Route 240 and the intersection of Beloit Avenue south to Borrow Area C to enable transport of excavated borrow materials to points of use across Hanford. It was assumed for analysis purposes that gravel pit No. 30 and Borrow Area C would be available and would be operated for as long as necessary to support the active project phase associated with each Tank Closure alternative.

Facilities constructed to support tank waste retrieval, treatment, and disposal would be deactivated when they are no longer needed. This activity is not expected to directly impact geology and soils, as facilities would not be demolished or destroyed, and no additional land disturbance should be required. Waste materials and contaminated media would be removed from deactivated facilities and properly disposed of; they would not be disposed of in an unabated manner where they could contaminate geologic materials or underlying groundwater.

The following sections present projected impacts on geologic and soil resources specific to implementation of each of the Tank Closure alternatives, as well as the effects of geologic conditions on proposed project activities.

#### 4.1.5.1 Alternative 1: No Action

WTP construction and ongoing tank farm facility upgrades and associated construction activities would continue through 2008 under Alternative 1, at which time WTP construction would be terminated. As the WTP site is already disturbed, construction activities through 2008 would have a negligible incremental impact on geologic strata and soils. However, an area of 17 hectares (42 acres), consisting of the 18 tank farms, would be indefinitely committed to waste management use (see Section 4.1.1.1.1). Ongoing tank system upgrades would be confined to developed areas. In addition to cement, sand, and gravel used principally for concrete production, construction activities through 2008 would require additional geologic resources, including borrow materials for site grading, backfilling, and other uses, as shown in Table 4–7.

Total geologic resource requirements under Alternative 1 were projected to be 92,800 cubic meters (121,000 cubic yards), with little or no geologic resources expected to be required during the

100-year administrative control period. Excavation of about 2 hectares (5 acres) of Borrow Area C would be required to supply this volume of geologic material. However, it is expected that this volume would continue to be supplied by gravel pit No. 30, which has sufficient reserves to supply this relatively small demand volume without use of Borrow Area C, as further described in Section 4.1.5.

Hazards from large-scale geologic conditions at Hanford are summarized in Chapter 3, Section 3.2.5.1.4, and were previously analyzed in the *Final Programmatic Environmental Impact Statement for Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility* (DOE 2000). Review of the previous analyses, as well as data presented in this EIS, indicates that the ground shaking of Modified Mercalli Intensity (MMI) V to VII that is associated with the postulated earthquakes (see Appendix F, Table F–7) could potentially affect the integrity of inadequately designed or nonreinforced structures and cause moderate damage in some other structures. Analysis of a beyond-design-basis accident triggered by an earthquake-induced tank dome collapse has been considered; the result is incorporated by reference in Section 4.1.11.1.

#### 4.1.5.2 Alternative 2A: Existing WTP Vitrification; No Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal under Alternative 2A would permanently disturb about 33.9 hectares (83.8 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities (see Section 4.1.1.2.1 and Table 4–1). An additional 29.1 hectares (72 acres) would also be excavated from Borrow Area C, making a total of 63.1 hectares (156 acres) of new, permanent land disturbance. An additional 17 hectares (42 acres) of land, consisting of the 18 tank farms and adjacent areas, would remain in waste management use. Other direct impacts on geology and soils under Alternative 2A, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Section 4.1.5; excavation depths are not expected to exceed about 12 meters (40 feet) and would generally be less than 3 meters (10 feet).

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources. The surficial soils, unconsolidated strata, and underlying basaltic bedrock of the 200 Areas are present elsewhere in the region and at Hanford. However, relatively large quantities of geologic resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; and waste retrieval activities over the active phase of this alternative. In addition to the cement, sand, and gravel used principally for concrete production, additional geologic resources in the form of borrow materials would be required for site grading, backfilling, and other uses, as shown in Table 4–7 and further described in Section 4.1.5. Total geologic resource requirements under Alternative 2A were projected to be 1.32 million cubic meters (1.73 million cubic yards). This volume is not expected to deplete locally available deposits or material stockpiles because reserves of aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5.

Hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect new facilities in the 200 Areas are summarized in Chapter 3, Section 3.2.5.1.4. Maximum considered earthquake ground motions for Hanford encompass those that may cause substantial structural damage to buildings (equivalent to an MMI of VII and up), thus presenting safety concerns for occupants. Ground shaking of MMI VII associated with postulated earthquakes is possible, as supported by the historical record for the region. However, this level of ground motion is expected to primarily affect the integrity of inadequately designed or nonreinforced structures (see Appendix F, Table F–7). All facilities would be designed, constructed, and operated in compliance with applicable DOE orders, requirements, and governing standards established to protect public and worker health and

the environment. DOE Order 420.1B requires that nuclear and nonnuclear facilities be designed, constructed, and operated so that the public, workers, and environment are protected from adverse impacts of natural phenomena hazards, including earthquakes. As further described in Appendix F, Section F.5.2, the order stipulates natural phenomena hazards mitigation for DOE facilities and specifically provides for reevaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. An analysis of potential effects of a beyond-design-basis earthquake on human health and the environment is provided in Section 4.1.11.2.

#### 4.1.5.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal and landfill closure under Alternative 2B would permanently disturb about 16.7 hectares (41.3 acres) of land. Most of this activity would take place within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities with expanded LAW vitrification capacity (see Section 4.1.1.3.1 and Table 4–1). An additional 95.1 hectares (235 acres) would also be excavated from Borrow Area C, making a total of 112 hectares (276 acres) of new, permanent land disturbance.

The type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those under Alternative 2A (see Sections 4.1.5 and 4.1.5.2); excavation depths are not expected to exceed about 12 meters (40 feet) and would be less than 3 meters (10 feet) for most activities. However, the total scale of direct impacts associated with new facility construction would generally be greater than under Alternative 2A due to the addition of the expanded LAW Vitrification Facility melter bays and activities associated with landfill closure of the SST system. Specifically, to support landfill closure of the tank farms under this alternative, a portable grout production facility would be required in both the 200-East and 200-West Areas to fill and stabilize tanks and ancillary equipment in each area (DOE 2003a:6-9). Domed containment structures would also be erected over both the BX and SX tank farms in the 200-East and 200-West Areas, respectively, to support removal of the upper 4.6 meters (15 feet) of contaminated soils.

The upper 4.6 meters (15 feet) of soils and encountered ancillary equipment within the BX and SX tank farms would then be excavated and removed for disposal as mixed low-level radioactive waste (MLLW) in the River Protection Project Disposal Facility (RPPDF). Waste generation and management activities under this alternative are further discussed in Section 4.1.14.3. The excavations would be backfilled with clean soil from Borrow Area C (DOE 2003a:6-90–6-95).

Construction of the modified RCRA Subtitle C barrier would then commence. To complete landfill closure of the SST system, the engineered barrier would be emplaced in five separate lobes to cover all 18 tank farms and the six sets of cribs and trenches (ditches) associated with the B and T tank farms. Surface clearing, grading, and grubbing work associated with emplacement of the engineered surface barrier lobes would likely encompass all other site construction activities from a soil erosion perspective, as relatively large areas of denuded soils would be exposed at one time. However, the depth of excavation would not exceed that necessary to achieve the uniform topography upon which to emplace barrier layers. In addition, landfill construction and barrier layer placement would occur in the later stages of the waste retrieval and treatment phases of this alternative after most other construction activities have been completed. Regardless, standard best management practices for soil erosion and sediment control would be employed, including watering to control fugitive dust over the estimated 7-year construction period (DOE 2003a:6-73, 6-74).

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources. The surficial soils, unconsolidated strata, and underlying basaltic bedrock of the 200 Areas are present elsewhere in the region and at Hanford. However, relatively large

quantities of geologic resources would be required under this alternative to support ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; and, most substantially, tank farm landfill closure, as shown in Table 4–7 and further described in Section 4.1.5.

Total geologic resource requirements under Alternative 2B were projected to be 4.36 million cubic meters (5.7 million cubic yards). This volume is not expected to deplete locally available deposits or material stockpiles because reserves of aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5.

Under this alternative, design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect new and existing facilities would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal and landfill closure under Alternative 3A would permanently disturb about 16.3 hectares (40.4 acres) of land. Most of this activity would occur within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities. Also, a Bulk Vitrification Facility and facilities for mixed transuranic (TRU) waste supplemental treatment would be constructed under this alternative in or adjacent to the 200-East and 200-West Areas (see Section 4.1.1.4.1 and Table 4–1). An additional 100 hectares (247 acres) would be excavated from Borrow Area C, making a total of 116 hectares (287 acres) of new, permanent land disturbance. Nevertheless, the type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Sections 4.1.5 and 4.1.5.3 under Alternative 2B; excavation depths are not expected to exceed about 12 meters (40 feet) and would be less than 3 meters (10 feet) for most activities. Further, activity-specific impacts under this alternative related to landfill closure of the SST system would be the same as those described in Section 4.1.5.3 under Alternative 2B. However, the total scale of direct impacts under this alternative would be greater than under Alternative 2B due to the construction of supplemental treatment facilities combined with landfill closure of the SST system.

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources for the reasons previously described in Section 4.1.5.3. In addition to the relatively large quantities of a number of geologic resources required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; and, most substantially, tank farm closure (see Table 4–7), soil and/or sand would be used in the bulk vitrification process to form glass and to stabilize bulk vitrification waste form roll-off boxes prior to disposal (DOE 2003b:6-70, 6-74). Due to the larger demands for construction-related uses and materials for bulk vitrification operations, total geologic resource requirements under Alternative 3A are projected to be 4.57 million cubic meters (5.98 million cubic yards). This volume is not expected to deplete locally available deposits or material stockpiles because reserves of aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal and landfill closure under Alternative 3B would permanently disturb 17.2 hectares (42.6 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities. In addition, a Cast Stone Facility and facilities for mixed TRU waste supplemental treatment would be constructed in or adjacent to the 200-East and 200-West Areas (see Section 4.1.1.5.1 and Table 4–1). An additional 92.3 hectares (228 acres) would be excavated from Borrow Area C, making a total of 110 hectares (271 acres) of new, permanent land disturbance.

The type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Sections 4.1.5 and 4.1.5.4 under Alternative 3A; excavation depths are not expected to exceed about 12 meters (40 feet) and would be less than 3 meters (10 feet) for most activities. Further, activity-specific impacts under this alternative related to landfill closure of the SST system would be similar to those generally described in Sections 4.1.5 and 4.1.5.3 under Alternative 2B. Overall, the total scale of direct impacts under this alternative would be very similar to those under Alternative 3A.

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources for the reasons previously described in Section 4.1.5.3. As under Alternative 3A, relatively large quantities of a number of geologic resources or products made from rock and mineral resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; and, most substantially, tank farm closure (see Table 4–7). Under this alternative, use of the cast stone supplemental treatment technology would reduce the demand for clean soil and sand, compared with Alternative 3A, because the cast stone process would immobilize tank waste utilizing fly ash and blast furnace slag (both industrial waste products) derived from local offsite and regional sources and Portland cement (produced from limestone and other minerals) (DOE 2003b:6-94, 6-95, 6-111–6-113). Due to the smaller demands for supplemental treatment operations associated with cast stone as compared with bulk vitrification, total geologic resource requirements under Alternative 3B are projected to be 4.23 million cubic meters (5.53 million cubic yards). This volume is not expected to deplete locally available deposits or material stockpiles because reserves of aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal and landfill closure under Alternative 3C would permanently disturb about 17.2 hectares (42.4 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities. In addition, a Steam Reforming Facility and facilities for mixed TRU waste supplemental treatment would be constructed in or adjacent to both the 200-East and 200-West Areas (see Section 4.1.1.6.1 and Table 4–1). An additional 92.7 hectares (229 acres) would be excavated from Borrow Area C, making a total of 110 hectares (271 acres) of new, permanent land disturbance. The type and intensity of anticipated direct impacts on geology and soils, including factors that could lead to increased wind and water erosion, would generally be similar to those described in

Sections 4.1.5 and 4.1.5.4 under Alternative 3A; excavation depths are not expected to exceed about 12 meters (40 feet) and would be less than 3 meters (10 feet) for most activities. Further, activity-specific impacts under this alternative related to landfill closure of the SST system would be the same as those described in Section 4.1.5.3 under Alternative 2B. Overall, the total scale of direct impacts under this alternative would be very similar to those under Alternative 3A.

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources for the reasons previously described in Section 4.1.5.2. As under Alternatives 3A and 3B, relatively large quantities of a number of geologic resources or products made from rock and mineral resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; and, most substantially, tank farm closure (see Table 4–7). Under this alternative, geologic resources utilized in the steam reforming supplemental treatment process would be limited to iron oxide and kaolin clay, which would be obtained from offsite regional sources (DOE 2003b:6-37, 6-38, 6-45, 6-61).

Similar to Alternative 3B, total geologic resource requirements under Alternative 3C are projected to be 4.24 million cubic meters (5.55 million cubic yards). This volume is not expected to deplete locally available deposits or material stockpiles because reserves of aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal and tank farm closure under Alternative 4 would permanently disturb about 19.8 hectares (48.9 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities. In addition, a Cast Stone Facility would be constructed adjacent to the 200-East Area, while a Bulk Vitrification Facility would be constructed in the 200-West Area. Facilities for mixed TRU waste supplemental treatment would also be constructed, as well as a PPF for treatment of highly contaminated rubble, soil, and equipment from selective clean closure of the BX and SX tank farms (see Section 4.1.1.7.1 and Table 4–1). An additional 102 hectares (252 acres) would be excavated from Borrow Area C, making a total of 122 hectares (301 acres) of new, permanent land disturbance.

The type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Section 4.1.5 and Sections 4.1.5.4 through 4.1.5.6 under Alternatives 3A through 3C. However, while activity-specific impacts related to landfill closure of the SST system would be similar to those described in Section 4.1.5.3 under Alternative 2B, selective clean closure of the BX and SX tank farms would involve deep excavation work that would entail additional direct and indirect impacts under this alternative.

As under Alternatives 2B, 3A, 3B, and 3C, a portable grout production facility would be required in both the 200-East and 200-West Areas to fill and stabilize tanks and ancillary equipment in each area (DOE 2003a:6-9). Domed containment structures would also be temporarily erected over both the BX and SX tank farms in the 200-East and 200-West Areas, respectively, to support clean closure,

encompassing excavation and removal of contaminated soils, tanks, and associated ancillary equipment within these areas.

In support of clean closure of the BX and SX tank farms, excavation to a depth of about 20 meters (65 feet) below the land surface or 3 meters (10 feet) below the base elevations of the waste tanks would be required at a minimum. This excavation depth is expected to be sufficient to remove soils and sediments contaminated by retrieval-related leaks, as well as contamination from historic waste releases that have accumulated horizontally on compacted strata beneath the waste tanks. For some tank sites, excavation to depths of up to 78 meters (255 feet) below land surface may be required to remediate contaminant plumes from past-practice discharges that have migrated through the vadose zone soils and sediments and possibly to the water table.

To accomplish excavation of the magnitude required for clean closure, work would proceed by first filling each tank with a 0.3-meter (1-foot) layer of grout to stabilize the residual waste and reduce worker exposure. Jet-grouted pile (retaining) walls that extend down the length of each tank elevation to a depth of about 38 meters (125 feet) would then be installed. This would be followed by erection of the containment structure. Closure operations would then proceed by excavation and removal of soils and ancillary equipment, including demolition and removal of the tank structures, tank slabs, and footings. Excavated soils would be characterized and transported either directly to the RPPDF or to the PPF for treatment prior to final disposal as MLLW. Ancillary equipment and tank debris would also be sent to the PPF for treatment prior to onsite disposal. Final closure of the BX and SX tank farms would involve filling the open excavations with clean soil derived from Borrow Area C (DOE 2003c:3–8, 13, 17). Waste generation and management activities under this alternative are further discussed in Section 4.1.14.7.

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources for the main reasons previously described in Section 4.1.5.2. As under Alternatives 3A through 3C, relatively large quantities of a number of geologic resources or products made from rock and mineral resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; supplemental treatment operations; and, most substantially, tank farm closure (see Table 4–7). Under this alternative, the additional demand for borrow material for backfill of excavations in the BX and SX tank farms would be partly compensated for by the fact that construction of the landfill closure barrier would require less resources, as compared with Alternatives 2B through 3C. Total geologic resource requirements under Alternative 4 are projected to be 4.65 million cubic meters (6.1 million cubic yards). This volume is not expected to deplete locally available deposits or material stockpiles because reserves of aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal and landfill closure under Alternative 5 would permanently disturb about 20.2 hectares (49.9 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities. In addition, a Cast Stone Facility would be constructed adjacent to the 200-East Area, while a Bulk Vitrification Facility would be constructed in the 200-West Area. Facilities for mixed TRU waste supplemental treatment would also be constructed. To support

accelerated treatment under this alternative, new DSTs and a Sulfate Removal Facility would be built (see Section 4.1.1.8.1 and Table 4–1). An additional 117 hectares (290 acres) would also be excavated from Borrow Area C, making a total of 138 hectares (340 acres) of new, permanent land disturbance.

The type and intensity of anticipated direct impacts on geology and soils, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Sections 4.1.5 and 4.1.5.4 under Alternative 3A; excavation depths are not expected to exceed about 12 meters (40 feet) and would be less than 3 meters (10 feet) for most activities. Further, activity-specific impacts under this alternative related to landfill closure of the SST system would be somewhat greater than those described in Section 4.1.5.3 under Alternative 2B. Specifically, instead of construction of a modified RCRA Subtitle C barrier as under Alternatives 2B through 3C, a more robust Hanford barrier with a 4.6-meter (15-foot) thickness would be constructed under Alternative 5 for landfill closure of the tank farms. As under the other landfill closure alternatives, a portable grout production facility would be required in both the 200-East and 200-West Areas to fill and stabilize tanks and ancillary equipment in each area (DOE 2003a:6-9). In contrast, there would be no contaminated soil removal at any tank farm under this alternative, and ancillary equipment outside the barrier lobes would be neither removed nor grouted.

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources for the main reasons previously described in Section 4.1.5.2. As under Alternatives 3A through 3C, relatively large quantities of a number of geologic resources or products made from rock and mineral resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; supplemental treatment operations; and, most substantially, tank farm closure (see Table 4–7). Under this alternative, while there would be no additional demand for borrow material for backfill of tank farm excavations, construction of the thicker Hanford barrier across all tank farms would drive an overall greater demand for geologic resources, as compared with the previous alternatives. Total geologic resource requirements under Alternative 5 are projected to be 5.38 million cubic meters (7.04 million cubic yards). This volume is not expected to deplete locally available deposits or material stockpiles because reserves of aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5.

### 4.1.5.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.5.9.1 Base Case

Construction of new facilities to support tank waste retrieval, treatment, and disposal; clean closure of the SST system; and landfill closure of six sets of cribs and trenches (ditches) under Alternative 6A, Base Case, would permanently disturb about 210 hectares (519 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities with expanded HLW vitrification and associated IHLW canister storage capacity. In addition, due to the longer timeframe required to process all tank waste under this alternative, a number of facilities would have to be replaced over time, including the WTP.

For clean closure activities, domed containment structures would also be temporarily erected over each tank farm in the 200-East and 200-West Areas to facilitate excavation and removal of contaminated soils, tanks, and associated ancillary equipment within these areas. Finally, a PPF for treatment of highly contaminated deep soils generated during clean closure activities would also be constructed to the west of the 200-East Area (see Section 4.1.1.9.1.1 and Table 4–1). An additional 381 hectares (942 acres) would also be excavated from Borrow Area C, making a total of 591 hectares (1,460 acres) of new, permanent land disturbance.

The type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would be similar to those generally described in Section 4.1.5. Still, the potential for soil erosion would increase from site activities under all Tank Closure alternatives, but the potential would be somewhat greater under this alternative due to the much greater land area disturbed. Also, while excavation depths for new facility construction would generally not be expected to exceed about 12 meters (40 feet) for the WTP HLW melter bays, clean closure of the SST system farm would involve deep excavation work at all tank farm locations. To be specific, deep soil removal, including excavation to a depth of about 20 meters (65 feet) below the land surface or 3 meters (10 feet) below the base elevations of the waste tanks, would be required at a minimum. This excavation depth is expected to be sufficient to remove soils and sediments contaminated by retrieval-related leaks, as well as contamination from historic waste releases that have accumulated horizontally on compacted strata beneath the waste tanks. For some tank sites, excavation to depths of up to 78 meters (255 feet) below the land surface may be required to remediate contaminant plumes from past-practice discharges that have migrated through the vadose zone soils and sediments and possibly to the water table.

To accomplish excavation of the magnitude required for clean closure, work would proceed by first filling each tank with a 0.3-meter (1-foot) layer of grout to stabilize the residual waste and reduce worker exposure. Jet-grouted pile (retaining) walls that extend down the length of each tank elevation to a depth of about 38 meters (125 feet) would then be installed. This installation would be followed by erection of the containment structure. Closure operations would then proceed by excavation and removal of soils and ancillary equipment, including demolition and removal of the tank structures, tank slabs, and footings. Excavated soils, except for tank bottom soils managed as HLW, would be characterized and transported either directly to the RPPDF or to the PPF for treatment prior to final disposal as MLLW. Highly and moderately contaminated ancillary equipment and tank debris and intermixed soil would be packaged in shielded boxes and transported to onsite HLW Debris Storage Facilities. Final closure of the tank farms would involve filling the open excavations with clean soil derived from Borrow Area C (DOE 2003c:3-8, 13, 17). Waste generation and management activities under this alternative are further discussed in Section 4.1.14.9.1.

As an additional closure action under this alternative, a modified RCRA Subtitle C barrier of very limited extent would be constructed for landfill closure of the six sets of cribs and trenches (ditches) in the B and T Areas that are located outside the areas that would be clean-closed (see Section 4.1.5).

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources for the main reasons previously described in Section 4.1.5. However, large quantities of a number of geologic resources or products made from rock and mineral resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; and, most substantially, tank farm clean closure (see Table 4–7). In addition to geologic resources to support facility construction, large volumes of borrow materials would be required for site grading, backfilling (particularly for tank excavations), and other uses. Total geologic resource requirements under Alternative 6A, Base Case, are projected to be 17.4 million cubic meters (22.8 million cubic yards). While this volume could deplete immediately available stockpiles, it is not expected to deplete onsite reserves because aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5. Similar materials are also widely available in the region, and offsite commercial quarries could supplement onsite sources if needed.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.9.2 Option Case

Construction of new facilities to support tank waste retrieval, treatment, and disposal and clean closure of the SST system and the six sets of cribs and trenches (ditches) under Alternative 6A, Option Case, would permanently disturb about 212 hectares (524 acres) of land. Construction requirements and associated impacts on geology and soils would be very similar to those described in Section 4.1.5.9.1 under Alternative 6A, Base Case, although a larger PPF would be constructed under this case. Further, a larger volume of material and associated land area totaling 458 hectares (1,131 acres) would be excavated from Borrow Area C to support remediation activities, making a total of 668 hectares (1,650 acres) of new, permanent land disturbance. The type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Section 4.1.5. Tank farm closure activities would essentially be the same as described in Section 4.1.5.9.1 under Alternative 6A, Base Case, with one major exception. Under Alternative 6A, Option Case, the six sets of cribs and trenches (ditches) in the B and T Areas would be clean-closed along with all SSTs, instead of being landfill-closed, as under the Base Case. This would require additional excavation work and soil removal in areas adjacent to the B and T tank farms.

Total geologic resource requirements under Alternative 6A, Option Case, are projected to be 20 million cubic meters (26 million cubic yards). While this demand volume could deplete immediately available stockpiles during the course of project implementation, it is not expected to deplete onsite reserves because aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5. Similar materials are also widely available in the region, and offsite commercial quarries could supplement onsite sources if needed.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

### 4.1.5.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.5.10.1 Base Case

Construction of new facilities to support tank waste retrieval, treatment, and disposal; clean closure of the SST system; and landfill closure of the six sets of cribs and trenches (ditches) under Alternative 6B, Base Case, would permanently disturb about 119 hectares (294 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities with expanded LAW vitrification capacity.

To support clean closure activities, domed containment structures would be temporarily erected over each tank farm in the 200-East and 200-West Areas to facilitate excavation and removal of contaminated soils, tanks, and associated ancillary equipment within these areas. Finally, a PPF for treatment of highly contaminated deep soils generated during clean closure activities would be constructed to the west of the 200-East Area (see Section 4.1.1.10.1.1 and Table 4–1). An additional 240 hectares (592 acres) would be excavated from Borrow Area C, making a total of 359 hectares (886 acres) of new, permanent land disturbance.

Construction requirements and associated impacts on geology and soils would be somewhat greater than those described in Section 4.1.5.3 under Alternative 2B because additional ILAW Interim Storage Facilities would be required under this alternative. The type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Section 4.1.5; excavation depths are not expected to exceed about 12 meters (40 feet) and would be less than 3 meters (10 feet) for most activities.

Additionally, activity-specific impacts under this alternative related to clean closure of the SST system and landfill closure of the six sets of cribs and trenches (ditches) in the B and T Areas would essentially be the same as those described in Section 4.1.5.9.1 under Alternative 6A, Base Case. Overall, even with clean closure as a component of this alternative, the total scale of direct impacts under this alternative would be much less than under Alternative 6A due to the smaller scale of new facility construction required, which is comparable to, but still greater than, that under Alternative 2B.

Construction activities and subsequent operations would not preclude the use of rare or otherwise valuable geologic or soil resources for the main reasons previously described in Section 4.1.5. However, large quantities of a number of geologic resources or products made from rock and mineral resources would be required for ongoing facility construction; upgrades to existing facilities, including the 200 Area tank farms; waste retrieval activities; and, most substantially, tank farm clean closure (see Table 4–7). As under Alternative 6A, large volumes of borrow materials would be required for site grading, backfilling (particularly for tank excavations), and other uses in addition to geologic resources to support facility construction. Total geologic resource requirements under Alternative 6B, Base Case, are projected to be 10.9 million cubic meters (14.3 million cubic yards). While this demand volume could deplete immediately available stockpiles during the course of project implementation, it is not expected to deplete onsite reserves because aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5. Similar materials are also widely available in the region, and offsite commercial quarries could supplement onsite sources if needed.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.10.2 Option Case

Construction of new facilities to support tank waste retrieval, treatment, and disposal and clean closure of the SST system and the six sets of cribs and trenches (ditches) under Alternative 6B, Option Case, would permanently disturb about 121 hectares (299 acres) of land. Construction requirements and associated impacts on geology and soils would be very similar to those described in Section 4.1.5.10.1 under Alternative 6B, Base Case; however, a larger PPF than is considered under the Base Case would be constructed. An additional 316 hectares (781 acres) would be excavated from Borrow Area C, making a total of 437 hectares (1,080 acres) of new, permanent land disturbance. The type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Section 4.1.5. Tank farm closure activities would essentially be the same as described in Section 4.1.5.9.1 under Alternative 6A, Base Case, with one major exception. Under Alternative 6B, Option Case, the six sets of cribs and trenches (ditches) in the B and T Areas would be clean-closed along with all SSTs, instead of being landfill-closed, as under the Base Case. This would require additional excavation work and soil removal and replacement in areas adjacent to the B and T tank farms.

Total geologic resource requirements under Alternative 6B, Option Case, are projected to be 14.4 million cubic meters (18.8 million cubic yards). While this demand volume could deplete immediately available stockpiles during the course of project implementation, it is not expected to deplete onsite reserves because aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5. Similar materials are also widely available in the region, and offsite commercial quarries could supplement onsite sources if needed.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

#### 4.1.5.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Construction of new facilities to support tank waste retrieval, treatment, and disposal and landfill closure of the SST system and the six sets of cribs and trenches (ditches) under Alternative 6C would permanently disturb about 61.5 hectares (152 acres) of land. Most of this activity would be located within or adjacent to the 200-East or 200-West Area and would include completion of WTP construction activities with expanded HLW vitrification capacity (see Section 4.1.1.11.1 and Table 4–1).

Construction requirements and associated impacts on geology and soils would be somewhat greater than those described in Section 4.1.5.3 under Alternative 2B, as additional ILAW Interim Storage Facilities would be required under this alternative. Additionally, impacts and activities associated with removal of the upper 4.6 meters (15 feet) of contaminated soil in the BX and SX tank farms and subsequent emplacement of a modified RCRA Subtitle C barrier for landfill closure of all 18 tank farms and the six sets of cribs and trenches (ditches) associated with the B and T tank farms would be the same as described in Section 4.1.5.3. Further, an additional 104 hectares (258 acres) would be excavated from Borrow Area C, making a total of 166 hectares (410 acres) of new, permanent land disturbance. Otherwise, the type and intensity of anticipated direct impacts on geology and soils under this alternative, including factors that could lead to increased wind and water erosion, would generally be similar to those described in Section 4.1.5.

Total geologic resource requirements under Alternative 6C are projected to be 4.78 million cubic meters (6.25 million cubic yards). While this demand volume could deplete immediately available stockpiles during the course of project implementation, it is not expected to deplete onsite reserves because aggregate and other borrow materials available on site from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (64.9 million cubic yards), as further described in Section 4.1.5. Similar materials are also widely available in the region, and offsite commercial quarries could supplement onsite sources if needed.

Design consideration of hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative would be substantially the same as those described in Section 4.1.5.2 under Alternative 2A.

### 4.1.6 Water Resources

This subsection presents the potential direct, short-term impacts of implementing the Tank Closure alternatives on water resources encompassing surface water, the vadose zone, and groundwater. Potential short-term impacts of facility construction, operations, deactivation, and closure activities were analyzed over the active project phase for each alternative, extending through the 100-year administrative control, institutional control, or postclosure care period, as applicable, for each alternative. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.

Under the Tank Closure alternatives, direct impacts on surface water, the vadose zone, and groundwater would be similar in nature; any variability would be related to the intensity and duration of the activities conducted under each alternative. Generally, facility construction activities are not expected to have any direct impact on surface-water features, including the Columbia River, as there are no natural, perennial surface-water drainages on the Central Plateau of Hanford. While several manmade ponds and impoundments are located in the 200 Areas, including the two Treated Effluent Disposal Facility (TEDF) disposal ponds and the three Liquid Effluent Retention Facility (LERF) impoundments adjacent to the

200-East Area, these ponds and impoundments would not be directly impacted by construction activities. In addition, no portion of the 200 Areas lies within a floodplain. Although the southwest corner of the 200-West Area is within the probable maximum flood zone of Cold Creek, no facilities would be constructed there under any Tank Closure alternative.

While portions of the probable maximum flood zone associated with Cold Creek lie within the confines of Borrow Area C, production operations associated with material extraction to support tank closure and waste management activities would be conducted to avoid impacting the watercourse and associated floodplain. Any changes in the extent and nature of predicted mining that could impact the floodplain would be evaluated, and a floodplain assessment would be prepared as required by Executive Order 11988, *Floodplain Management*, and Federal regulations (10 CFR 1022).

All construction- and closure-related land disturbances, especially for new facility construction, would expose soils and sediments to possible erosion by infrequent, heavy rainfall or by wind. While unlikely to reach surface-water features as discussed above, stormwater runoff from exposed areas could convey soil, sediments, and other pollutants (e.g., construction waste materials and spilled materials, such as petroleum, oils, and lubricants from construction equipment) from construction footprint and laydown areas. Nevertheless, appropriate soil erosion and sediment control measures, as well as spill prevention and waste management practices, would be employed to minimize suspended sediment, the transport of other deleterious materials, and any potential water-quality impacts. Further, all construction and other ground-disturbing activities would be conducted in accordance with current National Pollutant Discharge Elimination System (NPDES) and state waste discharge general permits for stormwater discharges associated with construction activities, issued by the Washington State Department of Ecology (Ecology). The NPDES permit specifically requires the development and implementation of a stormwater pollution prevention plan.

Once completed, new facilities, including the WTP and other tank waste retrieval, treatment, and storage/disposal facilities, would incorporate appropriate stormwater management controls to collect, convey, and detain stormwater from buildings and other impervious surfaces so as to minimize the impacts of onsite hydrology and soil erosion. Hanford's NPDES Storm Water Multi-Sector General Permit would cover stormwater discharges associated with industrial activity and, as necessary, stormwater discharges would be covered under state waste discharge permits for discharges to the ground.

Under normal operations associated with waste retrieval, treatment, and disposal and tank closure, facility design combined with adherence to spill prevention and emergency response plans and procedures would help to ensure that involved hazardous substances, including spills, should they occur, do not reach soils or surfaces where they could be conveyed to surface water or groundwater. For construction, operations, deactivation, and closure activities, adherence to best management practices and other preventive measures under applicable permits and compliance plans would be coordinated by DOE with those measures in similar sitewide pollution prevention plans.

Direct, short-term impacts of tank closure activities, including tank waste retrieval, treatment, and disposal and SST system closure, on the vadose zone and underlying groundwater would mainly be limited to SST leaks that could be induced by waste retrieval activities under all alternatives, except Alternative 1: No Action.

Projected impacts on water resources specific to implementation of each of the Tank Closure alternatives are presented in the following sections.

#### 4.1.6.1 Alternative 1: No Action

##### 4.1.6.1.1 Surface Water

No additional direct impacts on surface water or groundwater availability or quality resources are expected in the short term under Alternative 1, as ongoing tank farm facility upgrades and associated construction activities would not result in any additional land disturbance in the 200 Areas. Sanitary and industrial wastewater generation in the 200 Areas is expected to decrease with the termination of WTP construction. It was assumed that existing facilities, or their equivalents, would continue to be available to manage liquid waste generated under this alternative, with any necessary operational-life extensions or replacements completed as needed. Specifically, sanitary wastewater would continue to be managed via existing 200 Area collection and treatment facilities. Nonhazardous process wastewater would continue to be discharged to the TEDF in the 200-East Area, while any dilute, radioactive liquid effluents would continue to be managed in the 200 Area LERF prior to treatment in the ETF (DOE 2003d:6-10). The State-Approved Land Disposal Site (SALDS), located north of the 200-West Area, is the ultimate discharge point for liquid waste after it passes through the LERF/ETF system. Waste management is further discussed in Section 4.1.14. Additional water use associated with the proposed facility upgrades and WTP construction would peak in 2008 and then fall to pre-WTP activity levels, as quantified in Section 4.1.2.1. In total, water use to support activities under this alternative has been conservatively estimated at 3,300 million liters (872 million gallons).

##### 4.1.6.1.2 Vadose Zone and Groundwater

This alternative would result in impacts on groundwater quality over the long term only; no short-term impacts would occur because no tank waste retrieval would be performed. The SSTs, DSTs, and miscellaneous underground storage tanks (MUSTs) would fail over time, resulting in the release of their contents to the vadose zone and unconfined aquifer system. These releases would add to the range of 2.84–3.97 million liters (0.75–1.05 million gallons) of waste estimated to have leaked to the vadose zone to date. Ultimately, these contaminants would be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.1.

#### 4.1.6.2 Alternative 2A: Existing WTP Vitrification; No Closure

##### 4.1.6.2.1 Surface Water

Facility construction activities and normal facility operation are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 2A for the same reasons as previously described in Section 4.1.6.

There would be no direct discharge of effluents to either surface water or groundwater during construction, operations, and deactivation under Alternative 2A. Nonhazardous sanitary wastewater (sewage) would be managed via appropriate sanitary wastewater collection and treatment systems. During the early phases of new facility construction, it was assumed that portable toilet facilities would be provided for construction personnel, with collected waste disposed of at offsite contractor facilities, as is standard construction practice. During facility operations and deactivation, sanitary wastewater would be disposed of via the dedicated sanitary sewer or septic/drain field system serving a particular facility. A dedicated sanitary sewage collection, treatment, and drain field disposal system will serve the WTP complex. Industrial wastewater effluent may be generated as a result of some construction activities, including facility commissioning, but would mainly consist of process effluents from the WTP. Nonhazardous process wastewater would be discharged to the TEDF in the 200-East Area, while radioactive liquid effluents would be discharged to the 200 Area LERF prior to treatment in the ETF (DOE 2003b:6-10). It was assumed that these facilities, or their equivalents, would continue to be

available to manage process liquids generated under this alternative, with any necessary operational-life extensions or replacements completed as needed. Due to the relatively long treatment timeframe associated with this alternative, it would be necessary to replace the ETF twice and the 242-A Evaporator once. Waste generation and management activities under this alternative are further discussed in Section 4.1.14.

Water would be required during construction for soil compaction, dust control, concrete production, and possibly for work surface and equipment washdown. During operations, water would be required to support process makeup requirements and facility cooling, as well as the potable and sanitary needs of the operations workforce and other uses. Water would also be used during facility deactivation activities to stabilize and partially decontaminate waste treatment, retrieval, and disposal facilities, but this requirement would be relatively small compared with operational and construction demands. In total, water use to support activities under this alternative has been conservatively estimated at 208,000 million liters (55,000 million gallons), with a peak demand of 3,720 million liters (983 million gallons). While some water use would occur through 2193 associated with the DOE administrative control period, this water demand would primarily occur during the 88-year facility construction, waste retrieval, and waste treatment phases. This peak demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.2.

#### 4.1.6.2.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative. As described in Section 4.1.5.2, the depth of excavation for facility construction would not exceed about 12 meters (40 feet), and the depth of the water table in the unconfined aquifer beneath the 200 Areas averages more than 50 meters (164 feet). As such, construction dewatering should not be required for any proposed activities under this alternative. In addition, construction activities would be conducted so as to avoid contaminated geologic media in the vadose zone.

In addition, there would be no direct discharge of effluents to either surface water or groundwater during construction, operations, and deactivation. Sanitary wastewater, nonhazardous process wastewater, and radioactive liquid effluents would be discharged to permitted onsite treatment facilities, as discussed in Section 4.1.6.2.1 above. The only potential effect of these discharges on groundwater would be to maintain or possibly expand the groundwater mounds (i.e., locally elevated water table areas) that exist beneath the TEDF ponds adjacent to the 200-East Area and the WTP site and beneath the SALDS located north of the 200-West Area. The latter is the ultimate discharge point for treated effluent passing through the LERF and the ETF.

During normal operations, the main direct impact on the vadose zone and groundwater in the 200 Areas would be due to leaks from the tank systems during retrieval operations. Leaks are projected to occur due to liquid volume additions (mainly water) under pressure during retrieval. Under this alternative, DOE would utilize a combination of retrieval technologies, including modified sluicing, VBR, and the MRS. The scope of waste retrieval operations is further described in Chapter 2, Section 2.2.2.1. The MRS would be used in tanks that are assumed or have been confirmed to have leaked in the past, as it introduces sluice liquid in a controlled fashion while pumping out the resulting waste slurry at approximately the same rate as liquid is introduced. Thus, this system minimizes increases in liquid volume within the tank during retrieval. Nevertheless, for analysis purposes, it was assumed that each of the 149 SSTs would leak an average of 15,000 liters (4,000 gallons) during retrieval to the surrounding soils and sediments within the vadose zone (DOE 2003e:4-8–4-11). These releases would add to the

range of 2.84–3.97 million liters (0.75–1.05 million gallons) of waste estimated to have leaked to the vadose zone to date and could contribute to groundwater contaminant migration over the long term.

Although tank waste retrieval would result in removal of 99 percent of the tank waste by volume as proposed under this alternative, residual tank waste inventories would have the potential to result in impacts on groundwater quality over the long term. Even after implementation of corrective action measures to fill deteriorating tanks with grout or gravel, Hanford SSTs, DSTs, and MUSTs would fail over time, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants would be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.2.

#### 4.1.6.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

##### 4.1.6.3.1 Surface Water

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 2B for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, to ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF and the 242-A Evaporator would each be replaced once. Waste generation and management activities are further discussed in Section 4.1.14.3.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. Under this alternative, excavation work associated with emplacement of the modified RCRA Subtitle C barrier for landfill closure of the SST system and the six sets of cribs and trenches (ditches) would add to the water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 86,300 million liters (22,800 million gallons), with a peak demand of 3,590 million liters (948 million gallons). While some water use may occur through 2145 associated with the DOE postclosure care period, water demand would be concentrated during the 40-year facility construction, waste retrieval, waste treatment, and SST system closure phases. This peak demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.3.

##### 4.1.6.3.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative for the same reasons as previously described in Section 4.1.6.2.2. The exception under this alternative would involve closure activities, including removal and disposal of the upper 4.6 meters (15 feet) of contaminated soils and encountered ancillary equipment within the BX and SX tank farms.

Furthermore, potential impacts of the discharge of facility effluents to permitted onsite treatment facilities would be similar to those described in Section 4.1.6.2.2. Waste generation and management activities are further discussed in Section 4.1.14.3.

Although tank waste retrieval would result in removal of 99 percent of the tank waste by volume, residual tank waste inventories would have the potential to result in impacts on groundwater quality over the long term. In the short term, leaks could occur due to liquid volume additions (mainly water) under pressure during tank waste retrieval activities, as further described in Section 4.1.6.2.2 under Alternative 2A. As a

short-term measure following retrieval, individual SSTs and DSTs in each tank farm would be stabilized by filling them with cement grout, then emplacing a landfill barrier over the tank farms. The modified RCRA Subtitle C barrier lobes would impede the movement of residual contaminants from the tanks to the vadose zone, principally by retarding surface-water infiltration. Similarly, the barrier system would impede further movement of previously released tank-related contaminants in the vadose zone. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. Nevertheless, this barrier would degrade over time, allowing infiltration and contaminant migration, and the SSTs, DSTs, and MUSTs would fail, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.3.

### 4.1.6.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

#### 4.1.6.4.1 Surface Water

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 3A for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Any potential for direct or indirect impacts on stormwater or surface-water quality would be very similar to that under Alternative 2B, as the total land area that would be disturbed is similar, despite the addition of Bulk Vitrification Facilities under this alternative.

Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, to ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF and the 242-A Evaporator would be replaced once. Waste generation and management activities are further discussed in Section 4.1.14.4.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. As under Alternative 2B (see Section 4.1.6.3.1), excavation work associated with emplacement of the modified RCRA Subtitle C barrier for landfill closure of the SST system and the six sets of cribs and trenches (ditches) in the B and T Areas under this alternative would add to the water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 77,000 million liters (20,300 million gallons), with a peak demand of 2,200 million liters (576 million gallons), which is less than the estimated requirements under Alternatives 2A and 2B. While some water use may occur through 2141 associated with the DOE postclosure care period, this water demand would primarily occur during the 36-year facility construction, waste retrieval, waste treatment, and SST system closure phases. This demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.4.

#### 4.1.6.4.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative for the same reasons as previously described in Section 4.1.6.2.2. As under Alternative 2B, the exception under this alternative would involve closure activities, including removal and disposal of the upper 4.6 meters (15 feet) of contaminated soils and encountered ancillary equipment within the BX and SX tank farms.

Furthermore, potential impacts of the discharge of facility effluents to permitted onsite treatment facilities would be similar to those described in Section 4.1.6.2.2. Waste generation and management activities are further discussed in Section 4.1.14.4.

As under the previous alternatives, tank waste retrieval activities would result in removal of 99 percent of the tank waste by volume under this alternative. The residual tank waste inventories would still have the potential to result in impacts on groundwater quality over the long term. In the short term, leaks could occur due to liquid volume additions (mainly water) under pressure during tank waste retrieval activities, as further described in Section 4.1.6.2.2 under Alternative 2A. As a short-term measure following retrieval, individual SSTs and DSTs in each tank farm would be stabilized by filling them with cement grout, then emplacing a landfill barrier over the tank farms. The modified RCRA Subtitle C barrier system would impede the movement of residual contaminants from the tanks to the vadose zone, principally by retarding surface-water infiltration. Similarly, the barrier system would impede further movement of previously released tank-related contaminants in the vadose zone. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. Nevertheless, this barrier would degrade over time, allowing infiltration and contaminant migration, and the SSTs, DSTs, and MUSTs would fail, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.4.

### 4.1.6.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

#### 4.1.6.5.1 Surface Water

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 3B for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Any potential for direct or indirect impacts on stormwater or surface-water quality would be very similar to those under Alternatives 2B and 3A, as the total land area that would be disturbed would be similar, despite the addition of Cast Stone Facilities under this alternative.

Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, to ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF and the 242-A Evaporator would each be replaced once. Waste generation and management activities are further discussed in Section 4.1.14.5.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. As under Alternative 2B (see Section 4.1.6.3.1), excavation work associated with emplacement of the modified RCRA Subtitle C barrier for landfill closure of the SST system and the six sets of cribs and trenches (ditches) in the B and T Areas under this alternative would add to the water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 77,000 million liters (20,300 million gallons), with a peak demand of 2,200 million liters (576 million gallons), which is less than the estimated requirements under Alternatives 2A and 2B and the same as those under Alternative 3A. While some water use may occur through 2141 associated with the DOE postclosure care period, this water demand would primarily occur during the 36-year facility construction, waste retrieval, waste treatment, and SST system closure phases. This demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.5.

#### 4.1.6.5.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative for the same reasons as previously described in Section 4.1.6.2.2. As under Alternative 2B, the exception under this alternative would involve closure activities, including removal and disposal of the upper 4.6 meters (15 feet) of contaminated soils and encountered ancillary equipment within the BX and SX tank farms.

Furthermore, potential impacts of the discharge of facility effluents to permitted onsite treatment facilities would be similar to those described in Section 4.1.6.2.2. Waste generation and management activities are further discussed in Section 4.1.14.5.

As under the previous alternatives, tank waste retrieval activities would result in removal of 99 percent of the tank waste by volume under this alternative. The residual tank waste inventories would still have the potential to result in impacts on groundwater quality over the long term. In the short term, leaks could occur due to liquid volume additions (mainly water) under pressure during tank waste retrieval activities, as further described in Section 4.1.6.2.2 under Alternative 2A. As a short-term measure following retrieval, individual SSTs and DSTs in each tank farm would be stabilized by filling them with cement grout, then emplacing a landfill barrier over the tank farms. The modified RCRA Subtitle C barrier system would impede the movement of residual contaminants from the tanks to the vadose zone, principally by retarding surface-water infiltration. Similarly, the barrier system would impede further movement of previously released tank-related contaminants in the vadose zone. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. Nevertheless, this barrier would degrade over time, allowing infiltration and contaminant migration, and the SSTs, DSTs, and MUSTs would fail, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.5.

### 4.1.6.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

#### 4.1.6.6.1 Surface Water

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 3B for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Any potential for direct or indirect impacts on stormwater or surface-water quality would be very similar to that under Alternatives 2B, 3A, and 3B, as the total land area that would be disturbed would be similar, despite the addition of Steam Reforming Facilities under this alternative.

Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, to ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF and the 242-A Evaporator would each be replaced once. Waste generation and management activities are further discussed in Section 4.1.14.6.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. As under Alternative 2B (see Section 4.1.6.3.1), excavation work associated with emplacement of the modified RCRA Subtitle C barrier for landfill closure of the SST system and the six sets of cribs and trenches (ditches) in the B and T Areas under this alternative would add to the water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 77,300 million liters (20,400 million gallons), with a peak demand of 2,200 million liters (579 million gallons), which is less

than the estimated requirements under Alternatives 2A and 2B and just slightly more than under Alternatives 3A and 3B. While some water use may occur through 2141 associated with the DOE postclosure care period, this water demand would primarily occur during the 36-year facility construction, waste retrieval, waste treatment, and SST system closure phases. This demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.6.

#### 4.1.6.6.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative for the same reasons as previously described in Section 4.1.6.2.2. As under Alternative 2B, the exception under this alternative would involve closure activities, including removal and disposal of the upper 4.6 meters (15 feet) of contaminated soils and encountered ancillary equipment within the BX and SX tank farms.

Furthermore, potential impacts of the discharge of facility effluents to permitted onsite treatment facilities would be similar to those described in Section 4.1.6.2.2. Waste generation and management activities are further discussed in Section 4.1.14.6.

As under the previous alternatives, tank waste retrieval activities would result in removal of 99 percent of the tank waste by volume under this alternative. The residual tank waste inventories would still have the potential to result in impacts on groundwater quality over the long term. In the short term, leaks could occur due to liquid volume additions (mainly water) under pressure during tank waste retrieval activities, as further described in Section 4.1.6.2.2 under Alternative 2A. As a short-term measure following retrieval, individual SSTs and DSTs in each tank farm would be stabilized by filling them with cement grout, then emplacing a landfill barrier over the tank farms. The modified RCRA Subtitle C barrier system would impede the movement of residual contaminants from the tanks to the vadose zone, principally by retarding surface-water infiltration. Similarly, the barrier system would impede further movement of previously released tank-related contaminants in the vadose zone. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. Nevertheless, this barrier would degrade over time, allowing infiltration and contaminant migration, and the SSTs, DSTs, and MUSTs would fail, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.6.

### 4.1.6.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

#### 4.1.6.7.1 Surface Water

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 4 for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Any potential for direct or indirect impacts on stormwater or surface-water quality would be very similar to that for Alternatives 2B, 3A, 3B, and 3C, as the total land area that would be disturbed would be similar and would include construction of Bulk Vitrification and Cast Stone Facilities in addition to construction of a new PPF to process waste generated from selective clean closure activities under this alternative.

Nevertheless, effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, to ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF and the 242-A Evaporator would each be replaced once.

Operation of the PPF for treatment of waste generated as a result of clean closure actions would also generate effluents. Concentrated hazardous constituents and radionuclides from this process would be returned to the WTP influent for eventual vitrification (DOE 2003c:9, 10). Waste generation and management activities under this alternative are further discussed in Section 4.1.14.7.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. As under Alternative 2B (see Section 4.1.6.3.1), excavation work associated with emplacement of the modified RCRA Subtitle C barrier for landfill closure of the SST system and the six sets of cribs and trenches (ditches) in the B and T Areas, plus clean closure of the BX and SX tank farms under this alternative, would add to the water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 82,200 million liters (21,700 million gallons), with a peak demand of 2,180 million liters (576 million gallons), which is greater overall than Alternatives 3A, 3B, and 3C, largely due to a higher treatment operations demand under this alternative. While some water use may occur through 2144 associated with the DOE postclosure care period, this water demand would primarily occur during the 39-year facility construction, waste retrieval, waste treatment, and SST system and tank farm closure phases. This demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.7.

#### 4.1.6.7.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative for the same reasons as previously described in Section 4.1.6.2.2. However, to implement selective clean closure at the BX and SX tank farm sites, excavation to depths of up to 78 meters (255 feet) below land surface may be required, particularly in the BX tank farm, to remediate contaminant plumes from past-practice discharges that have migrated through the vadose zone soils and sediments and possibly to the water table. This would have a beneficial impact by stemming further contaminant migration from these sources (see Section 4.1.5.7). Construction dewatering would likely be necessary in some tank farm excavations to allow clean closure to proceed, and, depending on the amount of pumping required, dewatering activities may have a local effect on groundwater flow and existing contaminant plumes beneath the tank farms. In addition, the water would require special handling and treatment. Therefore, this groundwater would be conveyed to onsite ETFs for processing.

Furthermore, potential impacts of the discharge of facility effluents to permitted onsite treatment facilities would be similar to those described in Section 4.1.6.2.2. Sanitary wastewater, nonhazardous process wastewater, and radioactive liquid effluents would be discharged to permitted onsite treatment facilities, as discussed above in Section 4.1.6.7.1. Waste generation and management activities are further discussed in Section 4.1.14.7.

Although tank waste retrieval would result in removal of 99.9 percent of the tank waste by volume in contrast to 99 percent under the previously discussed action alternatives, residual tank waste inventories would have the potential to result in impacts on groundwater quality over the long term. In the short term, leaks could occur due to liquid volume additions (mainly water) under pressure during tank waste retrieval activities, as further described in Section 4.1.6.2.2 under Alternative 2A. As a short-term measure following retrieval, individual SSTs and DSTs in each tank farm would be stabilized by filling them with cement grout, then emplacing a landfill barrier over the tank farms. Under this alternative, the modified RCRA Subtitle C barrier lobes placed over each tank farm that would not be clean-closed would impede the movement of residual contaminants from the tanks to the vadose zone, principally by retarding surface-water infiltration. Similarly, the barrier system would impede further movement of

previously released tank-related contaminants in the vadose zone. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. Nevertheless, this barrier would degrade over time, allowing infiltration and contaminant migration, and the Hanford SSTs, DSTs, and MUSTs would fail, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.7.

#### 4.1.6.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

##### 4.1.6.8.1 Surface Water

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 5 for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Any potential for direct or indirect impacts on stormwater or surface-water quality would be somewhat greater than that for Alternatives 2B, 3A, 3B, 3C, and 4 due to the slightly larger land area that would be disturbed under this alternative, which includes construction of Bulk Vitrification and Cast Stone Facilities in addition to a Sulfate Removal Facility to support accelerated waste treatment.

Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, to ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF and the 242-A Evaporator would be replaced once. Waste generation and management activities are further discussed in Section 4.1.14.8.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. In contrast to Alternatives 2B through 4, wherein a modified RCRA Subtitle C barrier would be constructed (see Section 4.1.6.3.1), excavation work associated with emplacement of the more robust Hanford barrier under this alternative would add to the amount of water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 92,500 million liters (24,400 million gallons), with a peak demand of 3,830 million liters (1,000 million gallons). While some water use may occur through 2139 associated with the DOE postclosure care period, this water demand would primarily occur during the 34-year facility construction, waste retrieval, and waste treatment phases and extend through landfill closure. This demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.8.

##### 4.1.6.8.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative for the same reasons as previously described in Section 4.1.6.2.2, as there would be no contaminated soil removal in the BX and SX tank farms prior to emplacement of the landfill closure barrier.

Furthermore, potential impacts of the discharge of facility effluents to permitted onsite treatment facilities would be similar to those described in Section 4.1.6.2.2. Waste generation and management activities are further discussed in Section 4.1.14.8.

To expedite waste treatment and tank farm closure, tank waste retrieval activities would result in removal of 90 percent of the tank waste by volume under this alternative. The residual tank waste inventories

would still have the potential to result in impacts on groundwater quality over the long term. In the short term, leaks could occur due to liquid volume additions (mainly water) under pressure during tank waste retrieval activities, as further described in Section 4.1.6.2.2 under Alternative 2A. As a short-term measure following retrieval, individual SSTs and DSTs in each tank farm would be stabilized by filling them with cement grout, then emplacing a landfill barrier over the tank farms. As opposed to the modified RCRA Subtitle C barrier proposed under Alternatives 2B through 4 and 6C, the more robust Hanford barrier, which is designed for a 1,000-year performance period, would be used for landfill closure (DOE 2003a:6-64). This would help compensate for the lower volume of tank waste retrieved under this alternative. The Hanford barrier would impede the movement of residual contaminants from the tanks to the vadose zone, principally by retarding surface-water infiltration. Similarly, the barrier system would impede further movement of previously released tank-related contaminants in the vadose zone. Nevertheless, the Hanford barrier would still degrade over time, allowing infiltration and contaminant migration, and the SSTs, DSTs, and MUSTs would fail, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.8.

### 4.1.6.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.6.9.1 Surface Water

##### 4.1.6.9.1.1 Base Case

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 6A, Base Case, for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Nevertheless, the potential for direct or indirect impacts on stormwater or surface-water quality would be highest under this alternative, compared with the previously discussed alternatives, due to the substantially larger land area that would be disturbed by new facility construction and then converted to impervious surface. This increased potential would be reduced by the much longer timeframe over which construction and operations activities would take place compared with the previously discussed alternatives.

Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, due to the relatively long operational timeframe to complete waste treatment, the ETF would be replaced five times and the 242-A Evaporator would be replaced six times to ensure the availability of treatment facilities to process liquid waste generated under this alternative. PPF operation for treatment of waste generated as a result of clean closure actions would also generate effluents. A portion of the ensuing waste streams would be solidified for onsite disposal, while concentrated hazardous constituents and radionuclides from this process would be vitrified, with the resulting PPF glass waste form also disposed of on site. Waste generation and management activities are further discussed in Section 4.1.14.9.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. In contrast to the previously described alternatives, complete clean closure of the SST system under this alternative and emplacement of the modified RCRA Subtitle C barrier for landfill closure of the six sets of cribs and trenches (ditches) in the B and T Areas would add to the water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 643,000 million liters (170,000 million gallons), with a peak demand of 6,570 million liters (1,740 million gallons), which is nearly an order of magnitude greater than that of the previously described alternatives due to HLW waste treatment operations occurring over a relatively long period of time. While some water use associated with the DOE postclosure care period for the B and T Areas may persist through 2250, this water demand

would primarily occur during the 159-year facility construction, waste retrieval, waste treatment, and facility deactivation and closure phases. Despite its relatively long timeframe, this demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.9.3.

#### 4.1.6.9.1.2 Option Case

Potential direct and indirect impacts of tank closure–related facility construction, waste retrieval, waste treatment, and facility deactivation and closure activities on surface-water resources would be similar to those discussed in Section 4.1.6.9.1.1 under Alternative 6A, Base Case. One exception is that under Alternative 6A, Option Case, the six sets of cribs and trenches (ditches) in the B and T Areas would be removed instead of being landfill-closed, as under Alternative 6A, Base Case. Removal would require construction and operation of a larger PPF to process the added waste from clean closure of the cribs and trenches (ditches). It was estimated that removal would increase water use by approximately 200 million liters (53 million gallons), driven by the closure phase of this option, compared with Alternative 6A, Base Case, and would generate additional effluents from the PPF. Nevertheless, removal is not expected to have any additional impact on surface water and water quality, and effluents generated by facility operations under this option would be managed in a manner similar to that described in Section 4.1.6.2.1.

### 4.1.6.9.2 Vadose Zone and Groundwater

#### 4.1.6.9.2.1 Base Case

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative. However, to implement selective clean closure under this alternative, excavation to depths of up to 78 meters (255 feet) below the land surface may be required, particularly in the B tank farm, to remediate contaminant plumes from past-practice discharges that have migrated through the vadose zone soils and sediments and possibly to the water table (see Section 4.1.5.9.1). Excavation and remediation would have a beneficial impact by stemming further contaminant migration from the tank farms. Construction dewatering would likely be necessary in some tank farm excavations to allow clean closure to proceed, and, depending on the amount of pumping required, dewatering activities might have a local effect on groundwater flow and existing contaminant plumes beneath the tank farms. In addition, the water would require special handling and treatment. Therefore, this groundwater would be conveyed to onsite ETFs for processing.

There would be no direct discharge of effluents to either surface water or groundwater during construction, operations, deactivation, or closure. Sanitary wastewater, nonhazardous process wastewater, and radioactive liquid effluents would be discharged to permitted onsite treatment facilities, as discussed above in Sections 4.1.6.9.1.1 and 4.1.6.2.1. The only potential effect of these discharges on groundwater would be to maintain or possibly expand the groundwater mounds (i.e., locally elevated water table areas) that exist beneath the TEDF ponds adjacent to the 200-East Area and the WTP site and beneath the SALDS located north of the 200-West Area. The latter is the ultimate discharge point for treated effluent passing through the LERF and the ETF.

During normal operations, the main direct impact on the vadose zone and groundwater in the 200 Areas would be due to leaks from the tank systems during retrieval operations. Leaks are projected to occur due to liquid volume additions (mainly water) under pressure during retrieval, as further described in Section 4.1.6.2.2 under Alternative 2. Nonetheless, clean closure of all 12 SST farms under this alternative, coupled with deep soil removal, would measurably reduce the long-term risk to groundwater quality. Clean closure would not eliminate all contamination stemming from historic tank waste operations, such as historic releases to cribs and trenches (ditches), which have already moved

downgradient in the vadose zone and in the unconfined aquifer system beneath Hanford. In addition, landfill closure of the six sets of cribs and trenches (ditches) in the B and T Areas would delay, but not prevent, future migration of contaminants from these sources. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.9.

#### 4.1.6.9.2.2 Option Case

Direct, short-term impacts of tank closure activities, including facility construction, tank waste retrieval, waste treatment operations, and SST system clean closure, on the vadose zone and groundwater under this option would be very similar to, but ultimately less than, those described in Section 4.1.6.9.2.1 under Alternative 6A, Base Case. While direct disturbance of the vadose zone and unconfined aquifer would be temporarily greater under this option in association with the removal of the six sets of cribs and trenches (ditches) in the B and T Areas, this action would essentially remove this source of contamination from further impacting the underlying groundwater over the long term. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.9.

### 4.1.6.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.6.10.1 Surface Water

#### 4.1.6.10.1.1 Base Case

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 6B, Base Case, for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. Nevertheless, the potential for direct or indirect impacts on stormwater or surface-water quality would be relatively high under this alternative compared with those under the previously discussed alternatives, except for Alternative 6A, Base Case, due to the substantially larger land area that would be disturbed from new facility construction and then converted to impervious surface.

Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. However, to ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF would be replaced twice and the 242-A Evaporator would be replaced once. As under Alternative 6A (see Section 4.1.6.9.1.1), PPF operation for treatment of waste generated as a result of clean closure actions would also generate effluents. A portion of the ensuing waste streams would be solidified for disposal on site, while concentrated hazardous constituents and radionuclides from this process would be vitrified, with the resulting PPF glass waste form also disposed of on site. Waste generation and management activities are further discussed in Section 4.1.14.10.

Water would be required to support new facility construction, facility operations, and facility deactivation, as summarized in Section 4.1.6.2.1. While SST system closure activities would be the same as those under Alternative 6A, Base Case (see Section 4.1.6.9.1.1), overall water requirements for new facility construction and waste treatment operations would be an order of magnitude lower under this alternative than under Alternative 6A, Base Case. In total, water use to support activities under this alternative has been conservatively estimated at 92,600 million liters (24,500 million gallons), with a peak demand of 3,500 million liters (925 million gallons). While some water use associated with the DOE postclosure care period for the B and T Areas may persist through 2201, this water demand would primarily occur during the 95-year facility construction, waste retrieval, waste treatment, and facility deactivation and closure phases. This demand is substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to

greatly impact the availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.10.3.

#### 4.1.6.10.1.2 Option Case

Potential direct and indirect impacts of tank closure–related facility construction, waste retrieval, facility treatment, facility deactivation, and closure activities on surface-water resources would be similar to those discussed in Section 4.1.6.10.1.1 under Alternative 6B, Base Case. One exception is that under Alternative 6B, Option Case, the six sets of cribs and trenches (ditches) in the B and T Areas would be removed instead of being landfill-closed, as under Alternative 6A, Base Case. This removal would require construction and operation of a larger PPF to process the added waste from clean closure of the cribs and trenches (ditches). It was estimated that clean closure would increase water use by approximately 200 million liters (53 million gallons), driven by the closure phase of this option, compared with Alternative 6B, Base Case, and generate additional effluents from the PPF. Nevertheless, removal is not expected to have any additional impact on surface water and water quality, and effluents generated by facility operations under this option would be managed in a manner similar to that described in Section 4.1.6.2.1.

### 4.1.6.10.2 Vadose Zone and Groundwater

#### 4.1.6.10.2.1 Base Case

Direct, short-term impacts of tank closure activities under this alternative case would be very similar, if not identical, to those described in Section 4.1.6.9.2.1 under Alternative 6A, Base Case, because waste retrieval and tank closure actions, including clean closure of the SST system and landfill closure of the six sets of cribs and trenches (ditches) in the B and T Areas, would be identical under this alternative case. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.10.

#### 4.1.6.10.2.2 Option Case

Under this alternative case, direct, short-term impacts of tank closure activities on the vadose zone and groundwater would be very similar to, but ultimately less than, those described in Section 4.1.6.9.2.1 under Alternative 6A, Base Case, and essentially identical to those under Alternative 6A, Option Case (see Section 4.1.6.9.2.2). While direct disturbance of the vadose zone and unconfined aquifer would be temporarily greater under this option in association with the removal of the six sets of cribs and trenches (ditches) in the B and T Areas, this action would essentially remove this source of contamination from further impacting the underlying groundwater over the long term. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.10.

## 4.1.6.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

### 4.1.6.11.1 Surface Water

Facility construction activities and normal facility operations are not expected to have any direct impact on surface-water features or surface-water quality under Alternative 6C for the same reasons as previously described in Sections 4.1.6 and 4.1.6.2.1. In general, effects on surface-water resources would be very similar to those described under Alternative 2B (see Section 4.1.6.3.1). While additional ILAW Interim Storage Facilities would be constructed and operated under this alternative, they are not expected to have any incremental impact on surface water. Effluents generated by facility operations would be managed in a manner similar to that described in Section 4.1.6.2.1. To ensure the availability of treatment facilities to process liquid waste generated under this alternative, the ETF and the 242-A Evaporator

would be replaced once, as also required under Alternative 2B. Waste generation and management activities are further discussed in Section 4.1.14.11.

Water would be required to support new facility construction, facility operations, and facility deactivation, as previously summarized in Section 4.1.6.2.1. Under this alternative, excavation work associated with emplacement of the modified RCRA Subtitle C barrier for landfill closure of the SST system and six sets of cribs and trenches (ditches) would add to the water required for dust control and soil compaction. In total, water use to support activities under this alternative has been conservatively estimated at 86,300 million liters (22,800 million gallons), with a peak demand of 3,590 million liters (975 million gallons). While some water use associated with the DOE postclosure care period may persist through 2145, this water demand would primarily occur during the 40-year facility construction, waste retrieval, waste treatment, and SST system closure phases. This demand would be substantially less than the production capacity of the Hanford Export Water System, which withdraws water from the Columbia River, and it is not expected to greatly impact availability of surface water for downstream users. The impact of this water demand on Hanford's utility infrastructure is further detailed in Section 4.1.2.11.

#### 4.1.6.11.2 Vadose Zone and Groundwater

Facility construction is unlikely to have any direct impact on groundwater hydrology or existing contaminant plumes under this alternative for the same reasons as previously described in Section 4.1.6.2.2. The exception under this alternative would involve closure activities, including removal and disposal of the upper 4.6 meters (15 feet) of contaminated soils and encountered ancillary equipment within the BX and SX tank farms.

Furthermore, potential impacts of the discharge of facility effluents to permitted onsite treatment facilities would be similar to those described in Section 4.1.6.2.2. Waste generation and management activities are further discussed in Section 4.1.14.11.

Although tank waste retrieval would result in removal of 99 percent of the tank waste by volume, residual tank waste inventories would have the potential to result in impacts on groundwater quality over the long term. In the short term, leaks could occur due to liquid volume additions (mainly water) under pressure during tank waste retrieval activities, as further described in Section 4.1.6.2.2 under Alternative 2A. As a short-term measure following retrieval, individual SSTs and DSTs in each tank farm would be stabilized by filling them with cement grout, then emplacing a landfill barrier over the tank farms. The modified RCRA Subtitle C barrier lobes would impede movement of residual contaminants from the tanks to the vadose zone, principally by retarding surface-water infiltration. Similarly, the barrier system would impede further movement of previously released tank-related contaminants in the vadose zone. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. Nevertheless, this barrier would degrade over time (following the end of DOE administrative control), allowing infiltration and contaminant migration, and the SSTs, DSTs, and MUSTs would fail, resulting in release of their contents to the vadose zone and unconfined aquifer system. Ultimately, these contaminants could be discharged to the Columbia River. Long-term impacts on water resources, including contamination releases to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.1.1.11.

## 4.1.7 Ecological Resources

### 4.1.7.1 Alternative 1: No Action

Under the No Action Alternative, there would be no new construction within the 200 Areas, although some work would take place within previously disturbed areas. Thus, there would be no additional impact on terrestrial resources, wetlands, aquatic resources, or threatened and endangered species under this alternative.

This alternative would require excavation of 2 hectares (5 acres) from Borrow Area C to supply geologic material for use in activities such as the stabilization of tanks and closure of the WTP. Due to the limited area to be disturbed, impacts on terrestrial resources would be minimal. As there are no wetlands or aquatic resources within Borrow Area C, these resources would not be affected. Surveys have identified Piper's daisy (state sensitive), stalked-pod milkvetch (state watch), crouching milkvetch (state watch), and the long-billed curlew (state monitor) within Borrow Area C. Because of the limited area to be disturbed, impacts on these species are expected to be minimal. A mitigation action plan would be prepared prior to excavation of Borrow Area C if conflicts with any of these species were likely. Due to the greater amount of land to be disturbed under the action alternatives, ecological impacts resulting from excavation of Borrow Area C are addressed in more detail below (see Sections 4.1.7.2 through 4.1.7.11).

### 4.1.7.2 Alternative 2A: Existing WTP Vitrification; No Closure

#### 4.1.7.2.1 Terrestrial Resources

As noted in Section 4.1.1.2.1, 33.9 hectares (83.8 acres) would be disturbed by construction of new facilities within the 200 Areas under this alternative. Of this total, 30.7 hectares (75.8 acres) would be developed within the 200-East Area and 3.2 hectares (8 acres) within the 200-West Area. The only new construction to take place within the 200-West Area is an underground transfer line that would be built along existing roads and, thus, would have a negligible impact on terrestrial resources. Within and adjacent to the 200-East Area, most new facilities would be built within previously disturbed areas and thus would have a negligible impact on terrestrial resources. However, the underground transfer line, new DSTs, and replacement WTP would disturb 14.2 hectares (35 acres) of big sagebrush habitat. Late successional sagebrush habitat is considered a Level III resource under the *Hanford Site Biological Resources Management Plan* (DOE 2001b:4.11). The loss of 1.2 hectares (3 acres) of sagebrush habitat resulting from construction of the 200-East Area portion of the underground transfer line would not be mitigable; however, Hanford guidance may require the replacement of other sagebrush habitat at a ratio ranging from 1:1 to 3:1 (DOE 2003f:20, 21, 31). Specific measures to mitigate the loss of sagebrush habitat would be set forth in a mitigation action plan prior to construction.

Microbiotic crusts, which are expected to occur only on undisturbed sites within the 200 Areas, would be destroyed by new construction. Thus, including both sagebrush and nonsagebrush habitat, up to 16.2 hectares (40 acres) of crusts could be destroyed. There would be no impacts on terrestrial plant communities from operations.

Wildlife potentially affected by the construction of new facilities under this alternative could include the mule deer, coyote, northern pocket gopher, sage sparrow, and western meadowlark. As the sage sparrow is listed as a candidate species, it is discussed in Section 4.1.7.2.4. Ground disturbance would result in the loss of less-mobile species such as small mammals and reptiles, including their nests and young. Larger, more-mobile species, such as many mammals and birds, would be displaced to similar surrounding habitat. Their ultimate survival would depend on whether the areas into which they moved were at their carrying capacity (i.e., contained the maximum number of the individual animals that the habitat is capable of supporting). If construction took place during the breeding season for ground-nesting birds, generally between March and July, the eggs and nests of these birds could be

destroyed and the adults displaced. Actions taken to mitigate the disturbance of sagebrush habitat would help maintain wildlife populations dependent on this important community. Although Hanford is on the Pacific Flyway, construction would not impact any bodies of water or wetlands; thus, waterfowl would not be affected under this alternative.

Wildlife could also be affected by noise and human disturbance during construction. The most obvious reaction would be a startle or fright response resulting from transient, unexpected noise. Such noise could cause animals to flee the area. If construction were to take place near a highway, this could lead to increased mortality from collisions with motor vehicles. Lower, more-constant noise levels may cause wildlife to temporarily avoid the construction zone. It is also likely that some animals would adapt to the lower noise levels during construction. Human disturbance, such as movement of construction workers or equipment outside of the work zone, could result in indirect effects on wildlife. As with noise disturbance, this could cause some animals to move from the area, while others would be able to adapt. Proper maintenance of equipment and clear marking of construction work zones to prevent intrusion into areas not slated for development would help prevent these impacts. Implementation of a spill prevention and control plan also would help reduce potential impacts on terrestrial resources.

Operations would have a negligible impact on terrestrial animals provided proper mitigation measures are taken, such as limiting unnecessary noise by properly maintaining equipment and keeping workers from intruding into undeveloped areas. As is the case during construction, proper handling of petroleum products and chemicals to prevent or rapidly clean up spills would minimize impacts on wildlife. As the 200 Areas are already illuminated at night, additional lighting associated with the operation of new facilities should have a negligible impact on nocturnal animals or those active during dusk or dawn (e.g., effects on navigation or predator–prey relationships).

Under Alternative 2A, 29.1 hectares (72 acres) of Borrow Area C would be excavated to supply needed geologic material. As noted in Chapter 3, Section 3.2.7.1.4, the two major plant communities present within the area are cheatgrass-bluegrass (782 hectares [1,933 acres]) and needle-and-thread grass/Indian ricegrass (107 hectares [265 acres]) (see Chapter 3, Figure 3–18). The latter represents an unusual and relatively pristine community type at Hanford; thus, it is considered a more highly valued community than the former. It is not possible to determine specific impacts on ecological resources from developing Borrow Area C because the particular portion of the site from which geologic material would be excavated is unknown. However, most of Borrow Area C can be developed without substantial adverse impacts on species or habitats (Sackschewsky and Downs 2007:8). To the extent that it is possible, the needle-and-thread grass/Indian ricegrass community should be avoided during excavation. A mitigation action plan would be developed prior to excavation.

#### 4.1.7.2.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200-East Area, 200-West Area, or Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north. Implementation of this alternative would not impact any site wetlands.

#### 4.1.7.2.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations, they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.2.

#### 4.1.7.2.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas or Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

A number of state-listed, special status species have been observed within areas that would be disturbed by construction under Alternative 2A. Two state-listed species were observed near or along the 200-East Area underground transfer line. The black-tailed jackrabbit (state candidate) has been observed near the underground transfer line route, and Piper's daisy (state sensitive) was identified on the edge of sagebrush habitat along the route. Thus, construction of the underground transfer line has the potential to disturb both of these listed species. Two listed plants, stalked-pod milkvetch and crouching milkvetch (both state watch), were observed within the area where the replacement WTP and new DSTs would be placed. Due to the presence of sagebrush habitat within these areas, other special status species could potentially be present.

Although mitigation would not be required for the state watch species, they should be considered during project planning. Impacts on state candidate and sensitive species, which are considered Level III resources under the *Hanford Site Biological Resources Management Plan*, require mitigation where impacts would occur. When avoidance and minimization are not possible or are insufficient, mitigation via rectification or compensation is recommended (DOE 2001b:4.9, 8.11). A comprehensive mitigation action plan, which would deal with the loss of listed species (as well as sagebrush habitat), would be developed prior to construction. Operations of new facilities within the 200 Areas are not expected to impact any federally or state-listed species.

As noted in Chapter 3, Section 3.2.7.4.4, surveys have identified Piper's daisy, stalked-pod milkvetch, crouching milkvetch, and the long-billed curlew (state monitor) within the boundaries of Borrow Area C. Mitigation requirements for Piper's daisy and the two species of milkvetch are addressed above. Although avoidance and minimization of impacts on state monitor species is recommended, mitigation is not required (DOE 2001b:4.11). A mitigation action plan would be developed prior to excavation.

### 4.1.7.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

#### 4.1.7.3.1 Terrestrial Resources

As noted in Section 4.1.1.3.1, 16.7 hectares (41.3 acres) would be disturbed by construction of new facilities within the 200 Areas under this alternative. Of this total, 13 hectares (32.2 acres) would be developed within the 200-East Area and 3.7 hectares (9.1 acres) within the 200-West Area. The only new construction to take place within the 200-West Area is an underground transfer line that would be built along existing roads and, thus, would have a negligible impact on terrestrial resources. Within the 200-East Area, an underground transfer line would disturb 3.2 hectares (8 acres) of undisturbed land, 1.2 hectares (3 acres) of which is sagebrush habitat. The loss of this sagebrush habitat would not be mitigable. As all other new facilities constructed within the 200-East Area would be built within previously disturbed areas, they would have a negligible impact on terrestrial resources.

Under this alternative, closure would involve removal of soil from around the BX tank farm in the 200-East Area and the SX tank farm in the 200-West Area and covering all 18 tank farms and six sets of cribs and trenches (ditches) with landfill barriers. As barriers would ultimately cover the BX and SX tank farms, the impact of soil removal is not addressed separately. Because land at the tank farms has been

disturbed from past and present operations, no sagebrush habitat is present. Thus, placement of landfill closure barriers over these areas would have negligible impacts on terrestrial resources. Upon completion, the barriers would be planted with a mixture of grasses.

This alternative would have a negligible impact on site wildlife, although any loss of sagebrush habitat has the potential to impact certain species, such as the sage sparrow. While some members of smaller, less-mobile species could be lost during construction of new facilities, most animals are expected to disperse to surrounding areas. Although the revegetated landfill closure barriers would provide some habitat for terrestrial species, their overall value would be minimal because to limit root penetration they would be maintained as grasslands. Operational impacts on terrestrial resources would be similar to those addressed in Section 4.1.7.2.1.

Under Alternative 2B, 95.1 hectares (235 acres) of Borrow Area C would be excavated to supply needed geologic material. Overall, impacts on terrestrial resources from the excavation of geologic material from the area would be similar to those described above under Alternative 2A.

#### 4.1.7.3.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas or Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

#### 4.1.7.3.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.3.

#### 4.1.7.3.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas or Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Two state-listed species were observed near or along the 200-East Area underground transfer line. The black-tailed jackrabbit (state candidate) and Piper's daisy (state sensitive) have been identified along the route of the 200-East Area underground transfer line and could be disturbed by construction. As other proposed facilities associated with this alternative would be constructed on previously disturbed land, there is little potential to disturb special status species. Mitigation requirements, including preparation of a mitigation action plan, would be similar to those discussed in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on special status species resulting from excavation of geologic material from 95.1 hectares (235 acres) in Borrow Area C generally would be similar to those described under Alternative 2A (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

#### 4.1.7.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

##### 4.1.7.4.1 Terrestrial Resources

As noted in Section 4.1.1.4.1, 16.3 hectares (40.4 acres) would be needed for construction of new facilities within the 200 Areas under this alternative. Of this total, 12.2 hectares (30.1 acres) would be needed within the 200-East Area and 4.2 hectares (10.3 acres) within the 200-West Area. Most new facilities would be built on previously disturbed land and therefore would have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, construction of new facilities would impact 3.6 hectares (8.8 acres) of sagebrush habitat. Within the 200-West Area, new facilities would be constructed on 0.4 hectares (1.1 acres) of such habitat within the 200-West Area Supplemental Treatment Technology Site (STTS-West). Sagebrush habitat disturbed by the 200-East Area underground transfer line and in the 200-West Area would not be mitigable. In addition, mitigation would not be required within the 200-East Area Supplemental Treatment Technology Site (STTS-East) because the loss of sagebrush habitat would not meet the minimum mitigation threshold (5 hectares [12.5 acres]) (DOE 2003f:20, 21).

Impacts on terrestrial resources during operations would be similar to those described in Section 4.1.7.2.1; impacts on terrestrial resources during closure would be similar to those described in Section 4.1.7.3.1.

Under Alternative 3A, 100 hectares (247 acres) of Borrow Area C would be excavated to supply needed geologic material. Overall, impacts on terrestrial resources from the excavation of geologic material from the area would be similar to those described under Alternative 2A.

##### 4.1.7.4.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas or Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

##### 4.1.7.4.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations, they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.4.

##### 4.1.7.4.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas or Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this

alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Under this alternative, a number of state-listed, special status species have been observed in areas where new facilities would be built; therefore, these species could be impacted by construction activities. The stalked-pod milkvetch and crouching milkvetch (both state watch) have been observed in STTS-East, while the loggerhead shrike (Federal species of concern and state candidate) and sage sparrow (state candidate) have been observed within STTS-West. Due to the presence of sagebrush habitat within this area, other special status species could potentially be present. The black-tailed jackrabbit (state candidate) and Piper's daisy (state sensitive) were observed along the route of the 200-East Area underground transfer line. Mitigation requirements, including preparation of a mitigation action plan, would be similar to those discussed in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on special status species resulting from excavation of geologic material from 100 hectares (247 acres) in Borrow Area C generally would be similar to those described under Alternative 2A (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

### 4.1.7.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

#### 4.1.7.5.1 Terrestrial Resources

As noted in Section 4.1.1.5.1, 17.2 hectares (42.6 acres) would be needed for construction of new facilities within the 200 Areas under this alternative. Of this total, 12.6 hectares (31.2 acres) would be developed within the 200-East Area and 4.6 hectares (11.4 acres) within and adjacent to the 200-West Area. As is the case under Alternative 3A, most new facilities would be built within previously disturbed areas and, therefore, would have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, construction of new facilities would impact a total of 4 hectares (9.9 acres) of sagebrush habitat. Within the 200-West Area, construction would take place on 0.9 hectares (2.2 acres) of sagebrush habitat within STTS-West. The loss of sagebrush habitat associated with construction of the 200-East Area underground transfer line and facilities in STTS-West would not be mitigable. In addition, mitigation would not be required within STTS-East because the loss of sagebrush habitat would not meet the minimum mitigation threshold (5 hectares [12.5 acres]) (DOE 2003f:20, 21).

Impacts on terrestrial resources during operations would be similar to those described in Section 4.1.7.2.1; impacts on terrestrial resources during closure, similar to those described in Section 4.1.7.3.1.

Under Alternative 3B, 92.3 hectares (228 acres) of Borrow Area C would be excavated to supply needed geologic material. Overall impacts on terrestrial resources from the excavation of geologic material from the area would be similar to those described under Alternative 2A.

#### 4.1.7.5.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas or Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

#### 4.1.7.5.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.5.

#### 4.1.7.5.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas or Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Although slightly more land would be required under Alternative 3B than under Alternative 3A, construction would take place within the same general areas. Thus, potential impacts on state-listed, special status species would be similar to those discussed in Section 4.1.7.4.4. Mitigation requirements, including preparation of a mitigation action plan, would be similar to those discussed in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on special status species resulting from excavation of geologic material from 92.3 hectares (228 acres) in Borrow Area C would be similar to, but greater than, those described under Alternative 2A because more area would be disturbed (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

### 4.1.7.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

#### 4.1.7.6.1 Terrestrial Resources

As noted in Section 4.1.1.6.1, 17.2 hectares (42.4 acres) would be needed for construction of new facilities within the 200 Areas under this alternative. Of this total, 12.8 hectares (31.7 acres) would be disturbed within and adjacent to the 200-East Area and 4.3 hectares (10.7 acres) within the 200-West Area. As is the case under Alternative 3A, most new facilities would be built within previously disturbed areas and therefore would have a negligible impact on terrestrial resources. However, in the 200-West Area, new facilities would be constructed on 0.6 hectares (1.5 acres) of sagebrush habitat within STTS-West. Construction of these new facilities within and adjacent to the 200-East Area would impact 4.2 hectares (10.4 acres) of sagebrush habitat. The loss of sagebrush habitat associated with construction of the 200-East Area underground transfer line and facilities in STTS-West would not be mitigable. In addition, mitigation would not be required within STTS-East because the loss of sagebrush habitat would not meet the minimum mitigation threshold (5 hectares [12.5 acres]) (DOE 2003f:20, 21).

Impacts on terrestrial resources during operations would be similar to those described in Section 4.1.7.2.1, and those during closure would be similar to those described in Section 4.1.7.3.1.

Under Alternative 3C, 92.7 hectares (229 acres) of Borrow Area C would be excavated to supply needed geologic material. Overall impacts on terrestrial resources from the excavation of geologic material from the area would be similar to those described under Alternative 3A.

#### 4.1.7.6.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas and Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

#### 4.1.7.6.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.6.

#### 4.1.7.6.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas or Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Although slightly more land would be required under this alternative than under Alternative 3A, construction would take place within the same general areas. Thus, potential impacts on state-listed, special status species would be similar to those discussed in Section 4.1.7.4.4. Mitigation requirements, including preparation of a mitigation action plan, would be similar to those discussed in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on special status species resulting from excavation of geologic material from 92.7 hectares (229 acres) in Borrow Area C generally would be similar to those described under Alternative 2A (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

### 4.1.7.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

#### 4.1.7.7.1 Terrestrial Resources

As noted in Section 4.1.1.7.1, 19.8 hectares (48.9 acres) would be needed for construction of new facilities within the 200 Areas under this alternative. Of this total, 13.7 hectares (33.8 acres) would be needed within or adjacent to the 200-East Area, 4.2 hectares (10.3 acres) within the 200-West Area, and 1.9 hectares (4.8 acres) between the 200-East and 200-West Areas. Most new facilities would be built

within previously disturbed areas and therefore would have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, construction of new facilities would impact a total of 4 hectares (9.9 acres) of sagebrush habitat and would disturb 0.4 hectares (1.1 acres) of sagebrush habitat within the 200-West Area. Facilities located between the 200-East and 200-West Areas would disturb 1.9 hectares (4.8 acres) of sagebrush habitat. The loss of sagebrush habitat associated with construction of the 200-East Area underground transfer line and facilities in STTS-West would not be mitigable. In addition, mitigation would not be required within STTS-East because the loss of sagebrush habitat would not meet the minimum mitigation threshold (5 hectares [12.5 acres]). However, the loss of 1.9 hectares (4.8 acres) of sagebrush habitat between the 200-East and 200-West Areas would be mitigable at a ratio of 3:1 (DOE 2003f:20, 21). Specific measures to mitigate this loss would be set forth in a mitigation action plan prior to construction.

Impacts on terrestrial resources during operations would be similar to those described in Section 4.1.7.2.1; impacts on terrestrial resources during closure, similar to those described in Section 4.1.7.3.1. Clean closure of the BX and SX tank farms and six sets of cribs and trenches (ditches) has the potential to increase wildlife habitat provided that native plant communities have been reestablished; however, because the remediated areas are part of the highly developed 200 Areas, they could also be used for other industrial purposes.

Under Alternative 4, 102 hectares (252 acres) of Borrow Area C would be excavated to supply needed geologic material. Overall impacts on terrestrial resources from the excavation of geologic material from the area would be similar to those described under Alternative 3A.

#### 4.1.7.7.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas and Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

#### 4.1.7.7.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.7.

#### 4.1.7.7.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas and Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Facilities built under Alternative 4 would disturb about the same amount of land within the same areas (i.e., the 200-East underground transfer line, STTS-East, and STTS-West) as is the case under Alternative 3A. Thus, potential impacts on state-listed, special status species would be similar to those discussed in Section 4.1.7.4.4. Mitigation requirements, including preparation of a mitigation action plan, would be similar to those discussed in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on special status species resulting from excavation of geologic material from 102 hectares (252 acres) in Borrow Area C generally would be similar to those described under Alternative 2A (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

### 4.1.7.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

#### 4.1.7.8.1 Terrestrial Resources

As noted in Section 4.1.1.8.1, 20.2 hectares (49.9 acres) would be needed for construction of new facilities within the 200 Areas under this alternative. Of this total, 16 hectares (39.6 acres) within or adjacent to the 200-East Area and 4.2 hectares (10.3 acres) within the 200-West Area would be disturbed. Most new facilities would be built within previously disturbed areas and therefore would have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, construction of new facilities would impact a total of 4 hectares (9.9 acres) of sagebrush habitat, and within the 200-West Area, new facilities would be constructed on 0.4 hectares (1.1 acres) of sagebrush habitat. The loss of sagebrush habitat associated with construction of the 200-East Area underground transfer line and facilities in STTS-West would not be mitigable. In addition, mitigation would not be required within STTS-East since the loss of sagebrush habitat would not meet the minimum mitigation threshold (5 hectares [12.5 acres]) (DOE 2003f:20, 21).

Under Alternative 5, 117 hectares (290 acres) of Borrow Area C would be excavated to supply needed geologic material. Overall impacts on terrestrial resources from the excavation of geologic material from the area would be similar to those described above under Alternative 2A (see Section 4.1.7.2.1).

#### 4.1.7.8.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas and Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

#### 4.1.7.8.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.8.

#### 4.1.7.8.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas and Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this

alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Although slightly more land would be required under Alternative 5 compared with Alternative 3A, construction would take place within the same general areas. Thus, potential impacts on state-listed, special status species would be similar to those discussed in Section 4.1.7.4.4. Mitigation requirements, including preparation of a mitigation action plan, would be similar to those discussed in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on state-listed, special status species resulting from excavation of geologic material from 117 hectares (290 acres) in Borrow Area C generally would be similar to those described under Alternative 2A (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

#### 4.1.7.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

##### 4.1.7.9.1 Terrestrial Resources

###### 4.1.7.9.1.1 Base Case

As noted in Section 4.1.1.9.1, under this alternative, 210 hectares (519 acres) would be needed for construction of new facilities within the 200 Areas. Of this total, 153 hectares (377 acres) would be required within or adjacent to the 200-East Area, 3.2 hectares (8 acres) within the 200-West Area, and 54.2 hectares (134 acres) between the 200-East and 200-West Areas. Most of the land (i.e., 182 hectares [450 acres]) within or adjacent to the 200-East Area and between the 200-East and 200-West Areas that would be used for new construction contains sagebrush habitat, while sagebrush habitat would not be affected in the 200-West Area. The loss of sagebrush habitat associated with construction of the 200-East Area underground transfer line and facilities in STTS-West would not be mitigable; however, Hanford guidance may require the replacement of other sagebrush habitat at a ratio ranging from 1:1 to 3:1 (DOE 2003f:20, 21, 31). Specific measures to mitigate this loss would be set forth in a mitigation action plan prior to construction.

Implementation of this alternative would result in impacts on wildlife similar in nature to those described in Section 4.1.7.2.1; however, due to the greater extent of habitat destruction, the extent of the impacts would be greater. As the tank farms would undergo clean closure, the area occupied by the farms would be available for unrestricted use. If that use involved revegetation with native species, there would be an opportunity to increase terrestrial habitat in the area, including sagebrush habitat. Operational impacts on terrestrial resources would be somewhat greater than those addressed in Section 4.1.7.2.1.

Under Alternative 6A, Base Case, 381 hectares (942 acres) of Borrow Area C would be excavated to supply needed geologic material. As noted in Chapter 3, Section 3.2.7.1, the two major communities present within the area are Sandberg's bluegrass/cheatgrass (782 hectares [1,933 acres]) and needle-and-thread grass/Indian ricegrass (107 hectares [265 acres]) (see Chapter 3, Figure 3–18). The latter represents an unusual and relatively pristine community type at Hanford and thus is considered a more highly valued community than the former. It is not possible to determine specific impacts on ecological resources of developing Borrow Area C because the area(s) from which different types of geologic material would be excavated is not known. However, because approximately 41 percent of Borrow Area C would be developed, it is likely that at least some of the more highly valued

needle-and-thread grass/Indian ricegrass community would be impacted. To the extent that it is possible, the needle-and-thread grass/Indian ricegrass community should be avoided.

#### 4.1.7.9.1.2 Option Case

Impacts on terrestrial resources under this option would generally be similar to those described for the Base Case (see Section 4.1.7.9.1.1), including the loss of 184 hectares (455 acres) of sagebrush habitat. However, under the Option Case, a modified RCRA Subtitle C landfill barrier would not be used to cover the six sets of cribs and trenches (ditches) because they would be removed and their deep plumes remediated. Thus, compared with the Base Case, an additional 25.4 hectares (62.7 acres) of land would become available for alternative uses in the future, including possible restoration of shrub-steppe habitat.

The Option Case would require that 458 hectares (1,131 acres) of land be excavated from Borrow Area C to supply needed geologic material. Although somewhat more habitat would be disturbed, impacts on ecological resources, including the highly valued needle-and-thread grass/Indian ricegrass community, would be similar to those described above for the Base Case.

### 4.1.7.9.2 Wetlands

#### 4.1.7.9.2.1 Base and Option Cases

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas or Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of either the Base or Option Case would not impact any site wetlands.

### 4.1.7.9.3 Aquatic Resources

#### 4.1.7.9.3.1 Base and Option Cases

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.9.

### 4.1.7.9.4 Threatened and Endangered Species

#### 4.1.7.9.4.1 Base Case

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas and Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Under this alternative, a number of state-listed, special status species have been observed within areas that would be disturbed by construction. The black-tailed jackrabbit (state candidate) and Piper's daisy (state sensitive) have been identified along the route of the 200-East Area underground transfer line. Two listed plants, stalked-pod milkvetch and crouching milkvetch (both state watch), were observed in the area where the IHLW Interim Storage Modules (and replacements), replacement WTP, and new DSTs would

be built. Due to the presence of sagebrush habitat within these areas, other special status species could potentially be present. In addition, under this alternative, the PPF and HLW Debris Storage Facility would be constructed between the 200-East Area and 200-West Areas. The loggerhead shrike, black-tailed jackrabbit, sage sparrow, and crouching milkvetch have all been observed within this area. Mitigation measures, including the preparation of a mitigation action plan, would be similar to those described in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers over the six sets of cribs and trenches (ditches) during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

As noted in Section 4.1.7.2.4, surveys have identified Piper's daisy (state sensitive), stalked-pod milkvetch, crouching milkvetch, and the long-billed curlew (state monitor) within the boundaries of Borrow Area C. Due to the extent of development under this alternative, it is highly likely that one or all of these species could be impacted by the excavation of geologic material. Mitigation measures related to special status species are addressed in Section 4.1.7.2.4 and would include the preparation of a mitigation action plan prior to site development.

#### 4.1.7.9.4.2 Option Case

Impacts on special status species generally would be similar to those described above for the Base Case; however, because an additional 76.5 hectares (189 acres) would be excavated from Borrow Area C, potential impacts on state-listed species would be greater.

### 4.1.7.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.7.10.1 Terrestrial Resources

##### 4.1.7.10.1.1 Base Case

As noted in Section 4.1.1.10.1, under this alternative, 119 hectares (294 acres) would be needed for construction of new facilities within the 200 Areas. Of this total, 61 hectares (151 acres) would be required within or adjacent to the 200-East Area, 3.7 hectares (9.1 acres) within the 200-West Area, and 54.2 hectares (134 acres) between the 200-East and 200-West Areas. Most of the land (i.e., 102 hectares [253 acres]) within or adjacent to the 200-East Area and between the 200-East and 200-West Areas has not been disturbed; all but 2 hectares (5 acres) is sagebrush habitat. Only previously disturbed areas would be utilized in the 200-West Area. The loss of sagebrush habitat associated with construction of the 200-East Area underground transfer line and facilities in STTS-West would not be mitigable; however, Hanford guidance may require the replacement of other sagebrush habitat at a ratio ranging from 1:1 to 3:1 (DOE 2003f:20, 21, 31). Specific measures to mitigate the loss of sagebrush habitat would be set forth in a mitigation action plan prior to construction.

Under this option, the tank farms would undergo clean closure; thus, the area occupied by these farms would be available for unrestricted use. If that use involved revegetation with native species, there would be an opportunity to increase terrestrial habitat in the area, including sagebrush habitat. Operational impacts would be similar to those addressed in Section 4.1.7.2.1.

Under Alternative 6B, Base Case, 240 hectares (592 acres) of Borrow Area C would be excavated to supply needed geologic material. Impacts on terrestrial resources from the excavation of geologic material from the area would be similar to, but somewhat less than, those described for the Base Case under Alternative 6A (see Section 4.1.7.9.1.1).

#### 4.1.7.10.1.2 Option Case

Impacts on terrestrial resources under this case would generally be similar to those described for the Base Case (see Section 4.1.7.9), including the loss of 102 hectares (253 acres) of sagebrush habitat. However, under the Option Case, a modified RCRA Subtitle C landfill barrier would not be used to cover the six sets of cribs and trenches (ditches) because they would be removed and their deep plumes would be remediated. Thus, compared with the Base Case, an additional 25.4 hectares (62.7 acres) of land would become available for alternative uses in the future, including possible restoration of shrub-steppe habitat.

Under the Option Case, 316 hectares (781 acres) would need to be excavated from Borrow Area C to supply geologic material. As this land represents about 34 percent of Borrow Area C, compared with 26 percent for the Base Case, potential impacts on the highly valued needle-and-thread grass/Indian ricegrass community would be greater. To the extent that it is possible, the needle-and-thread grass/Indian ricegrass community should be avoided.

### 4.1.7.10.2 Wetlands

#### 4.1.7.10.2.1 Base and Option Cases

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas and Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

### 4.1.7.10.3 Aquatic Resources

#### 4.1.7.10.3.1 Base and Option Cases

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.10.

### 4.1.7.10.4 Threatened and Endangered Species

#### 4.1.7.10.4.1 Base Case

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas and Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Under this alternative, a number of state-listed, special status species have been observed within areas that would be disturbed by construction. The black-tailed jackrabbit (state candidate) and Piper's daisy (state sensitive) have been identified along the route of the 200-East Area underground transfer line. Two listed plants, stalked-pod milkvetch and crouching milkvetch (both state watch), were observed within the area where the ILAW Storage Facility would be built. Due to the presence of sagebrush habitat within this area, other special status species could potentially be present. In addition, under this alternative, the HLW Debris Storage Facility would be constructed between the 200-East and 200-West Areas. The loggerhead

shrike, black-tailed jackrabbit, sage sparrow, and crouching milkvetch have all been observed within this area. Mitigation measures, including the preparation of a mitigation action plan, would be similar to those described in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers over the six sets of cribs and trenches (ditches) during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on state-listed special status species resulting from excavation of geologic material from 240 hectares (592 acres) in Borrow Area C generally would be similar to those described under Alternative 6A (see Section 4.1.7.9.4). As is the case under Alternative 6A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

#### 4.1.7.10.4.2 Option Case

Impacts on special status species would be similar to those noted above for the Base Case, although a greater potential exists to affect these species within Borrow Area C due to the greater area of habitat disturbed (i.e., 316 hectares [781 acres] versus 240 hectares [592 acres]).

### 4.1.7.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

#### 4.1.7.11.1 Terrestrial Resources

As noted in Section 4.1.1.11.1, under this alternative, 61.5 hectares (152 acres) would be disturbed by construction of new facilities within the 200 Areas. Of this total, 57.9 hectares (143 acres) within or adjacent to the 200-East Area and 3.7 hectares (9.1 acres) within the 200-West Area would be utilized. Most of the land (i.e., 46.1 hectares [114 acres]) within or adjacent to the 200-East Area that would be used for new construction contains sagebrush habitat, while only previously disturbed areas would be affected in the 200-West Area. The loss of sagebrush habitat associated with construction of the 200-East Area underground transfer line would not be mitigable; however, Hanford guidance may require the replacement of other sagebrush habitat at a ratio of 3:1 (DOE 2003f:20, 21, 31). Specific measures to be taken to mitigate the loss of sagebrush habitat would be set forth in a mitigation action plan prior to construction.

Construction and operational impacts of this alternative on wildlife would be similar to those described in Section 4.1.7.2.1; impacts on terrestrial resources during closure, similar to those described in Section 4.1.7.3.1.

Under Alternative 6C, a total of 104 hectares (258 acres) of Borrow Area C would be excavated to supply needed geologic material. Impacts on terrestrial resources from the excavation of geologic material from the area would be similar to those described above under Alternative 2A (see Section 4.1.7.2.1).

#### 4.1.7.11.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2, there are no wetlands within the 200 Areas and Borrow Area C, although West Lake is located about 4.8 kilometers (3 miles) to the north of the 200 Areas. Implementation of this alternative would not impact any site wetlands.

#### 4.1.7.11.3 Aquatic Resources

The five ponds associated with the LERF and the TEDF, which are located within and adjacent to the 200-East Area, would not be directly affected by construction of any of the new facilities planned for the

area. During operations they would receive effluent discharges. As noted in Chapter 3, Section 3.2.7.3.2, these ponds, though accessible to wildlife, do not support fish populations. There are no aquatic resources within Borrow Area C. Potential indirect impacts on Columbia River aquatic resources of air emissions and groundwater are addressed in Chapter 5, Section 5.1.3.11.

#### 4.1.7.11.4 Threatened and Endangered Species

Federally or state-listed threatened or endangered species have not been observed within or in the immediate vicinity of the 200 Areas and Borrow Area C; therefore, impacts on this group of plants and animals are not expected under this alternative. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Under this alternative, a number of state-listed, special status species have been observed within areas that would be disturbed by construction. The black-tailed jackrabbit (state candidate) and Piper's daisy (state sensitive) have been identified along the route of the 200-East Area underground transfer line. Two listed plants, stalked-pod milkvetch and crouching milkvetch (both state watch), were observed within the area where the ILAW Storage Facility would be built. Due to the presence of sagebrush habitat within this area, other special status species could potentially be present. Mitigation measures, including the preparation of a mitigation action plan, would be similar to those described in Section 4.1.7.2.4.

The operation of new facilities is not expected to impact any listed species. Placement of landfill barriers over the 18 tank farms and six sets of cribs and trenches (ditches) during closure also is not expected to disturb any listed species, as none have been identified in the affected areas.

Impacts on state-listed, special status species resulting from excavation of geologic material from 104 hectares (258 acres) in Borrow Area C generally would be similar to those described under Alternative 2A (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified because the exact areas to be excavated are unknown. A mitigation action plan would be developed prior to excavation.

### 4.1.8 Cultural and Paleontological Resources

#### 4.1.8.1 Alternative 1: No Action

Under Alternative 1: No Action, no new facilities would be constructed within either the 200-East or 200-West Area, and construction of the WTP and Canister Storage Building would be terminated. The survey and geology of the 200-East and 200-West Areas indicate that the potential for subsurface archaeological resources is low (Chatters and Cadoret 1990).

The No Action Alternative would require a commitment of land within the 200 Areas over the long term. Additionally, 2 hectares (5 acres) of geological material would be excavated from Borrow Area C for use in stabilization of tanks and closure of the WTP. The survey and geology of Borrow Area C indicate that subsurface cultural deposits have no potential or a low potential of being present (PNNL 2007).

##### 4.1.8.1.1 Prehistoric Resources

As noted in Chapter 3, Section 3.2.8.1.2, the prehistoric White Bluffs Road (eligible for listing in the National Register of Historic Places [National Register]), which was in use prior to exploration and settlement of the area, traverses the northwest portion of the 200-West Area in a southwest to northeast direction. The only other prehistoric resources found in the 200 Areas were isolated flakes and projectile

point fragments, most of which were collected and curated by archaeologists upon discovery. As there would be no new construction under this alternative, prehistoric resources would not be disturbed.

If prehistoric resources were discovered during the excavation of geologic material from Borrow Area C, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.1.2 Historic Resources

Historic artifacts found within or adjacent to the 200-East Area include a number of historic cans and bottles. These artifacts would not be affected under this alternative. There would be no impact on White Bluffs Road or other early historic artifacts within the 200-West Area. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative.

As is the case for prehistoric resources, if historic resources were discovered during the excavation of geologic material from Borrow Area C, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.1.3 American Indian Interests

Under this alternative, no resources would be directly affected by project-related facilities. Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.1.1. Rattlesnake Mountain, Gable Mountain, and Gable Butte, all of which are important to American Indians for religious and other cultural purposes, would not be directly affected under this alternative. As noted in Section 4.1.1.1.2, the industrial appearance of the 200-East and 200-West Areas from Gable Mountain and Gable Butte would remain unchanged because no new construction within the 200 Areas would occur. The 2 hectares (5 acres) of Borrow Area C that would be excavated would be noticeable from Rattlesnake Mountain, although this development would not dominate the view. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.1.4 Paleontological Resources

There would be no impacts on paleontological resources under this alternative, as no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were discovered during the excavation of geologic material from Borrow Area C, procedures in place to properly manage the discovery site would be implemented.

### 4.1.8.2 Alternative 2A: Existing WTP Vitrification; No Closure

#### 4.1.8.2.1 Prehistoric Resources

Under Alternative 2A, there would be no impacts on known prehistoric resources. White Bluffs Road would not be affected by construction of the underground transfer line, and most of the prehistoric isolated artifacts found in the 200 Areas were collected and curated by archaeologists upon discovery. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction or excavation, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.2.2 Historic Resources

Under Alternative 2A, there would be no impacts on White Bluffs Road or other known early historic artifacts within the 200-West Area, as all such resources are located in the northwest part of the area and would not be affected by construction of the underground transfer line. As is the case for prehistoric resources, if historic resources were discovered during construction or excavation, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

#### 4.1.8.2.3 American Indian Interests

Under this alternative, no resources would be directly affected by project-related facilities. Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.2.1. Rattlesnake Mountain, Gable Mountain, and Gable Butte, all of which are important to American Indians for religious and other cultural purposes, would not be directly affected under this alternative, and, as noted in Section 4.1.1.2.2, the view from these places would remain largely unchanged. The construction of the underground transfer line and changes in the 200-East Area would not be visible from Gable Mountain and Gable Butte. However, the 29.1 hectares (72 acres) excavated from Borrow Area C would be readily visible from Rattlesnake Mountain. Upon completion of work, Borrow Area C would be revegetated, lessening the visual impact. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.2.4 Paleontological Resources

There would be no impacts on known paleontological resources under this alternative, as no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction or excavation, procedures in place to properly manage the discovery site would be implemented.

### 4.1.8.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

#### 4.1.8.3.1 Prehistoric Resources

Under Alternative 2B, there would be no impacts on known prehistoric resources. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction or excavation, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.3.2 Historic Resources

Under Alternative 2B, there would be no impacts on White Bluffs Road or other known early historic artifacts within the 200-West Area, as all such resources are located in the northwest part of the area and would not be affected by construction of the underground transfer line. As is the case for prehistoric resources, if historic resources were discovered during construction or excavation, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

#### 4.1.8.3.3 American Indian Interests

Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.3.1. Under this alternative, visual impacts would be similar to those described in Section 4.1.8.2.3 under Alternative 2A; however, as part of landfill closure, the 200-East and 200-West Area containment structures and closure barriers would be visible from nearby higher elevations like Gable Mountain and

Gable Butte, both of which are important to American Indians for religious and other cultural purposes. The view of the 200 Areas from these places would remain largely unchanged from its current industrial nature. Under this alternative, 95.1 hectares (235 acres) of Borrow Area C would be excavated. The development of Borrow Area C would be readily visible from Rattlesnake Mountain. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impacts. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.3.4 Paleontological Resources

There would be no impacts on paleontological resources under this alternative, as no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction or excavation, procedures in place to properly manage the discovery site would be implemented.

### 4.1.8.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

#### 4.1.8.4.1 Prehistoric Resources

Under Alternative 3A, existing prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction or excavation, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.4.2 Historic Resources

Under this alternative, there would be no impacts on White Bluffs Road or other early historic artifacts within the 200-East and 200-West Areas because none are located within areas to be disturbed by new facilities. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered during excavation or construction, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

#### 4.1.8.4.3 American Indian Interests

Under this alternative, visual impacts would be similar to those under Alternative 2B, as described in Section 4.1.8.3.3. Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.4.1. Construction and closure activities would not greatly change the industrial nature of the view from nearby higher elevations like Gable Mountain and Gable Butte, both of which are important to American Indians for religious and other cultural purposes. The view of the 200 Areas from these places would remain largely unchanged from its current industrial nature. An additional 4.9 hectares (12 acres) of land would be disturbed within Borrow Area C, and the visual impacts would be similar to those described under Alternative 2B. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.4.4 Paleontological Resources

There would be no impacts on paleontological resources under this alternative, as no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any

paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

#### 4.1.8.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

##### 4.1.8.5.1 Prehistoric Resources

Under Alternative 3B, known prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during excavation or construction, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

##### 4.1.8.5.2 Historic Resources

Under this alternative, there would be no impacts on White Bluffs Road or known early historic artifacts within the 200-East and 200-West Areas because none are located within the construction or excavation areas. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

##### 4.1.8.5.3 American Indian Interests

Impacts on American Indian interests for this alternative would be similar to those described under Alternative 2B. Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.5.1. Closure activities would not greatly change the industrial view of nearby higher elevations. The land requirement in Borrow Area C would be slightly less under Alternative 3B (e.g., 2.8 hectares [7 acres]), but visual impacts would be similar (see Section 4.1.1.5.2). If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

##### 4.1.8.5.4 Paleontological Resources

There would be no impacts on known paleontological resources under this alternative because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

#### 4.1.8.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

##### 4.1.8.6.1 Prehistoric Resources

Under Alternative 3C, known prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.6.2 Historic Resources

Under this alternative, there would be no impacts on White Bluffs Road or known early historic artifacts within the 200-East or 200-West Area because all such resources are located in the northwest part of the area and would not be affected by construction or excavation. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

#### 4.1.8.6.3 American Indian Interests

Under this alternative, visual impacts would be similar to those in Section 4.1.8.3.3 under Alternative 2B. Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.6.1. Construction, operations, deactivation, and closure activities in the 200 Areas would not greatly change the industrial nature of the view from Gable Mountain or Gable Butte, and approximately the same amount of geologic material would be required in Borrow Area C. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.6.4 Paleontological Resources

There would be no impacts on known paleontological resources under this alternative because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

### 4.1.8.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

#### 4.1.8.7.1 Prehistoric Resources

Under Alternative 4, known prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction or excavation, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.7.2 Historic Resources

Under this alternative, there would be no impacts on White Bluffs Road or other known early historic artifacts within the 200-East or 200-West Area because all such resources are located in the northwest part of the area and would not be affected by construction or excavation. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

#### 4.1.8.7.3 American Indian Interests

Under this alternative, visual impacts would be similar to those described in Section 4.1.8.3.3 under Alternative 2B. Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.7.1. Construction and closure activities would not greatly change the industrial nature of the view from nearby higher elevations like Gable Mountain and Gable Butte. Although an additional 6.9 hectares (17 acres) of land within Borrow Area C would be disturbed, the view would remain largely unchanged. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.7.4 Paleontological Resources

There would be no impacts on known paleontological resources under this alternative because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

### 4.1.8.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

#### 4.1.8.8.1 Prehistoric Resources

Under Alternative 5, known prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction or excavation, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.8.2 Historic Resources

Under this alternative, there would be no impacts on White Bluffs Road or other known early historic artifacts within the 200-East or 200-West Area because all such resources are located in the northwest part of the area and would not be affected by construction or excavation. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

#### 4.1.8.8.3 American Indian Interests

The impacts on American Indian interests under this alternative would be similar to those under Alternative 2B for construction, operations, deactivation, and closure activities. Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.8.1. The industrial nature of the view from nearby higher elevations like Gable Mountain and Gable Butte would not greatly change.

Under this alternative, 117 hectares (290 acres) of Borrow Area C would be excavated. Development of Borrow Area C would be visible from Rattlesnake Mountain. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.8.4 Paleontological Resources

There would be no impacts on known paleontological resources under this alternative because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

### 4.1.8.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.8.9.1 Prehistoric Resources

##### 4.1.8.9.1.1 Base Case

Under Alternative 6A, Base Case, prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

##### 4.1.8.9.1.2 Option Case

As with the Base Case, under Alternative 6A, Option Case, known prehistoric resources would not be affected. If prehistoric resources were discovered during excavation of this alternative, appropriate measures would be implemented.

#### 4.1.8.9.2 Historic Resources

##### 4.1.8.9.2.1 Base Case

There would be no impacts on White Bluffs Road or other known early historic artifacts within the 200-East and 200-West Areas because all such resources are located in the northwest part of the area and would not be affected by construction or excavation. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

##### 4.1.8.9.2.2 Option Case

Similar to Alternative 6A, Base Case, historic resources would not be affected under the Option Case.

#### 4.1.8.9.3 American Indian Interests

##### 4.1.8.9.3.1 Base Case

Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.9.1.1. Under this alternative case, 210 hectares (519 acres) would be converted to industrial use. The majority of this land would be within or adjacent to the 200-East Area and between the 200-East and 200-West Areas. Facilities constructed would noticeably add to the industrial nature of the 200 Areas and would be visible from nearby higher elevations like Gable Mountain and Gable Butte (see Section 4.1.1.9.2.1). The viewscape from these higher elevations is important to American Indians with cultural ties to Hanford.

In addition, 381 hectares (942 acres) of Borrow Area C would be excavated under this alternative. This would be visible from Rattlesnake Mountain, an area of cultural significance to the American Indians. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.1.8.9.3.2 Option Case

Activities and impacts under the Option Case would be similar to those discussed above under the Base Case. Remediation of the deep plumes would require more fill material. It would be necessary to excavate an additional 76.5 hectares (189 acres) of Borrow Area C compared with the Base Case. This excavation would cause a greater impact on the view from higher elevations such as Rattlesnake Mountain. As noted under the Base Case, excavations in Borrow Area C would be recontoured and revegetated upon completion of work, thereby lessening the visual impact. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

### 4.1.8.9.4 Paleontological Resources

#### 4.1.8.9.4.1 Base Case

There would be no impacts on known paleontological resources under this alternative because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

#### 4.1.8.9.4.2 Option Case

There would be no impacts on known paleontological resources under this alternative because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

## 4.1.8.10 Alternative 6B: All Vitrification with Separations; Clean Closure

### 4.1.8.10.1 Prehistoric Resources

#### 4.1.8.10.1.1 Base Case

Under Alternative 6B, Base Case, known prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction or excavation, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

#### 4.1.8.10.1.2 Option Case

Similar to Alternative 6B, Base Case, prehistoric resources would not be affected under the Option Case.

#### 4.1.8.10.2 Historic Resources

##### 4.1.8.10.2.1 Base Case

There would be no impacts on White Bluffs Road or other known early historic artifacts within the 200-East or 200-West Area because all such resources are located in the northwest part of the area and would not be affected by construction or excavation. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

##### 4.1.8.10.2.2 Option Case

Similar to the Base Case, historic structures would not be affected under the Option Case.

#### 4.1.8.10.3 American Indian Interests

##### 4.1.8.10.3.1 Base Case

Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.10.1.1. Under Alternative 6B, Base Case, there would be an overall increase in the industrial appearance of the 200 Areas, although less than half as much land within the 200 Areas would be converted to industrial use compared with Alternative 6A. Facilities constructed would noticeably add to the industrial nature of the 200 Areas and would be visible from nearby higher elevations like Gable Mountain and Gable Butte. Additionally, approximately 240 hectares (592 acres) of Borrow Area C would be excavated. This would be visible from Rattlesnake Mountain, and thus would have an impact on the viewscape. Upon completion of the work, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

##### 4.1.8.10.3.2 Option Case

Activities and visual impacts would be similar to those noted under the Base Case. Remediation of the deep plumes would result in disturbance of an additional 76.5 hectares (189 acres) within Borrow Area C compared with the Base Case. This would further impact the view from Rattlesnake Mountain.

#### 4.1.8.10.4 Paleontological Resources

##### 4.1.8.10.4.1 Base Case

There would be no impacts on known paleontological resources under this alternative case because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

##### 4.1.8.10.4.2 Option Case

There would be no impacts on known paleontological resources under this alternative case because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

#### 4.1.8.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

##### 4.1.8.11.1 Prehistoric Resources

Under Alternative 6C, known prehistoric resources would not be affected. The survey and geology of the 200-East and 200-West Areas and Borrow Area C indicate that subsurface cultural deposits have little or no potential of being present. If prehistoric resources were discovered during construction, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

##### 4.1.8.11.2 Historic Resources

Under this alternative, there would be no impacts on White Bluffs Road or other known early historic artifacts within the 200-East and 200-West Areas because all such resources are located in the northwest part of the area and would not be affected by construction or excavation. Buildings associated with the Manhattan Project and Cold War era are found within both the 200-East and 200-West Areas; however, none of these structures would be affected under this alternative. As is the case for prehistoric resources, if historic resources were discovered, procedures in place to properly identify, evaluate, record, curate, and manage the discovery site would be implemented.

##### 4.1.8.11.3 American Indian Interests

Prehistoric resources that may be of American Indian interest are discussed in Section 4.1.8.11.1. Under Alternative 6C, newly constructed aboveground facilities would add to the overall industrial view from the higher elevations, such as Gable Mountain and Gable Butte, which are important to American Indians with cultural ties to Hanford. In addition, 104 hectares (258 acres) of Borrow Area C would be excavated. This would also be visible from Rattlesnake Mountain. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

##### 4.1.8.11.4 Paleontological Resources

There would be no impacts on known paleontological resources under this alternative because no such resources have been discovered within the 200 Areas or Borrow Area C. As is the case for cultural resources, if any paleontological resources were found during construction, procedures in place to properly manage the discovery site would be implemented.

### 4.1.9 Socioeconomics

The potential primary (direct) and secondary (indirect) impacts of all tank closure activities on employment, regional demographics, housing and community services, and local transportation were analyzed for this section of the EIS. The potential primary impacts were identified by analyzing projected changes in employment (in terms of full-time equivalents [FTEs]) and truck activity related to the activities in each alternative (see Appendix I). The projected changes in employment and truck activity could impact the need for housing units, public services, and local transportation in the region.

Projected changes in employment would likely result in additional, secondary changes in employment, salaries, expenditures in the area, and demands for social services. Analyses of these potential secondary economic and social impacts across the alternatives were conducted using a blended multiplier developed by the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Input-Output Modeling System specifically for the Tri-Cities area, that is, Richland, Pasco, and Kennewick, Washington. The multiplier used was a blend of the new industrial and commercial construction multiplier and the

engineering and architectural services multiplier. The value of the blended multiplier was approximately 1.75, meaning that, for each full-time worker employed in support of tank closure activities, approximately three-quarters of an additional full-time job could be created elsewhere in the regional economy (Perteet, Thomas/Lane, and SCM 2001).

When calculating workforce estimates, partial FTE employee quantities were rounded up to the nearest whole FTE. The resulting conservative workforce estimates represent the upper limit of workforce requirements. For each type of activity (e.g., construction, operations, closure), a peak workforce estimate was calculated and the year(s) in which the peak occurred was noted. As each activity type may peak during different years, the totals do not add up because they represent different time periods. In addition, figures throughout this section may not tally due to rounding.

The projected workforce estimates could also impact the local commuter traffic. A 2005 commuter survey found that only 12 percent of employees commuting to Hanford used carpools or vanpools (two or more persons per vehicle); the remaining 88 percent used their own cars (one person per vehicle) (BFCOG 2006). It was assumed that employees would commute to work in vehicles averaging 1.25 persons each (Malley 2007). The conversion factor used when calculating the number of trips per day from trips per year was 260 days worked in a year. In addition, the number of calculated truck trips associated with the various activities was rounded up to the nearest whole trip. Impacts of onsite truck trips, i.e., trips conducted solely on site, are included in the onsite analysis. Impacts of the onsite portion of truck trips to or from the site are included in the offsite analysis.

**Common Socioeconomic Impacts**

The potential socioeconomic impacts of the alternatives below have many commonalities based on the activities associated with them. Construction, operations, and deactivation of the WTP and its replacements most often dominate the employment requirements for many of the Tank Closure alternatives.

As can be seen in Figure 4–16, each alternative includes at least one peak employment period, generally followed by an employment decline. Most alternatives include several growth periods with a leveling off in between. Most alternatives also include reduced workforce estimates for the final years when administrative controls of remaining facilities and postclosure care would be provided. During the high employment periods, increases in the projected workforce would result in some in-migration of workers from outside the region and associated secondary impacts on the local economy. The number of in-migrating workers and the sizes of their accompanying families would affect the predicted impacts on most public services.

After some peak employment periods, sharp drops in onsite employment might occur. These reductions could also reduce the number of indirect jobs in the region supporting Hanford activities. If these workers are unable to find employment in other industries, they could move out of the region, thereby reducing the overall regional population and decreasing the demand for housing and community services (Perteet, Thomas/Lane, and SCM 2001:3-4).

In the area of transportation, annual workforce estimates impact commuter traffic whether or not workers are new to the community, because they all use local roads to access the project site. Increased traffic from both higher employment and additional truck shipments would result in additional impacts on the local transportation system. The current roadway system has no additional capacity during the commute hours, so all workforce increases would impact the major commute routes. These impacts could include increased degradation of the roadways, increased congestion, and the need for increased maintenance to the roadways.

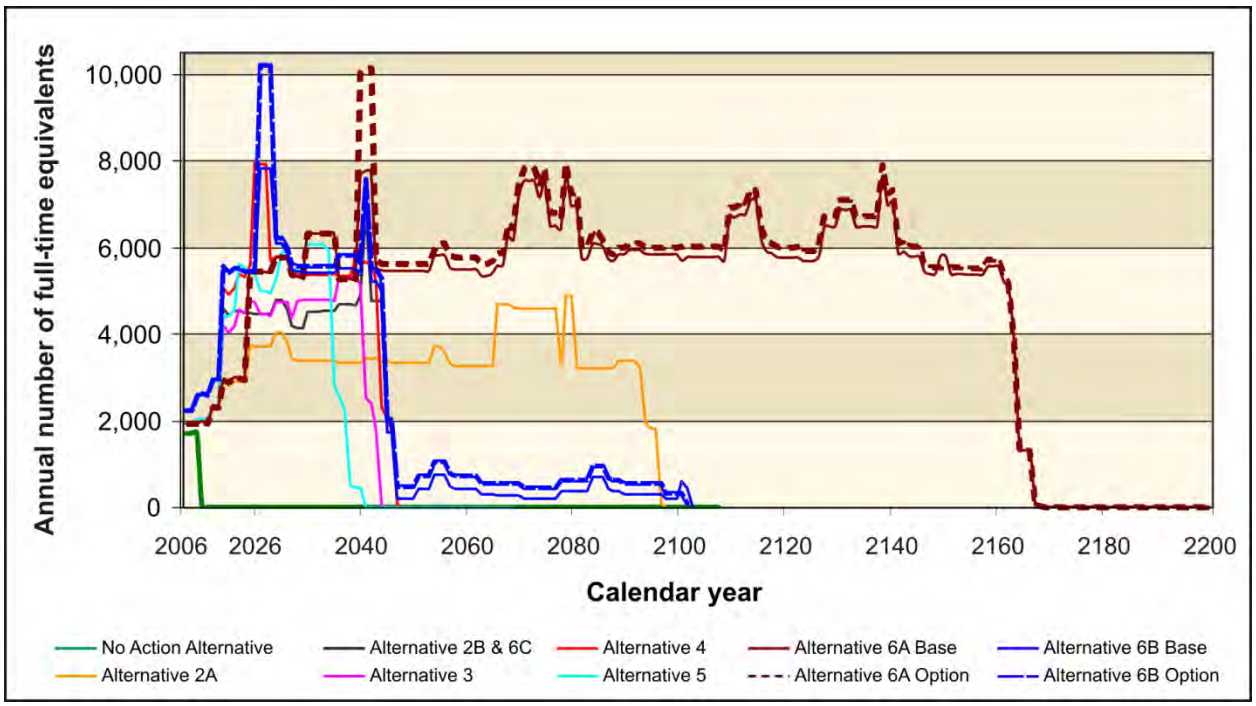


**Figure 4–16. Tank Closure Alternatives – Annual Workforce Estimates (2006–2200)**

#### 4.1.9.1 Alternative 1: No Action

Under Alternative 1: No Action, total onsite employment, as shown in Figure 4–16, would remain steady (about 1,730 FTEs) until 2008, then drop immediately to 15 FTEs, the number needed to provide administrative controls for 100 years through 2107. Over 50 percent of the workforce (906 FTEs) during the peak years would be performing construction activities (see Table 4–8) associated with the WTP. In addition to the direct employment associated with the No Action Alternative, approximately 1,300 indirect positions likely to be created would have a secondary impact on the region in the peak years.

**Table 4–8. Tank Closure Alternative 1 Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2006–2008 | 1,070 |
| Operations | 2006–2008 | 651 |
| Deactivation | 2008–2107 | 15 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

##### 4.1.9.1.1 Regional Economic Characteristics

The No Action Alternative would have an immediate short-term effect on the regional economy. The 1,730 jobs would be approximately 1.4 percent of the projected labor force in the region of influence (ROI) (120,000 jobs) in 2008. For comparison, the approximately 10,000 people employed at Hanford in 2006 represented about 10 percent of overall employment within the Hanford ROI. The reduction in onsite employment and expenditures in 2009 would correspondingly reduce the number of indirect jobs in the region supporting Hanford activities. If these workers were unable to find employment in other

industries, they could move out of the region, thereby reducing the overall regional population and decreasing the demand for housing and community services.

#### 4.1.9.1.2 Demographic Characteristics

The in-migration of workers to support construction of the WTP would increase rapidly during the early years of the project. The differential between the WTP impact and the baseline regional labor force projection would then get smaller, approaching zero with time. Therefore, any changes in the demographic characteristics of the Tri-Cities area and the Hanford ROI would be largely reversed by implementation of Alternative 1.

#### 4.1.9.1.3 Housing and Community Services

As construction on the WTP ceases in 2008, any demand for new housing and community services would also cease. Reduced demand for housing by construction and operations workers would likely reduce the cost and increase availability of houses and rental units.

#### 4.1.9.1.4 Local Transportation

The traffic associated with the WTP, including both commuter and local truck traffic, would impact the local transportation system. Currently, there is no excess capacity on the major Hanford commute routes during the peak commute hours. Under Washington State law, Benton and Franklin Counties and the cities of Kennewick, Pasco, Richland, and West Richland must adopt commute trip reduction (CTR) program plans for major employers. The intent of the CTR program plans is to reduce commutes by workers from their homes to major work sites during the peak period of 6:00 A.M. to 9:00 A.M. on weekdays. Construction work sites are generally excluded under the law, provided the construction duration is less than 2 years. The ongoing construction of the Hanford WTP would likely not be exempt. As construction on the WTP ceases, traffic levels on roads in the region are also expected to be substantially reduced.

##### 4.1.9.1.4.1 Commuter Traffic

Before termination of construction activities in 2008, about 1,700 employees would be commuting to the 200 Areas for activities associated with tank farm operations and WTP construction. Assuming an average of 1.25 persons per passenger vehicle, this could represent about 1,400 passenger vehicles per day commuting to the site. From 2009 through 2107, administrative controls would require about 15 FTEs. Therefore, commuter traffic to the 200-East and 200-West Areas at that time would decrease substantially compared with recent levels.

##### 4.1.9.1.4.2 Truck Traffic

The heaviest period of offsite truck activity would occur from 2006 through 2008 during construction of the WTP, prior to termination of activities in 2008. Around 1,000 trips per year (4 trips per day) would be required to deliver materials to the site. Onsite truck trips would also occur during construction of the WTP (over 20 trips per day). During the 100-year administrative control period, it is projected that there would be about 1 trip per year by offsite trucks delivering diesel fuel and gasoline to the site.

### 4.1.9.2 Alternative 2A: Existing WTP Vitrification; No Closure

Under Alternative 2A, near-term employment would increase to, and then remain steady at or above, 3,000 FTEs through 2064. The total onsite workforce would increase by nearly 50 percent starting in 2065 to a peak of 4,920 FTEs in 2078 and 2079 (see Figure 4–16). From 2080 through 2092, the total onsite workforce would again be steady at or above 3,000 FTEs. The workforce employment for the

remaining years would steadily decrease until 2097, when only 15 FTEs would be required to cover administrative controls. The existence of these direct jobs is expected to result in the creation of another 3,700 indirect positions in the ROI during the peak years.

Under this alternative, the employment period would be dominated by construction and operations activities at the WTP. Workers constructing the WTP (2006 through 2017) and its replacement facility (2065 through 2076) would dominate the construction workforce of up to 1,880 FTEs. From 2053 through 2076, over half of the roughly 2,940 FTE operations workers would be employed at the WTP (see Figure 4–17). Workers deactivating the WTP and its replacement facility would dominate the deactivation workforce, which is projected to reach approximately 1,700 FTEs from 2078 through 2079 and again from 2094 through 2095 (see Table 4–9).

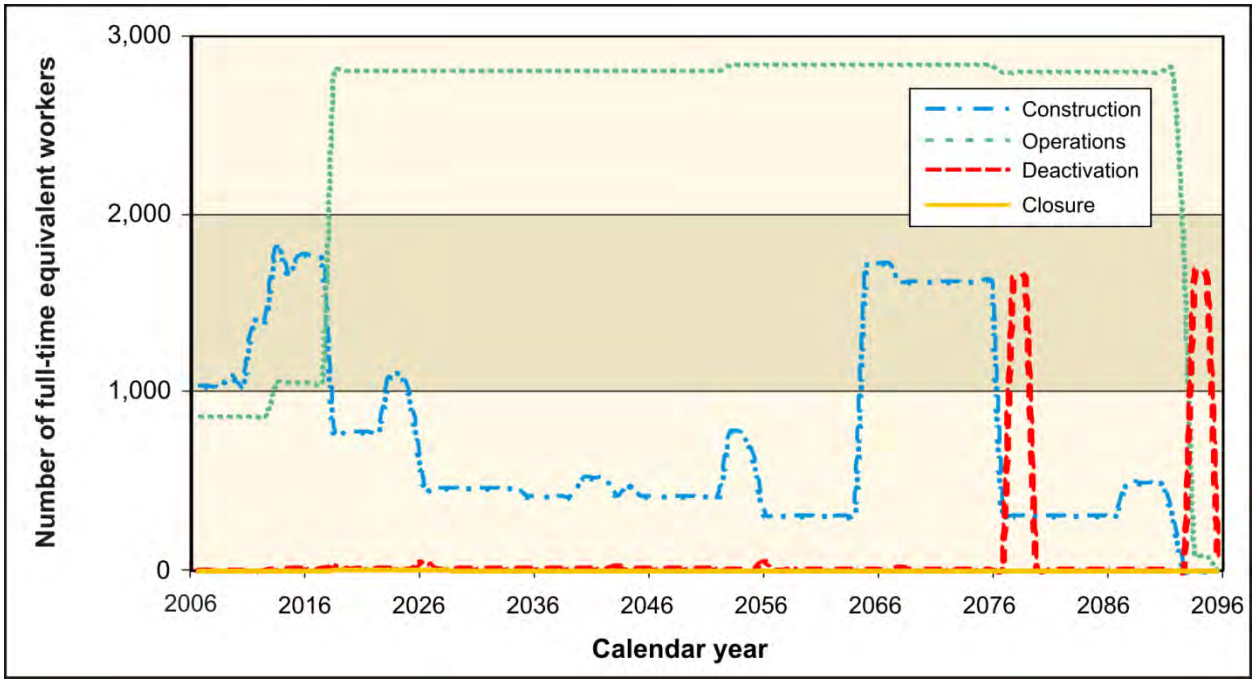


**Figure 4–17. Tank Closure Alternative 2A Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2096)**

**Table 4–9. Tank Closure Alternative 2A Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2013–2017<br>2065–2076 | 1,720–1,880<br>1,670–1,780 |
| Operations | 2018–2092 | 2,890–2,940 |
| Deactivation | 2078–2079<br>2094–2095 | 1,710<br>1,720–1,740 |
| Closure | 2018–2028 | 9 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

#### 4.1.9.2.1 Regional Economic Characteristics

The peak workforce estimate of 4,920 jobs under Alternative 2A would occur in 2078 and 2079. This estimate is approximately 1.8 percent of the projected labor force in the ROI (267,000) in 2078, as compared with 10 percent in 2006. Nevertheless, implementing Alternative 2A could alter the economic characteristics of the region by increasing demands for goods and services in the Tri-Cities area over an extended period of time (i.e., approximately 90 years) due to increases in expenditures, income, and employment (direct and indirect) at Hanford.

#### 4.1.9.2.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the continuing demand for operations workers would compel drawing from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region.

#### 4.1.9.2.3 Housing and Community Services

Implementation of this alternative would increase the demand for housing and would impact schools and other community services within the Hanford ROI. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollments are expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.2.4 Local Transportation

Implementation of this alternative is expected to have an impact on the local transportation system, especially during the commute periods. It is expected that all new commute period trips would impact the regionally established level of service (LOS), reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

##### 4.1.9.2.4.1 Commuter Traffic

Under Alternative 2A, the near-term peak years of construction and operations activities would begin in 2013. The projected increase in commuter traffic to the site would be primarily due to construction and operations at the WTP and other facilities. These activities could ultimately increase the number of site personnel to almost 4,920 FTEs annually in 2078 and 2079. Assuming an average of 1.25 persons per passenger vehicle, this could represent up to 4,000 passenger vehicles per day commuting to the site during peak years.

##### 4.1.9.2.4.2 Truck Traffic

The number of annual offsite truck trips is projected to average over 2,500 trips per year (10 trips per day) from 2011 through 2095. The peak years for offsite truck traffic under Alternative 2A would be from 2065 through 2079, averaging around 3,400 trips per year. During that time, construction of the replacement WTP would account for the major portion of offsite truck traffic—3,920 peak truck trips (15 trips per day) in 2078 and 2079.

Onsite truck traffic supporting similar activities would peak from 2011 through 2017, requiring an average of about 15,300 truck trips per year (59 trips per day) to move concrete aggregate materials and other borrow materials on site. Onsite truck traffic would peak again from 2065 through 2076, with an average of about 12,600 truck trips per year (48 trips per day) for construction of the replacement WTP.

#### 4.1.9.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

Under Alternative 2B, the total workforce requirements would increase until 2013, when it would remain steady at or above 4,000 FTEs (see Figure 4–16). Peak employment would occur in 2040, when onsite employment would reach 6,860 FTEs. As a result of this increase in direct employment, an additional 5,130 indirect jobs are projected in this peak year. Direct employment is then projected to significantly decrease until 2045, when deactivation workers would make up the bulk (74 percent) of the workforce requirements. The workforce requirements would then decline until 2047, when 3 FTEs would be needed for postclosure care of the site.

As shown in Figure 4–18, the total workforce projection would be dominated (over 70 percent) first by construction workers from 2013 through 2017, followed by operations workers through 2043. As under Alternative 2A, construction and operations workers for the WTP would be the major workforce during this time period. Of the 5,540 FTE peak operations workforce (see Table 4–10), 70 percent would be employed at the WTP and in its supplemental operations. In addition, deactivation of the WTP in 2044 and 2045 would dominate the workforce requirements, with a projection of over 1,500 FTEs. From 2039 through 2045, construction of the modified RCRA Subtitle C barrier over the SSTs would dominate the closure workforce.

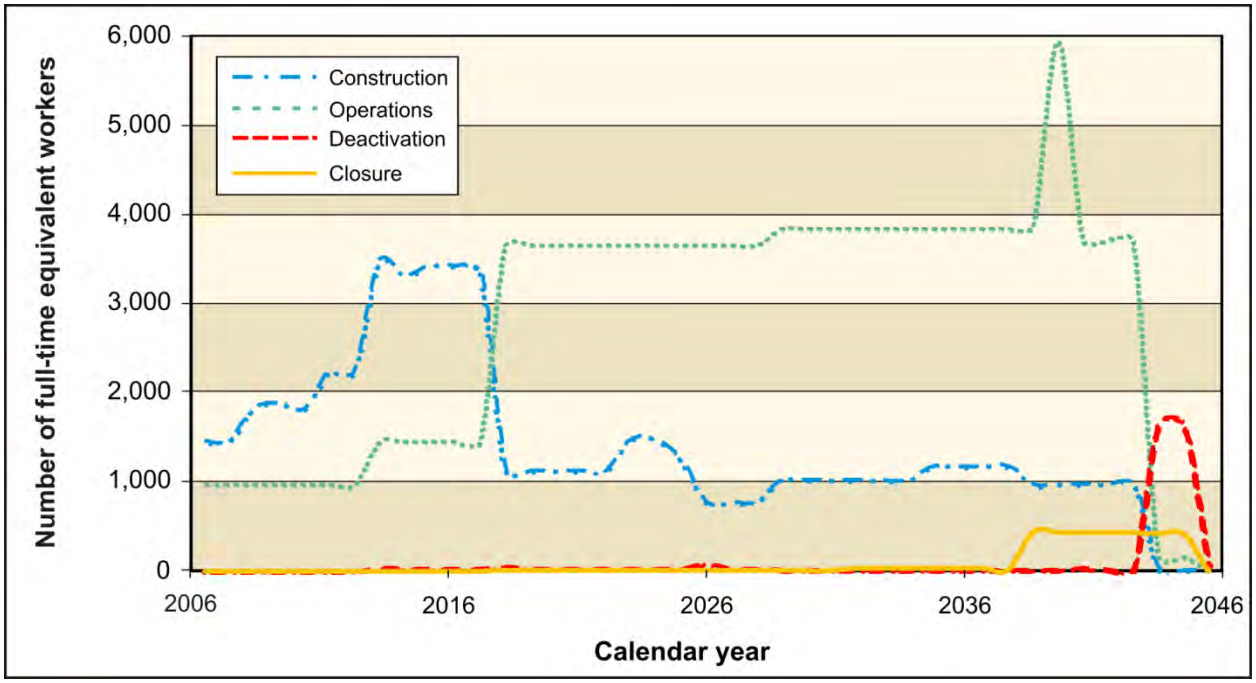


**Figure 4–18. Tank Closure Alternative 2B Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2046)**

**Table 4–10. Tank Closure Alternative 2B Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2013–2017 | 3,080–3,240 |
| Operations | 2018–2043 | 3,400–5,540 |
| Deactivation | 2044–2045 | 1,530–1,540 |
| Closure | 2039–2045 | 394–412 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

#### 4.1.9.3.1 Regional Economic Characteristics

Under Alternative 2B, the near-term impact on economic conditions within the ROI would exceed those impacts under Alternative 2A. The peak workforce estimate of 6,860 FTEs in 2040 would occur much earlier than the peak under Alternative 2A of 4,920 FTEs in 2078–2079. This estimate would be approximately 3.6 percent of the projected labor force in the ROI (189,000) in 2040, compared with approximately 10 percent in 2006. Implementing Alternative 2B could temporarily (for 30 years) increase demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment (direct and indirect) at Hanford. The increase in demand would be followed by an abrupt decrease in expenditures, income, and employment.

#### 4.1.9.3.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the continuing demand for operations workers would compel drawing from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region. More workers would be required over a longer period of time under this alternative compared with Alternative 2A.

#### 4.1.9.3.3 Housing and Community Services

Implementation of this alternative would increase the demand for housing and would impact schools and other community services within the ROI, exceeding the demands of Alternative 2A. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollment is expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.3.4 Local Transportation

As under Alternative 2A, implementation of this alternative is expected to have an impact on the local transportation system, especially during the commute periods. It is expected that all new commute period trips would impact the regionally established LOS, reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

##### 4.1.9.3.4.1 Commuter Traffic

Under Alternative 2B, the peak years of construction and operations activities at the site would begin in 2013. The projected increase in commuter traffic to and from the site would be primarily due to activities from the expanded WTP. These and other activities would increase the number of site personnel to about 6,900 FTEs in 2040. Assuming an average of 1.25 persons per passenger vehicle, this could represent up to 5,500 commuter vehicles per day commuting to and from the site during the peak years.

#### 4.1.9.3.4.2 Truck Traffic

From 2006 through 2017, the number of annual offsite truck trips is projected to be small, ranging from 1,100 to 2,900 (4 to 11 trips per day). The heaviest period of offsite truck activity would occur from 2018 through 2043, mainly to support WTP operations. It is projected that an average of 6,820 truck trips per year (26 trips per day) would be needed for daily operations at the WTP and the tank-filling grout facility. At its peak in 2040, there would be an estimated 12,400 truck trips per year (48 trips per day).

Onsite trucking would increase during the construction period from 2011 through 2017. During that time, construction of the IHLW Shipping/Transfer Facility and IHLW Interim Storage Modules, the WTP, and WRFs would account for the major portion of onsite truck traffic—18,000 peak truck trips in 2013. Onsite truck traffic would average around 15,000 truck trips per year (58 trips per day) during this construction period. Onsite truck traffic would be the heaviest from 2039 through 2045, averaging around 53,800 truck trips per year (207 trips per day). This period of onsite truck activity would support closure activities under Alternative 2B. At its peak from 2039 through 2043, closure activities, led by construction of the modified RCRA Subtitle C landfill barrier, would require an estimated 56,500 truck trips per year (217 trips per day).

### 4.1.9.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Under Alternative 3A, total onsite employment would increase until 2013, when it would remain steady at or above 4,000 FTEs, peaking at 5,330 FTEs in 2035 (see Figure 4–16). This increase in direct employment would result in the creation of another approximately 4,000 indirect jobs in the ROI in the peak year. Employment is then projected to decrease substantially until 2042, when deactivation workers would make up the bulk (95 percent) of the employment requirements. The employment requirements would then decline until 2044, when three FTEs would be needed for postclosure care of the site.

Under this alternative, construction employment would almost triple by the time it peaks in 2016 at 3,040 FTEs (see Table 4–11). The operations workforce would increase until 2018, remaining above 3,000 FTEs from 2018 through 2039, as shown in Figure 4–19. Almost half of these workers (1,700 FTEs) would be employed at the WTP during this period. The workforce required for deactivation of the WTP would peak in 2041 at 1,860 FTEs. Closure workforce requirements would remain steady until 2035, when requirements would increase to approximately 400 FTEs for 7 years.

**Table 4–11. Tank Closure Alternative 3A Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2013<br>2016–2017 | 2,750<br>2,980–3,040 |
| Operations | 2018–2039 | 3,480–3,700 |
| Deactivation | 2041–2042 | 1,700–1,860 |
| Closure | 2035–2041 | 394–412 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

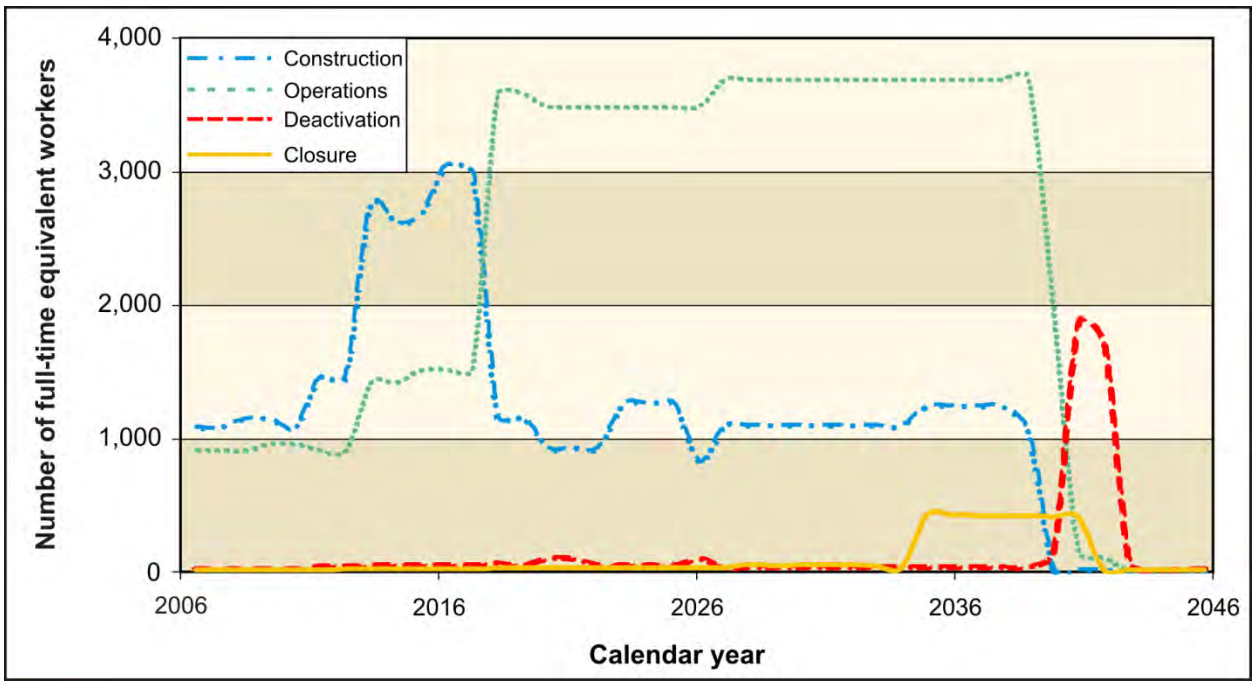


**Figure 4–19. Tank Closure Alternatives 3A, 3B, and 3C Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2046)**

#### 4.1.9.4.1 Regional Economic Characteristics

The peak workforce estimate of 5,330 FTEs under Alternative 3A would occur in 2035. This estimate represents approximately 3.0 percent of the projected labor force in the ROI (179,000 FTEs) in 2035. The near-term impacts on economic conditions could alter the economic characteristics of the region by temporarily (for 30 years) increasing demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment (direct and indirect) at Hanford. The increase in demand would be followed by an abrupt decrease in expenditures, income, and employment beginning in 2043.

#### 4.1.9.4.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the continuing demand for operations workers would compel drawing from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region.

#### 4.1.9.4.3 Housing and Community Services

Implementation of this alternative would increase the demand for housing and would impact schools and other community services within the Hanford ROI. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollment is expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.4.4 Local Transportation

Implementation of Alternative 3A is expected to have an impact on the local transportation system, especially during the commute periods. The local transportation system has additional capacity during noncommute periods, but has no additional capacity during the morning and afternoon peaks. It is

expected that all new commute period trips would impact the regionally established LOS, reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

#### 4.1.9.4.4.1 Commuter Traffic

Under Alternative 3A, the construction and operations activities at the site would remain steady from 2013 through 2039. The projected increase in commuter traffic to and from the site during this period would be primarily due to construction of the WTP, the WRF, and retrieval systems. These activities would increase the number of site personnel to over 5,300 FTEs in 2035. Assuming an average of 1.25 persons per passenger vehicle, the increased traffic could represent a peak of about 4,300 commuter vehicles per day traveling to and from the site.

#### 4.1.9.4.4.2 Truck Traffic

From 2006 through 2017, the number of annual offsite truck trips is projected to be small, ranging from 1,100 to 3,000 trips per year (4 to 12 trips per day). The heaviest period of offsite truck activity would occur from 2018 through 2039 during operations of the WTP, Bulk Vitrification Facilities, and grout facilities. It is projected that an average of 5,200 truck trips per year (20 trips per day) would be required to ship in materials during that period. At its peak in 2035 and 2036, there would be an estimated 6,300 truck trips per year (24 trips per day).

Onsite trucking would be at its highest from 2035 through 2041 due to the movement of concrete aggregate materials and other borrow materials that support closure activities, the process of filling the SSTs with grout, construction of a modified RCRA Subtitle C barrier, and the transport of resources needed for daily operations at the Bulk Vitrification Facilities. Onsite truck traffic would average around 55,400 truck trips per year (213 per day) during this period.

### 4.1.9.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

The socioeconomic impacts of implementing Alternative 3B would be virtually identical to those impacts of implementing Alternative 3A. This alternative uses the cast stone process in place of the bulk vitrification process as a supplemental treatment. All activities related to the cast stone process would be carried out in the same years as the bulk vitrification process and would be differentiated only by the workforce requirements. In addition to the direct employment associated with this alternative, approximately 3,900 indirect positions would likely be created in the peak year.

Figure 4–19 presents the workforce increases and decreases associated with Alternative 3B. Construction, operations, and deactivation of the Cast Stone Facilities in the 200-East and 200-West Areas would have smaller employment requirements than the Bulk Vitrification Facilities under Alternative 3A, resulting in slightly lower peak FTE employment projections (see Table 4–12).

The total workforce estimate peaks in 2035 (5,260 FTEs) under Alternative 3B. As this total workforce estimate is about 70 FTEs less than under Alternative 3A, the impacts on the economic and demographic characteristics and housing and community services under Alternative 3B would be similar to those impacts described under Alternative 3A.

**Table 4–12. Tank Closure Alternative 3B Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2013<br>2016–2017 | 2,750<br>2,870–2,940 |
| Operations | 2018–2039 | 3,400–3,630 |
| Deactivation | 2041–2042 | 1,700–1,820 |
| Closure | 2035–2041 | 394–412 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

#### 4.1.9.5.1 Local Transportation

Implementation of Alternative 3B is expected to have an impact on the local transportation system similar to the impact of Alternative 3A, especially during the commute periods.

##### 4.1.9.5.1.1 Commuter Traffic

Under Alternative 3B, the construction and operations activities at the site would remain steady from 2013 through 2039, similar to Alternative 3A. Assuming an average of 1.25 persons per passenger vehicle, the increased traffic could represent a peak of about 4,200 commuter vehicles per day traveling to and from the site.

##### 4.1.9.5.1.2 Truck Traffic

From 2006 through 2017, the number of annual offsite truck trips is projected to be small, ranging from 1,100 to 2,900 (4 to 11 trips per day). Similar to Alternative 3A, the heaviest period of offsite truck activity would occur from 2018 through 2039 during operations of the WTP and Cast Stone Facilities. It is projected that an average of 8,400 truck trips per year (32 trips per day) would be required to ship in materials during this period. At its peak in 2035 and 2036, there would be an estimated 9,500 truck trips per year (36 trips per day).

Similar to Alternative 3A, onsite trucking would be at its highest from 2035 through 2041, averaging around 54,000 truck trips per year (208 trips per day) during this period. This period of onsite truck activity would support closure activities under Alternative 3B.

### 4.1.9.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

The socioeconomic impacts of implementing Alternative 3C would be virtually identical to those impacts of implementing Alternative 3A. This alternative uses the steam reforming process in place of the bulk vitrification process as a supplemental treatment. All activities related to the steam reforming process would be carried out in the same years as the bulk vitrification process and would be differentiated only by the workforce requirements.

Figure 4–19 presents the workforce increases and decreases associated with Alternative 3C. Construction, operation, and deactivation of the Steam Reforming Facilities in the 200-East and 200-West Areas would have larger employment requirements than the Bulk Vitrification Facilities under Alternative 3A, resulting in higher peak FTE employment projections (see Table 4–13).

**Table 4–13. Tank Closure Alternative 3C Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2013<br>2016–2017 | 2,750<br>3,360–3,420 |
| Operations | 2018–2039 | 3,600–3,830 |
| Deactivation | 2041–2042 | 1,700–1,930 |
| Closure | 2035–2041 | 394–412 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

The total workforce estimate peaks in 2035 (5,460 FTEs) under Alternative 3C. As this total workforce estimate is only 130 FTEs more than under Alternative 3A, the impacts on the economic and demographic characteristics and housing and community services under Alternative 3C would be similar to those impacts described under Alternative 3A. In addition to the direct employment associated with this alternative, approximately 4,100 indirect jobs would likely be created in the peak year.

#### 4.1.9.6.1 Local Transportation

Implementation of Alternative 3C is expected to have an impact on the local transportation system similar to the impact under Alternative 3A, especially during the commute periods.

##### 4.1.9.6.1.1 Commuter Traffic

Under Alternative 3C, construction and operations activities at the site would remain steady from 2013 through 2039, similar to Alternative 3A. Assuming an average of 1.25 persons per passenger vehicle, the increased traffic could represent a peak of over 4,300 commuter vehicles per day traveling to and from the site.

##### 4.1.9.6.1.2 Truck Traffic

From 2006 through 2017, the number of annual offsite truck trips is projected to be small, ranging from 1,100 to 3,200 (4 to 12 trips per day). Similar to Alternative 3A, truck traffic would then increase until the heaviest period of offsite truck activity (2018 through 2039), which would occur during operations of the WTP and Steam Reforming Facilities. It is projected that an average of 36,000 truck trips per year (138 trips per day) would be required to ship in materials during that time. At its peak from 2035 through 2036, there would be an estimated 37,000 truck trips per year (142 trips per day).

Similar to Alternative 3A, onsite trucking would be at its highest from 2035 through 2041, averaging around 54,000 truck trips per year (208 trips per day) during this period. This period of onsite truck activity would support closure activities under Alternative 3C.

### 4.1.9.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

Under Alternative 4, total onsite employment would steadily increase, more than doubling by 2013 and reaching a peak of 8,000 FTEs in 2019 (see Figure 4–16). Total employment projections would then remain steady at or above 5,000 FTEs through 2042. This would be followed by a sharp decrease in the workforce until 2047, when only 3 FTEs would be needed for postclosure care of the site. The existence of these direct jobs is expected to result in the creation of almost 6,000 indirect jobs in the ROI in the peak year.

Under this alternative, construction employment would more than triple by the time it reaches its peak of 3,380 FTEs in 2016 (see Table 4–14 and Figure 4–20), shortly thereafter dropping and remaining steady at over 1,000 FTEs until 2042. The operations workforce would increase until 2018, remaining around 4,000 FTEs until 2042. The workforce required for deactivation of the WTP (1,700 FTEs) would not occur until 2044 and 2045. The workforce required to construct the PPF, which supports tank farm clean closure, would make up the bulk (2,390 FTEs) of the peak closure workforce requirements in 2019.

**Table 4–14. Tank Closure Alternative 4 Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2013<br>2016–2017 | 3,150<br>3,310–3,380 |
| Operations | 2018–2042 | 3,700–4,020 |
| Deactivation | 2044–2045 | 1,700–1,710 |
| Closure | 2019–2021 | 2,410 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

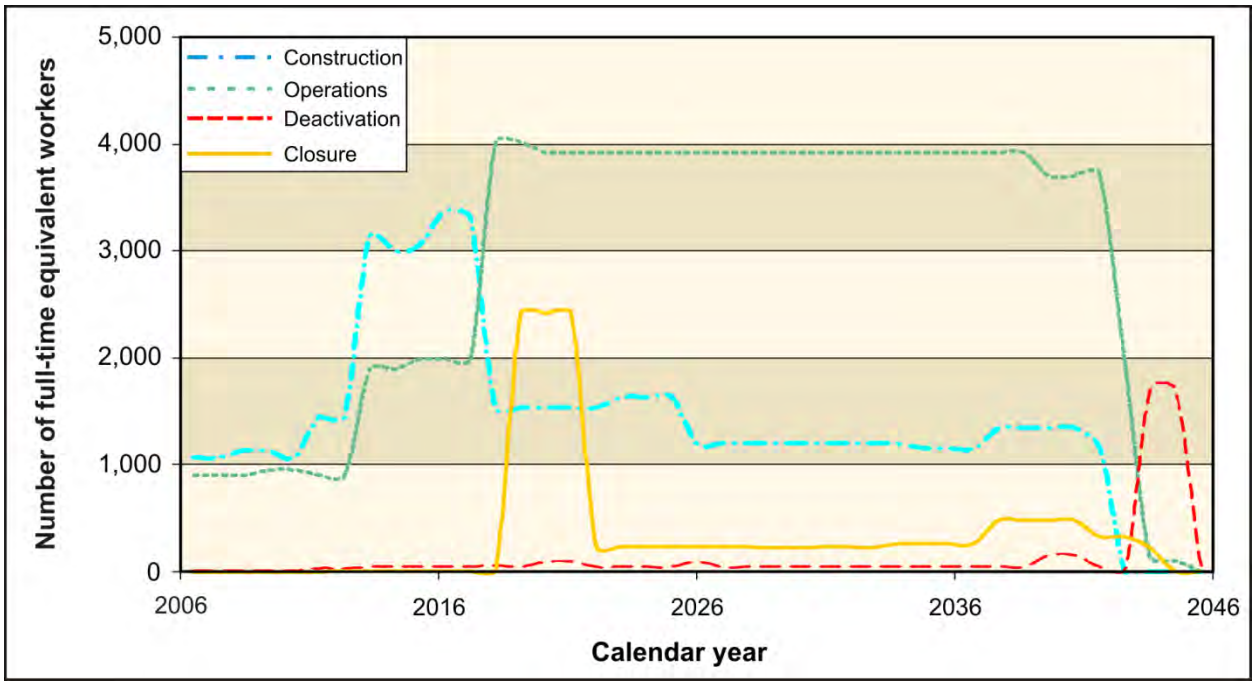


**Figure 4–20. Tank Closure Alternative 4 Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2046)**

#### 4.1.9.7.1 Regional Economic Characteristics

The near-term impacts on economic conditions within the ROI under Alternative 4 would exceed those of many of the other alternatives. The peak workforce estimate of 8,000 FTEs would be mostly operations workers (4,020 FTEs). This peak workforce would be approximately 5.5 percent of the projected labor force in the ROI (146,000 FTEs) in 2019 compared with approximately 10 percent in 2006. Implementing Alternative 4 would alter the economic characteristics of the region by temporarily (for 30 years) increasing demands for goods and services in the Tri-Cities area due to increases in

expenditures, income, and employment (direct and indirect) at Hanford. The increase in demand would be followed by an abrupt decrease in expenditures, income, and employment beginning in 2046.

#### 4.1.9.7.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the continuing demand for operations workers would draw from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region.

#### 4.1.9.7.3 Housing and Community Services

Implementation of this alternative would increase the demand for housing and would impact schools and other community services within the ROI. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollment is expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.7.4 Local Transportation

Implementation of this alternative is expected to have an impact on the local transportation system, especially during the commute periods. The local transportation system has additional capacity during noncommute periods, but has no additional capacity during the morning and afternoon peaks. It is expected that all new commute period trips would impact the regionally established LOS, reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

##### 4.1.9.7.4.1 Commuter Traffic

Under Alternative 4, the peak years of construction and operations activities at the site would occur from 2013 through 2042. The projected increase in commuter traffic to and from the site would be primarily due to construction and subsequent operations of the WTP, WRF, and retrieval systems. These and other activities would increase the number of site personnel to almost 8,000 FTEs in 2019. Assuming an average of 1.25 persons per passenger vehicle, this could represent up to 6,400 commuter vehicles per day traveling to and from the site during the peak years.

##### 4.1.9.7.4.2 Truck Traffic

From 2006 through 2017, an average of approximately 2,200 offsite truck trips per year (9 trips per day) is projected to ship in construction materials primarily for construction of the WTP and the IHLW Shipping/Transfer Facility. The heaviest period of offsite truck activity would occur from 2018 through 2043 during construction of the WRFs; operations of the WTP, Bulk Vitrification Facility, and Cast Stone Facility; and various closure activities. It is projected that an average of 8,800 truck trips per year (34 trips per day) would be required to ship in construction materials and equipment for the removal of tanks, ancillary equipment, and soils in support of clean closure of the BX and SX tank farms. At its peak in 2043, there would be an estimated 16,600 truck trips per year (64 trips per day).

Onsite trucking would be at its highest from 2038 through 2044, averaging 40,000 truck trips per year (154 trips per day) during this period. This period of onsite truck activity would support closure activities under Alternative 4, including clean closure of the BX and SX tank farms and construction of the first four lobes of the modified RCRA Subtitle C barrier for landfill closure of the remaining tank farms in the SST system.

#### 4.1.9.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

The total onsite employment under Alternative 5 would steadily increase until 2013, when onsite employment would more than double (see Figure 4–16). Total employment requirements would then remain above 4,000 FTEs through 2033, ranging from 4,330 to 6,100 FTEs. The total workforce requirements during that time period would include several substantial increases. In 2016, the total employment requirements would increase by 23 percent over the previous year; in 2024, requirements would increase by 12 percent; and in 2029, requirements would increase by 11 percent. In 2034, a sharp decrease in total employment would begin, falling steadily until 2040, when only a handful of workers (3 FTEs) would be needed for postclosure care of the site. In addition to the direct employment associated with this alternative, approximately 4,600 indirect positions would likely be created as a secondary impact on the ROI in the peak years.

Under this alternative, the construction workforce would almost quadruple by the time it reaches its peak of 4,000 FTEs in 2016 (see Table 4–15). From 2023 through 2033, construction workforce requirements would remain above 1,000 FTEs, dropping to 0 in 2035. The operations workforce requirements would increase from 2018 through 2033 to 4,150 FTEs. Operations activities at the WTP related to retrieval systems and other activities would require a shorter time period than under the other alternatives. The deactivation workforce requirements would peak in 2035 (2,040 FTEs); the majority of the deactivation workforce (1,700 FTEs) would be required for deactivating the WTP. Closure workforce requirements would remain small, ranging from 0 to 21 FTEs until 2029, when requirements would increase to over 400 FTEs for a period of 11 years (see Figure 4–21).

**Table 4–15. Tank Closure Alternative 5 Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2016–2017 | 3,940–4,000 |
| Operations | 2018–2033 | 3,850–4,150 |
| Deactivation | 2035 | 2,040 |
| Closure | 2029–2039 | 418–438 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

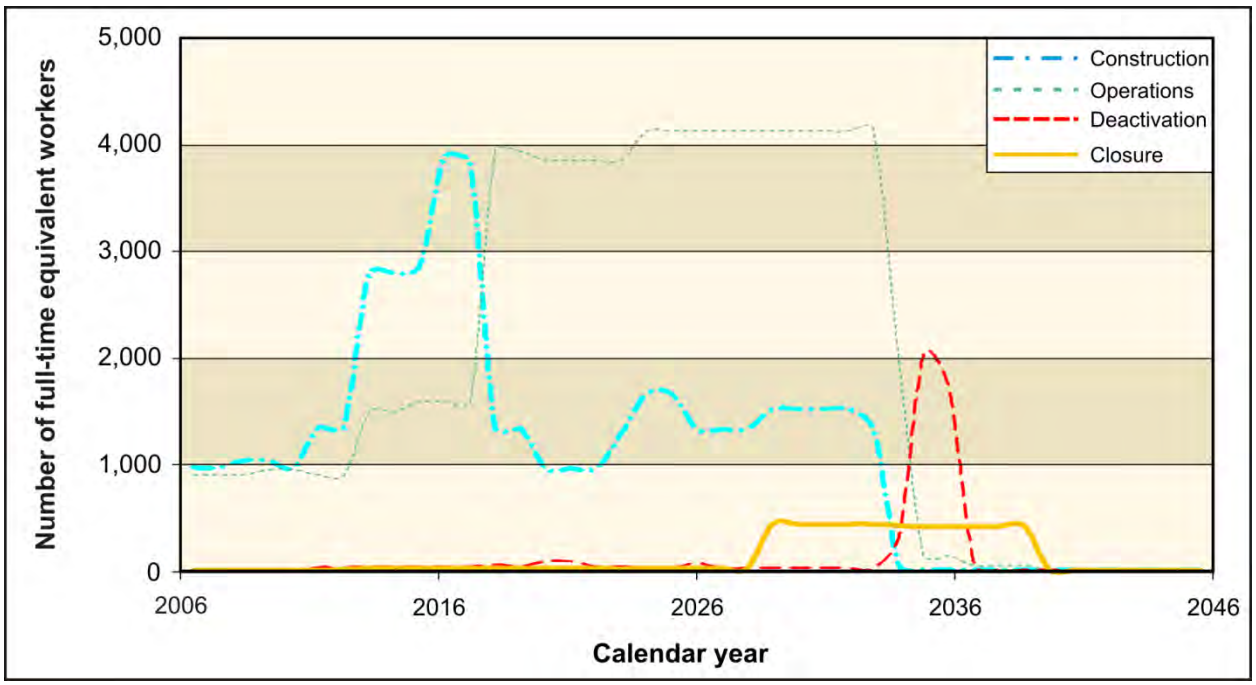


**Figure 4–21. Tank Closure Alternative 5 Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2046)**

#### 4.1.9.8.1 Regional Economic Characteristics

The peak workforce estimate of 6,100 FTEs (from 2029 through 2032) represents approximately 3.7 percent of the projected labor force in the ROI (166,000) in 2029. Nevertheless, implementing Alternative 5 would alter the economic characteristics of the region by temporarily (for 20 years) increasing demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment (direct and indirect) at Hanford. The increase in demand would be followed by an abrupt decrease in expenditures, income, and employment.

#### 4.1.9.8.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the demand for operations workers would compel drawing from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region.

#### 4.1.9.8.3 Housing and Community Services

Implementation of this alternative would increase the demand for housing and would impact schools and other community services within the Hanford ROI. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollment is expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.8.4 Local Transportation

Implementation of this alternative is expected to have an impact on the local transportation system, especially during the commute periods. The local transportation system has additional capacity during noncommute periods, but has no additional capacity during the morning and afternoon peaks. It is expected that all new commute period trips would impact the regionally established LOS, reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

#### 4.1.9.8.4.1 Commuter Traffic

Under Alternative 5, the peak years of construction and operations activity at the site would occur from 2016 through 2033. The projected increase in commuter traffic to and from the site would be primarily due to construction of the WTP, WRF, and retrieval systems. These activities would increase the number of site personnel to over 6,000 FTEs from 2029 through 2032. Assuming an average of 1.25 persons per passenger vehicle, this personnel increase could represent about 4,900 commuter vehicles per day traveling to and from the site.

#### 4.1.9.8.4.2 Truck Traffic

From 2006 through 2017, an average of 2,300 offsite truck trips per year (9 trips per day) is projected to ship construction materials primarily for construction of the WTP, the IHLW Shipping/Transfer Facility, and the TRU Waste Interim Storage Facility. The heaviest period of offsite truck activity would occur from 2018 through 2033. It is projected that an average of 13,900 truck trips per year (53 trips per day) would be required during construction of the WTP and the new DSTs; operations of the WTP, Sulfate Removal Facility, Bulk Vitrification Facility, and Cast Stone Facility; and various closure activities. At its peak from 2029 through 2032, there would be an estimated 14,700 truck trips per year (57 trips per day).

Onsite trucking would be at its highest from 2029 through 2039 and would average around 54,500 truck trips per year (210 trips per day). This period of onsite truck activity under Alternative 5 would support closure activities led by construction of the Hanford landfill barrier and would peak from 2029 through 2032 at an estimated 60,800 truck trips per year (234 trips per day).

### 4.1.9.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

Alternative 6A, Base and Option Cases, would differ only in the intensity of some closure activities. Under both alternatives, near-term employment would steadily increase for both cases until 2018, when total employment requirements would more than double to 5,470 FTEs (see Figure 4–16). The total onsite workforce would remain at or above 5,000 FTEs until 2163. During this time period, in both cases there would be a large number of substantial increases and subsequent decreases in total onsite workforce requirements. These large spikes in total workforce requirements would potentially occur in 2029–2034, 2039–2041, 2069–2074, 2078, 2109–2114, and 2138. Under Alternative 6A, Base Case, the peak of 7,790 FTEs would occur in 2041. Alternative 6A, Option Case, would have a peak in 2041 with a high of 10,200 FTEs. Beginning in 2163, there would be a sharp decrease (over 60 percent) in total employment, through 2168, when only a handful of workers would be needed for postclosure care of the site. The existence of these direct jobs is expected to result in the creation of up to 7,600 additional indirect jobs under the Option Case in the peak years.

Under this alternative, more than 4,600 FTE operations workers would make up the bulk of the total onsite employment requirements from 2018 through 2162 (see Figure 4–22). Almost half of these operations workers (2,170 FTEs) would be employed at the WTP. In both cases, the construction workforce would experience 10 spikes (short-term annual increases and subsequent decreases in employment) involving more than a 15 percent change in workforce requirements. The largest of these spikes would peak in 2015–2016, 2029–2034, 2070–2072, 2113–2114, and 2130–2132 (see Figure 4–22). The bulk of the deactivation workforce requirements would occur during the deactivation of the WTP (1,210 FTEs) and its replacement facilities over the periods 2078–2080, 2138–2140, and 2164–2166. The closure workforce would remain under 200 FTEs under Alternative 6A, Base Case, except for the periods 2039–2041 and 2149–2150 (see Table 4–16). Under Alternative 6A, Option Case, the closure workforce requirements after the 2039–2041 peak would more than double those under Alternative 6A, Base Case, ranging from 193 to 503 FTEs.

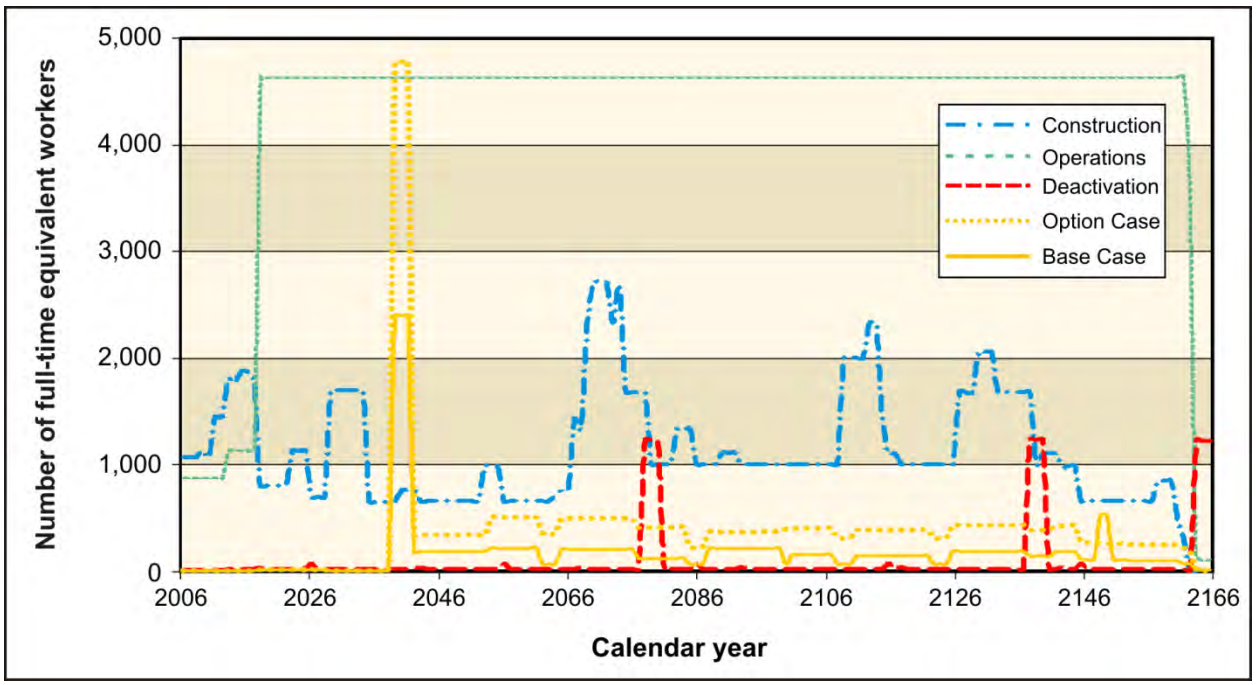


**Figure 4–22. Tank Closure Alternative 6A, Base/Option Case, Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2166)**

**Table 4–16. Tank Closure Alternative 6A, Base/Option Case, Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Base Case Workforce Peak or Peak Range (FTEs) | Option Case Workforce Peak or Peak Range (FTEs) |
|---|---|---|---|
| Construction | 2013–2017<br>2029–2034<br>2069–2074<br>2113–2114<br>2130–2132 | 1,770–1,870<br>1,700<br>2,330–2,710<br>2,330<br>2,060 | Same |
| Operations | 2018–2162 | 4,640–4,660 | Same |
| Deactivation | 2078–2080<br>2138–2140<br>2164–2166 | 1,230<br>1,230<br>1,220–1,230 | Same |
| Closure | 2039–2041<br>2149–2150 | 2,390<br>515 | 4,780<br>N/A |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent; N/A=not applicable.
**Source:** Appendix I; SAIC 2010a.

#### 4.1.9.9.1 Regional Economic Characteristics

##### 4.1.9.9.1.1 Base Case

Implementing Alternative 6A, Base Case, would alter the economic characteristics of the region by increasing demands for goods and services in the Tri-Cities area over an extended period of time (i.e., approximately 150 years) due to increases in expenditures, income, and employment (direct and indirect) at Hanford. According to estimates, the peak workforce of up to 7,790 FTEs would occur in 2041. This peak represents approximately 4.0 percent of the projected labor force in the ROI (191,000) in 2041. The peaks would be followed by abrupt decreases in expenditures, income, and employment.

#### 4.1.9.9.1.2 Option Case

The socioeconomic impacts of implementing the Option Case would be higher than those of implementing the Base Case. The number of closure workers under the Option Case is double that under the Base Case. The peak workforce estimate in 2041 (10,200 FTEs) represents 5.3 percent of the projected labor force in the ROI (191,000) in 2041.

#### 4.1.9.9.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the continuing demand for operations workers would compel drawing from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region. The impacts on the demographic characteristics of the ROI would be virtually the same for the Base and Option Cases, except during the peak year (2041). The increased number of closure workers under the Option Case represents a 3 percent increase in the total number of workers over that of the Base Case.

#### 4.1.9.9.3 Housing and Community Services

Implementation of this alternative for both the Base and Option Cases would increase the demand for housing and would impact schools and other community services within the ROI. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollment is expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.9.4 Local Transportation

Implementation of Alternative 6A for both the Base and Option Cases is expected to have an impact on the local transportation system, especially during the commute periods. The local transportation system has additional capacity during noncommute periods, but has no additional capacity during the morning and afternoon peaks. It is expected that all new commute period trips would impact the regionally established LOS, reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

#### 4.1.9.9.4.1 Commuter Traffic

Under Alternative 6A for both the Base and Option Cases, the near-term peak years of activity at the site would occur from 2039 through 2041. The projected increase in commuter traffic to and from the site would be primarily due to the operation of the WTP and Interim Storage Facility, as well as construction of the PPF. These activities would increase the number of site personnel to over 10,200 FTEs in 2041 under Alternative 6A, Option Case. Assuming an average of 1.25 persons per passenger vehicle, this personnel increase could represent over 8,100 commuter vehicles per day traveling to and from the site. Under Alternative 6A, Base Case, over 6,200 commuter vehicles could travel to and from the site each day.

#### 4.1.9.9.4.2 Truck Traffic

Under both the Base and Option Cases, an average of 1,600 offsite truck trips per year (6 trips per day) is projected from 2006 through 2017 to ship in construction materials, primarily for construction projects. The heaviest period of offsite truck activity would occur during periods of IHLW Interim Storage Module construction, WTP operations and deactivation, and closure activities. From 2018 through 2163, it is projected that an average of 8,000 (under Alternative 6A, Base Case) and 9,800 (under Alternative 6A, Option Case) truck trips per year (31 and 38 trips per day, respectively) would be required to ship in

materials to support facility operations and tank farm clean closure activities. Under Alternative 6A, Base Case, the peak would occur in 2138, with a projected 12,700 truck trips per year (49 trips per day). Under Alternative 6A, Option Case, the peak would occur in 2054 and 2055, with an estimated 17,500 truck trips per year (67 trips per day).

Onsite trucking under Alternative 6A, Base Case, would be at its highest from 2149 through 2150 due to construction of the modified RCRA Subtitle C barrier for landfill closure of the remaining tank farms in the SST system. At its peak, there would be an estimated 60,800 truck trips per year (234 trips per day). Under Alternative 6A, Option Case, the peak would occur in 2074, with up to 59,500 onsite truck trips per year (229 trips per day). These periods of onsite truck activity would support IHLW Interim Storage Modules and closure activities under Alternative 6A.

#### 4.1.9.10 Alternative 6B: All Vitrification with Separations; Clean Closure

As with Alternative 6A, the impacts under Alternative 6B, Base and Option Cases, differ only in the intensity of some closure workforce employment projections (see Table 4–16). Under both alternatives, total employment would steadily increase, more than doubling by 2013. Under Alternative 6B, Base Case, the peak of 7,860 FTEs would be in 2021 and 2022. Projections for Alternative 6B, Option Case, show the highest total onsite workforce of all Tank Closure alternatives, reaching a peak of over 10,200 FTEs in 2021 and 2022. As a result of these increases in employment, up to 7,600 additional indirect jobs are projected for the peak years. Employment for both the Base and Option Cases would then decrease to remain steady at or above 5,000 FTEs until a short spike in 2040. The total onsite workforce would then sharply decrease until 2046. From 2046 until 2096, the total onsite workforce would range from 200 to 762 FTEs under Alternative 6B, Base Case, and from 454 to 1,052 FTEs under Alternative 6B, Option Case. Beginning in 2102 under Alternative 6B, Base Case, only 3 FTEs would be needed for postclosure care of the site.

Under Alternative 6B, construction workers would dominate the workforce, as they more than double by 2013 and remain above 3,500 FTEs until 2017 (see Figure 4–23). The largest contributor (1,190 FTEs) to the workforce at this time would be employment at the WTP. The construction workforce would then decrease until 2044, when only 4 FTEs would be required, except for two 3-year construction periods for the ETF replacements (2053–2055 and 2083–2085, as shown in Figure 4–23) when the construction workforce would briefly increase to 333 FTEs. Beginning in 2018, operations workers would make up the bulk of the workforce, remaining steady at 3,900 FTEs except for a spike up to 5,880 FTEs in 2040. The deactivation workforce would peak in 2044 (see Table 4–17), the majority (1,530 FTEs) committed to deactivating the WTP. After a spike from 2020 through 2022, the closure workforce would range from 59 to 468 FTEs under Alternative 6B, Base Case, and from 189 to 586 FTEs under Alternative 6B, Option Case.

The socioeconomic impacts of implementing the Base and Option Cases of this alternative would be similar. All construction, operations, and deactivation activities would occur during the same time periods and involve the identical workforce. Under the Option Case, higher workforce requirements for closure activities are projected.

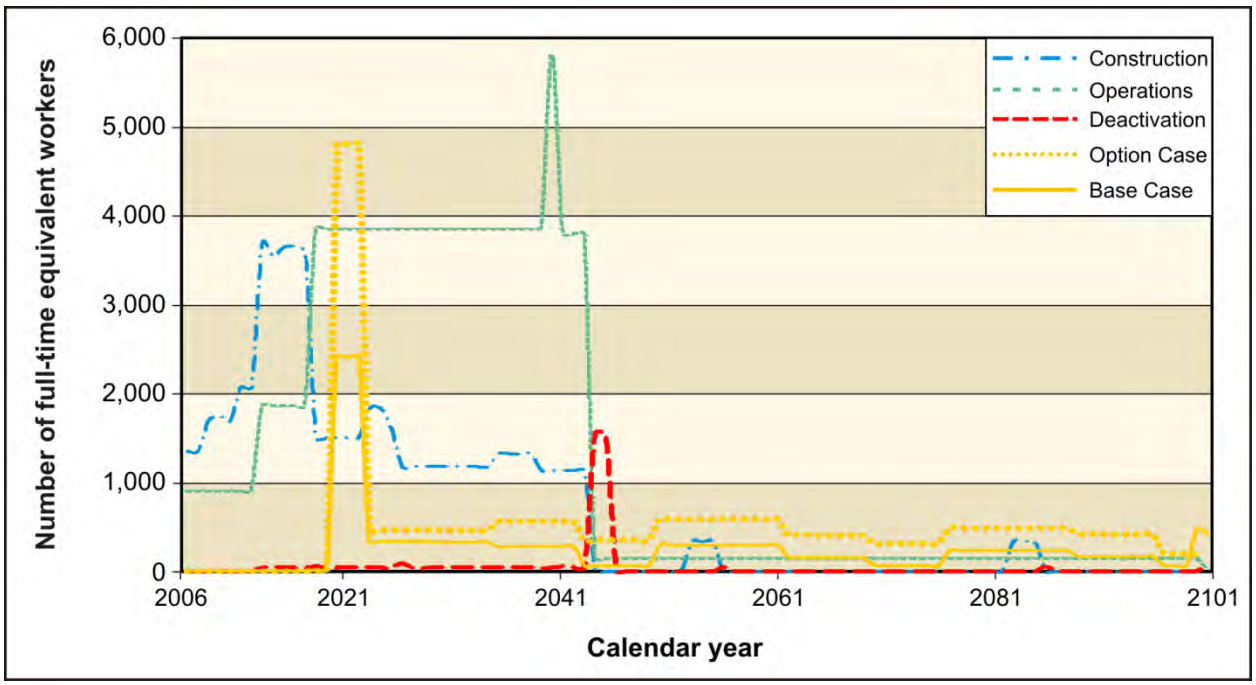


**Figure 4–23. Tank Closure Alternative 6B, Base/Option Case, Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2101)**

**Table 4–17. Tank Closure Alternative 6B, Base/Option Case, Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Base Case Workforce Peak or Peak Range (FTEs) | Option Case Workforce Peak or Peak Range (FTEs) |
|---|---|---|---|
| Construction | 2013–2017<br>2053–2055<br>2083–2085 | 3,540–3,690<br>333<br>333 | Same |
| Operations | 2018–2043 | 3,790–5,810 | Same |
| Deactivation | 2044–2045 | 1,530–1,540 | Same |
| Closure | 2020–2022<br>2100–2101 | 2,400<br>414–468 | 4,790<br>N/A |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent; N/A=not applicable.
**Source:** Appendix I; SAIC 2010a.

#### 4.1.9.10.1 Regional Economic Characteristics

##### 4.1.9.10.1.1 Base Case

Implementing the Base Case under Alternative 6B would alter the economic characteristics of the region by increasing demands for goods and services in the Tri-Cities area over an extended period of time (i.e., approximately 90 years) due to increases in expenditures, income, and employment (direct and indirect) at Hanford. It is estimated that the peak workforce, up to 7,860 FTEs, would occur from 2021 through 2022. These near-term peaks represent approximately 5.2 percent of the projected labor force in the ROI (150,000) in 2021.

#### 4.1.9.10.1.2 Option Case

The socioeconomic impacts of implementing the Option Case would be higher than those of implementing the Base Case. The number of closure workers under the Option Case would be almost double that under the Base Case. The peak workforce estimate for 2021 and 2022 (10,200 FTEs) represents 6.8 percent of the projected labor force in the ROI.

#### 4.1.9.10.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the demand for operations workers would compel drawing from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region. The increased number of closure workers under the Option Case during the later years (after 2045) represents from one-third to more than double the total number of workers under the Base Case. Nevertheless, the impacts on the demographic characteristics of the ROI would be virtually the same under the Base and Option Cases because the total workforce would be small compared with the projected labor force in the ROI (201,000) in 2046.

#### 4.1.9.10.3 Housing and Community Services

Implementation of Alternative 6B for both the Base and Option Cases would increase the demand for housing and would impact schools and other community services within the ROI. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollment is expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.10.4 Local Transportation

Implementation of this alternative for both the Base and Option Cases is expected to have an impact on the local transportation system, especially during the commute periods. The local transportation system has additional capacity during noncommute periods, but has no additional capacity during the morning and afternoon peaks. It is expected that all new commute period trips would impact the regionally established LOS, reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

#### 4.1.9.10.4.1 Commuter Traffic

Under Alternative 6B for both the Base and Option Cases, the peak years of construction and operations activities at the site would occur from 2013 through 2043. The projected increase in commuter traffic to and from the site during this period would be primarily due to construction and operation of the expanded WTP and retrieval systems. These activities would increase the number of site personnel to over 10,200 FTEs from 2021 through 2022 under Alternative 6B, Option Case. Assuming an average of 1.25 persons per passenger vehicle, this personnel increase could represent over 8,100 commuter vehicles per day traveling to and from the site. Under the Base Case during the same time period (2021–2022), over 6,200 commuter vehicles could travel to and from the site each day.

#### 4.1.9.10.4.2 Truck Traffic

Under both the Base and Option Cases, an average of over 2,200 offsite truck trips per year (8 trips per day) from 2006 through 2017 is projected to ship in construction materials, primarily for construction projects. The heaviest period of offsite truck activity would occur from 2018 through 2043 during WTP operations and closure activities. At its peak in 2040, there would be an estimated

17,200 (under Alternative 6B, Base Case) and 21,600 (under Alternative 6B, Option Case) truck trips per year (66 and 83 trips per day, respectively).

Onsite trucking under Alternative 6B, Base Case, would be at its highest in 2100 due to construction of the modified RCRA Subtitle C barrier for landfill closure of the remaining tank farms in the SST system. At its peak, there would be an estimated 48,800 truck trips (188 trips per day). Under Alternative 6B, Option Case, the peak would occur in 2023 and 2024, with up to 45,400 truck trips per year (175 trips per day). These periods of onsite truck activity would support construction and closure activities under Alternative 6B.

#### 4.1.9.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Under Alternative 6C, total onsite workforce requirements would be essentially the same as those under Alternative 2B (see Figure 4–16). The construction workforce of 11 FTEs from 2016 through 2043 for the ILAW Canister Storage Building would be required under Alternative 6C only. Peak employment numbers and years (see Table 4–18 and Figure 4–24) would be identical to those under Alternative 2B.

**Table 4–18. Tank Closure Alternative 6C Peak Annual Estimated Workforce Requirements**

| Work Activity | Peak Year(s) | Workforce Peak or Peak Range (FTEs) |
|---|---|---|
| Construction | 2013–2017 | 3,080–3,240 |
| Operations | 2018–2043 | 3,400–5,540 |
| Deactivation | 2044–2045 | 1,530–1,540 |
| Closure | 2039–2045 | 394–412 |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** FTE=full-time equivalent.
**Source:** Appendix I; SAIC 2010a.

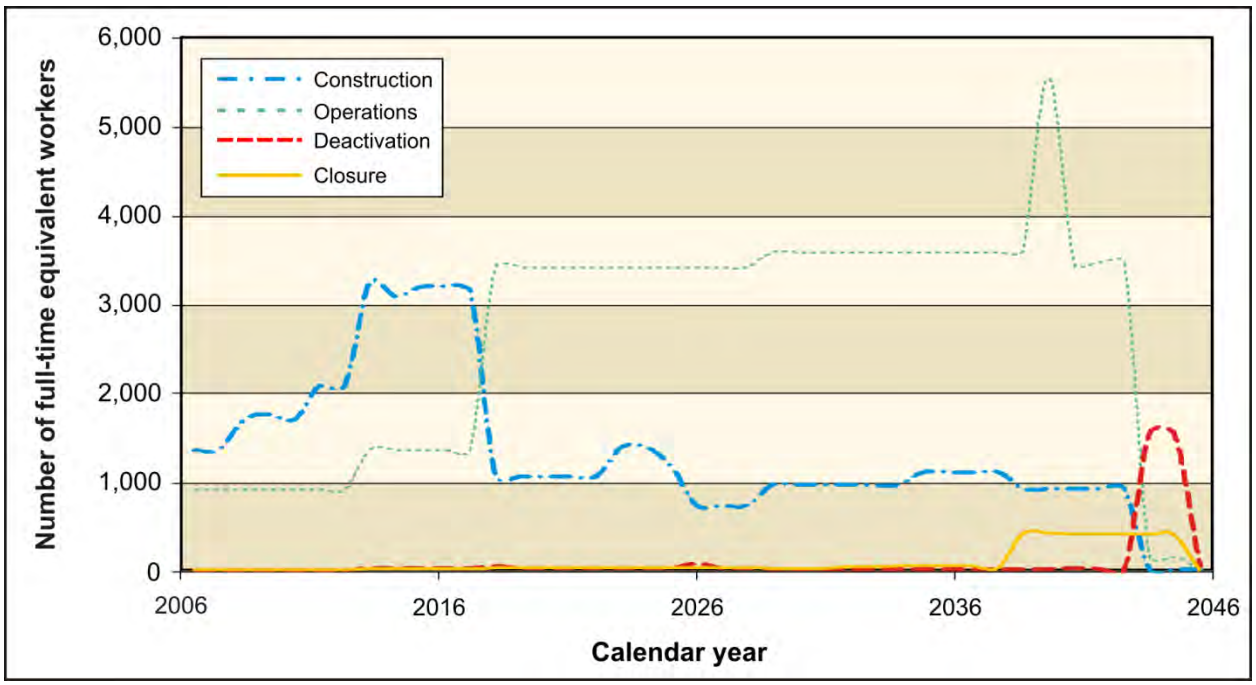


**Figure 4–24. Tank Closure Alternative 6C Annual Estimated Onsite Full-Time-Equivalent Workforce Requirements (2006–2046)**

#### 4.1.9.11.1 Regional Economic Characteristics

Implementing Alternative 6C would alter the economic characteristics of the region by temporarily (for 30 years) increasing demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment (direct and indirect) at Hanford. The peak workforce estimate of 6,870 FTEs would occur in 2040. This estimate would be approximately 3.6 percent of the projected labor force in the ROI (189,000) in 2040, compared with approximately 10 percent in 2006. The increase in demand would be followed by an abrupt decrease in expenditures, income, and employment.

#### 4.1.9.11.2 Demographic Characteristics

While this alternative would draw some workers from the local labor force, the continuing demand for operations workers would draw from outside the region. The in-migration of new workers and their families would increase the overall population within the Tri-Cities area and could alter the demographic characteristics of the region.

#### 4.1.9.11.3 Housing and Community Services

Implementation of this alternative would increase the demand for housing and would impact schools and other community services within the ROI. The demand for housing by construction and operations workers would impact the cost and availability of houses and rental units. School enrollment is expected to increase, and utilities and police and fire services may need to be expanded.

#### 4.1.9.11.4 Local Transportation

Implementation of this alternative is expected to have an impact on the local transportation system, especially during the commute periods. The local transportation system has additional capacity during noncommute periods, but has no additional capacity during the morning and afternoon peaks. It is expected that all new commute period trips would impact the regionally established LOS, reducing it to a level below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

##### 4.1.9.11.4.1 Commuter Traffic

Under Alternative 6C, the peak years of construction and operations activities at the site would begin in 2013. The projected increase in commuter traffic to and from the site would be primarily due to activities for the expanded WTP. These and other activities would increase the number of site personnel to about 6,900 FTEs in 2040. Assuming an average of 1.25 persons per passenger vehicle, this personnel increase could represent about 5,500 commuter vehicles per day traveling to and from the site.

##### 4.1.9.11.4.2 Truck Traffic

According to projections, from 2006 through 2017, an average of 2,200 offsite truck trips per year (8 trips per day) would be required to ship in construction materials. The heaviest period of offsite truck activity would occur from 2018 through 2043 during construction of the WRFs and the IHLW Interim Storage Modules, operations of the WTP, and some closure activities. It is projected that an average of 7,400 truck trips per year (29 trips per day) would be required to ship in materials during this time. At its peak in 2040, truck activity would reach an estimated 13,000 truck trips per year (50 trips per day).

Under Alternative 6C, onsite trucking would be at its highest during the period of modified RCRA Subtitle C landfill barrier construction; construction of the ILAW Interim Storage Facility; and the onsite movement of concrete aggregate materials, other borrow materials, and excavated soil supporting closure activities. This period of onsite truck activity would require an estimated 56,800 truck trips per year (218 trips per day) during its peak from 2039 through 2045.

### 4.1.10 Public and Occupational Health and Safety—Normal Operations

Activities to retrieve and treat tank waste and close tank farms could result in radiological and chemical exposures. Details of the assessment methodology for determining radiological exposure of workers and members of the public are presented in Appendix K. Radiological impacts are presented for three public receptors: the general population (approximately 560,000[1]) living within 80 kilometers (50 miles) of the Hanford 200 Areas, a maximally exposed individual (MEI) living near Hanford, and an onsite MEI. Impacts on the general population are evaluated for a residential scenario whereby people are exposed to radioactive materials emitted from project facilities. Radiological exposure occurs through inhalation, direct exposure to the radioactive plume and material deposited on the ground, and ingestion of contaminated products from animals raised locally and fruits and vegetables grown in a family garden (DOE 1995). Impacts on the offsite MEI are evaluated for a scenario that includes the same exposure pathways assumed for the general population, but with an increased amount of time spent outdoors and a higher rate of contaminated food consumption. Impacts on the onsite MEI, identified as a member of the public who works at the Columbia Generating Station, LIGO, or the US Ecology Commercial Low-Level Radioactive Waste Disposal Site (US Ecology), would be from inhalation and exposure to the plume and material deposited on the ground. Doses are presented as total effective doses.

The radiological impacts on members of the public are presented for each alternative in terms of impacts over the life of the project (the operational life of the project during which radioactive air emissions would occur) and peak annual impacts. Impacts over the life of the project are the total estimated radiation doses that would be incurred by members of the public over the duration of an alternative. The peak annual impacts are the estimated annual radiation doses that would be incurred by members of the public during the year(s) of largest radiation dose. Under all of the alternatives, the dose to an onsite MEI would be lower than the dose to an offsite MEI located near the Hanford boundary because the onsite MEI would be exposed for a shorter time (only during the workday) and through fewer pathways (e.g., no ingestion pathway).

In addition to members of the public, workers directly involved in the activities associated with each alternative and nearby noninvolved workers may receive radiation doses or chemical exposures. Doses to an involved worker are calculated based on an FTE employee. It was assumed for the purposes of this dose evaluation that an FTE involved worker has a 2,080-hour work year. In practice, the number of workers who could receive a radiation dose may be larger than the number assumed in this analysis, resulting in a smaller average dose per worker. A noninvolved worker is a person working at the site who is incidentally exposed due to the radioactive air emissions associated with the alternatives considered. The location selected for the noninvolved worker is a facility that is expected to be staffed on a daily basis and that is near the assumed emission sources.

The impacts of radionuclide releases from construction, operations, deactivation and cleanup, and postclosure care of each facility required under each of the Tank Closure alternatives were evaluated. Based on the data presented in the following subsections, radiological exposure of members of the public is expected to result in a single latent cancer fatality (LCF) among the population within an 80-kilometer (50-mile) radius under all alternatives except Alternative 1. The cumulative impacts associated with these alternatives in combination with Fast Flux Test Facility (FFTF) decommissioning, waste management operations, and other onsite, local, and regional activities are discussed in Chapter 6.

Under all Tank Closure alternatives except Alternative 1, the MEI would be about 13.1 kilometers (8.1 miles) east of the 200 Areas. Under Alternative 1, the MEI would be to the east-northeast, about

[1] The approximate population is based on populations of 542,324, 546,746, and 589,668 people residing within 80 kilometers (50 miles) of the WTP, STTS-East, and STTS-West, respectively.

11 kilometers (6.8 miles) from the 200 Areas. The annual dose to the MEI is not expected to exceed the regulatory limit of 10 millirem per year (40 CFR 61, Subpart H). In those cases where projections indicate that doses would be at or approaching 10 millirem per year, DOE would take action to ensure that emissions are controlled so that the total site impact remains below the regulatory limit. Americium-241, carbon-14, cesium-137, strontium-90, and plutonium-239 and -240 emitted from the WTP would be the primary contributors of the dose to members of the public over the life of the project under the Tank Closure action alternatives. The onsite MEI would receive an annual dose of 1.7 millirem or less.

Maximum annual impacts calculated for all Tank Closure alternatives except Alternative 1 would be determined by the treatment at the WTP of the materials from the strontium and cesium capsules. As currently described in the alternatives, all of the strontium and cesium would be processed in a 1-year timeframe following completion of tank waste processing. Under all alternatives, the year of strontium and cesium processing is the year of maximum impact on the public from radioactive air emissions. An alternate management strategy of distributing the treatment of the strontium and cesium materials over a period of years would reduce maximum annual impacts.

The potential dose to a noninvolved worker would result from exposure to, and inhalation of, radioactive contaminants released to the atmosphere from tank farm management, tank waste retrieval and treatment, and tank closure activities. The highest radioactive releases associated with the tank closure activities would be from the WTP and 200 Area fugitive emissions and diffuse sources. In the 200-East Area, the noninvolved worker was assumed to be at the 242-A Evaporator, 1,090 meters (3,580 feet) north-northwest of the 200-East Area source. In the 200-West Area, the noninvolved worker was assumed to be at the Environmental Restoration Disposal Facility (ERDF), about 950 meters (3,120 feet) east of the 200-West Area source. Radiation doses to noninvolved workers were calculated to remain below 3.6 millirem per year.

Based on the data presented in the following subsections, the average radiation dose to an FTE worker would be well below the Administrative Control Level of 500 millirem per year (DOE 2006a, 2007a) under Alternatives 1, 2A, 2B, 3A, 3B, 3C, 5, and 6C. The annual administrative control level would be approached or could be exceeded on the basis of exposure of an average FTE worker if Alternative 4, 6A, or 6B (Base or Option Cases) were implemented because these alternatives include exhumation of tank farms and contaminated soil underlying the tanks, activities that would result in comparatively large worker doses per hour worked.

Worker doses should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit them. Due to the number of years required to complete some alternatives, the dose over the life of the project would be distributed over several generations of workers. In addition, worker dose would be limited to less than 5 rem total effective dose equivalent per year (10 CFR 835). This regulatory limit would be further constrained by the application of administrative controls. DOE Standard 1098-2008, *Radiological Control*, recommends that the annual dose does not exceed 2 rem, unless explicitly authorized by DOE management (e.g., for emergency situations), and that the dose generally be controlled at a level below 500 millirem (0.5 rem) per year.

In practice, worker exposure would be controlled by use of engineering and administrative controls to keep doses below administrative limits and as low as is reasonably achievable. With the large amount of work resulting in exposure to radiation, all alternatives except Alternative 1 would result in large doses to the worker population that would result in the probability of LCFs occurring in the worker population. Potential doses and resulting LCFs to involved workers should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit individual worker dose, as discussed in Section 4.1.10.2.2. In summary, radiation doses to individual workers would be managed and mitigated to minimize impacts. Such measures were not taken into account in this analysis.

#### 4.1.10.1 Alternative 1: No Action

##### 4.1.10.1.1 Radiological Impacts on the Public

Table 4–19 presents estimated doses to the general population and the MEI under Alternative 1. Activities under this alternative that would generate radioactive air emissions would occur from 2006 through 2107. Due to the long timeframe involved, the doses over the life of the project would not be received by the same members of the population or the same MEI, but are presented to provide a basis for comparison with other alternatives.

**Table 4–19. Tank Closure Alternative 1 Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 0 | | | 0 | |
| | 200-East Area | 37 | | | 0.40 | |
| | 200-West Area | 37 | | | 0.39 | |
| | **Total** | **74** | **0 ($4\times10^{-2}$)** | **2008** | **0.78** | **0 ($5\times10^{-4}$)** |
| Maximally exposed individual | | **Dose[c] (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[d]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[d]** |
| | WTP | 0 | | | 0 | |
| | 200-East Area | 2.3 | | | 0.026 | |
| | 200-West Area | 1.3 | | | 0.015 | |
| | **Total** | **3.6** | **$2\times10^{-6}$** | **2008** | **0.041** | **$2\times10^{-8}$** |
| Onsite MEI | **Total** | **3.2** | **$2\times10^{-6}$** | **2008** | **0.033** | **$2\times10^{-8}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Impacts are provided for comparison to other alternatives. The life-of-project dose would not be received by one individual person due to the duration of this alternative. The MEI dose from 70 years of exposure at the average dose rate would be 2.5 millirem, with a corresponding lifetime risk of an LCF of $1\times10^{-6}$; the onsite MEI dose from 40 years of exposure would be 1.3 millirem, with a lifetime LCF risk of $8\times10^{-7}$.

d Probability of an LCF in the MEI is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 74 person-rem,[2] and the MEI would receive a cumulative dose of 3.6 millirem. Given the risk factor of 0.0006 LCFs per rem (DOE 2003h), no LCFs are expected in the general population as a result of this alternative. There would be a probability of $2 \times 10^{-6}$ (1 chance in 500,000)

[2] Person-rem=a unit of collective radiation dose applied to populations or groups of individuals; that is, a unit for expressing the dose when summed across all persons in a specified population or group.

of the MEI developing an LCF, assuming the same MEI was exposed over the life of the project. Radioactive air emissions would remain fairly constant over the duration of the alternative, not accounting for radioactive decay, with an annual population dose of 0.78 person-rem and an annual MEI dose of 0.041 millirem. The primary contributor to offsite doses would be tank farm emissions of uranium and, to a lesser extent, hydrogen-3 (tritium).

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 0.033 millirem. The increased risk of an LCF from this dose would be $2 \times 10^{-8}$ (1 chance in 50 million).

#### 4.1.10.1.2 Radiological Impacts on Workers

Table 4–20 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 140 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a dose of 5,700 millirem, corresponding to a risk of $3 \times 10^{-3}$ (1 chance in 300) of developing an LCF.

**Table 4–20. Tank Closure Alternative 1 Normal Operations Radiological Impacts on Worker**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 140 millirem | $9\times10^{-5}$ |
| Impact over life of project[b] | 5,700 millirem | $3\times10^{-3}$ |
| **Life-of-Project Worker Population** | 280 person-rem | 0 ($2\times10^{-1}$) |
| **Noninvolved Worker (Year of Maximum Impact)** | | |
| At the 242-A Evaporator (2008) | 0.097 millirem | $6\times10^{-8}$ |
| At the Environmental Restoration Disposal Facility (2008) | 0.27 millirem | $2\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

The total effective dose equivalent to the involved worker population from the 102 years of occupational exposure under this alternative was estimated to be 280 person-rem. Given the risk factor of 0.0006 LCFs per person-rem, no LCFs are expected to result from the dose associated with this alternative. A majority of the worker dose under this alternative (190 person-rem, or 68 percent) would be associated with 100 years of administrative control of the tank farms.

Estimated doses and risks to the noninvolved workers at the 242-A Evaporator or the ERDF in the year of maximum impact are shown in Table 4–20. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

### 4.1.10.2 Alternative 2A: Existing WTP Vitrification; No Closure

#### 4.1.10.2.1 Radiological Impacts on the Public

Table 4–21 presents estimated doses to the general population and the MEI under Alternative 2A. Activities that would generate radioactive air emissions would occur from 2006 through 2193. Due to the

long timeframe involved, doses over the life of the project would not be received by the same members of the population or the same MEI, but are presented to provide a basis for comparison with other alternatives.

**Table 4–21. Tank Closure Alternative 2A Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | Dose (person-rem) | Number of Latent Cancer Fatalities[b] | Year of Maximum Impact | Dose (person-rem per year) | Number of Latent Cancer Fatalities[b] |
| General population | WTP | 1,600 | | | 280 | |
| | 200-East Area | 39 | | | 0.000000064 | |
| | 200-West Area | 39 | | | 0 | |
| | **Total** | **1,700** | **1 (1)** | **2093** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose[c] (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[d]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[d]** |
| | WTP | 42 | | | 8.5 | |
| | 200-East Area | 2.2 | | | 0.0000000066 | |
| | 200-West Area | 1.3 | | | 0 | |
| | **Total** | **46** | **$3\times10^{-5}$** | **2093** | **8.5** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **12** | **$7\times10^{-6}$** | **2093** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Impacts are provided for comparison to other alternatives. The life-of-project dose would not be received by one individual person due to the duration of this alternative. The MEI dose from 70 years of exposure at the average dose rate would be 17 millirem, with a corresponding lifetime risk of an LCF of $1 \times 10^{-5}$; the onsite MEI dose from 40 years of exposure would be 2.6 millirem, with a lifetime LCF risk of $2 \times 10^{-6}$.

d Probability of an LCF in the MEI is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,700 person-rem. Doses from this alternative could result in 1 LCF in the general population. For the purposes of comparing the alternatives, a dose was calculated for an MEI, although the same individual could not be exposed over the duration of this alternative. The MEI would receive a cumulative dose of 46 millirem. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF, assuming the same MEI was exposed over the life of the project. The main sources of radioactive air emissions would be the WTP during its operations from 2018 through 2093 and fugitive and diffuse emissions from tank farms continuing at a low level over the administrative control period that extends to 2193. The year of maximum impact would be 2093, with a population dose of 280 person-rem and an MEI dose of 8.5 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.3 million).

#### 4.1.10.2.2 Radiological Impacts on Workers

Table 4–22 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 170 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 6,900 millirem, corresponding to a risk of $4 \times 10^{-3}$ (1 chance in 250) of developing an LCF.

**Table 4–22. Tank Closure Alternative 2A Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 170 millirem | $1\times10^{-4}$ |
| Impact over life of project[b] | 6,900 millirem | $4\times10^{-3}$ |
| **Life-of-Project Worker Population** | 22,000 person-rem | 13 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2094–2095) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2094–2095) | 0.90 millirem | $5\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

The total effective dose equivalent to the involved worker population from the 188 years of occupational exposure under this alternative was estimated to be 22,000 person-rem. Given the risk factor of 0.0006 LCFs per person-rem, an estimated 13 LCFs would occur in the worker population. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Due to the number of years required to complete this alternative, the cumulative dose would be distributed over several generations of workers. Most of the collective worker dose under this alternative (19,000 person-rem, or 86 percent) would be associated with the WTP, routine tank farm, and ETF operations. Even though the large worker population dose implies a number of LCFs, the operational controls used by DOE and its contractors would limit the dose that individual workers would receive and, therefore, their risk of an LCF.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the year of maximum impact are shown in Table 4–22. Doses to noninvolved workers would be a small fraction of the Administrative Control Level of 500 millirem per year.

### 4.1.10.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

#### 4.1.10.3.1 Radiological Impacts on the Public

Table 4–23 presents estimated doses to the general population and the MEI under Alternative 2B. Activities that would generate radioactive air emissions would occur from 2006 through 2045.

**Table 4–23. Tank Closure Alternative 2B Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,600 | | | 330 | |
| | 200-East Area | 0.93 | | | 0.026 | |
| | 200-West Area | 0.91 | | | 0.025 | |
| | **Total** | **1,600** | **1 (1)** | **2040** | **330** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[c]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[c]** |
| | WTP | 43 | | | 10 | |
| | 200-East Area | 0.11 | | | 0.0030 | |
| | 200-West Area | 0.063 | | | 0.0017 | |
| | **Total** | **43** | **$3\times10^{-5}$** | **2040** | **10** | **$6\times10^{-6}$** |
| Onsite MEI | **Total** | **9.2** | **$6\times10^{-6}$** | **2040** | **1.7** | **$1\times10^{-6}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,600 person-rem, and the MEI would receive a cumulative dose of 43 millirem. Doses from this alternative could result in 1 LCF in the general population. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of radioactive air emissions would be the WTP during its operations from 2018 through 2043. Fugitive and diffuse emissions of uranium from tank farms and other sources in the 200 Areas would also be significant contributors to dose over the life of the project. The year of maximum impact would be 2040, with a population dose of 330 person-rem and an MEI dose of 10 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.7 millirem. The increased risk of an LCF from this dose would be $1 \times 10^{-6}$ (1 chance in 1 million).

#### 4.1.10.3.2 Radiological Impacts on Workers

Table 4–24 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 6,400 millirem, corresponding to a risk of $4 \times 10^{-3}$ (1 chance in 250) of developing an LCF.

**Table 4–24. Tank Closure Alternative 2B Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 160 millirem | $1\times10^{-4}$ |
| Impact over life of project[b] | 6,500 millirem | $4\times10^{-3}$ |
| **Life-of-Project Worker Population** | 11,000 person-rem | 7 |
| **Noninvolved Worker (Year of Maximum Impact)** | | |
| At the 242-A Evaporator (2040) | 3.4 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2040) | 1.1 millirem | $7\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated for table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

The total effective dose equivalent to the involved worker population from the 41 years of occupational exposure under this alternative was estimated to be 11,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 7 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Most of the collective worker dose under this alternative (7,600 person-rem, or 69 percent) would be associated with WTP, routine tank farm, and ETF operations.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the year of maximum impact are shown in Table 4–24. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

### 4.1.10.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

#### 4.1.10.4.1 Radiological Impacts on the Public

Table 4–25 presents estimated doses to the general population and the MEI under Alternative 3A. Activities that would generate radioactive air emissions would occur from 2006 through 2042. No radioactive air emissions are expected during the remainder of the project.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,600 person-rem, and the MEI would receive a dose of 43 millirem. Doses from this alternative could result in 1 LCF in the general population. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of radioactive air emissions contributing to offsite doses would be the WTP during its operations from 2018 through 2040. Another significant contribution to offsite doses would be carbon-14 emissions from operation of the Bulk Vitrification Facilities. The year of maximum impact would be 2040, with a population dose of 280 person-rem and an MEI dose of 8.6 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.25 million).

**Table 4–25. Tank Closure Alternative 3A Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,200 | | | 280 | |
| | 200-East Area | 220 | | | 1.0 | |
| | 200-West Area | 200 | | | 0.90 | |
| | **Total** | **1,600** | **1 (1)** | **2040** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[c]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[c]** |
| | WTP | 33 | | | 8.5 | |
| | 200-East Area | 6.0 | | | 0.027 | |
| | 200-West Area | 3.7 | | | 0.016 | |
| | **Total** | **43** | **$3\times10^{-5}$** | **2040** | **8.6** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **8.9** | **$5\times10^{-6}$** | **2040** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this Tank Closure alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

#### 4.1.10.4.2 Radiological Impacts on Workers

Table 4–26 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 38 years would receive a cumulative dose of 6,100 millirem, corresponding to a risk of $4 \times 10^{-3}$ (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 38 years of occupational exposure under this alternative was estimated to be 10,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 6 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Most of the collective worker dose under this alternative (5,800 person-rem, or 58 percent) would be associated with WTP, routine tank farm, and ETF operations. Approximately 1,200 person-rem, or 12 percent, of the collective worker dose would result from closure activities such as removal of contaminated soil from the BX and SX tank farms, decontamination and decommissioning activities, and installation of a modified RCRA Subtitle C barrier over the tank farms.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–26. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

**Table 4–26. Tank Closure Alternative 3A Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 160 millirem | $1\times10^{-4}$ |
| Impact over life of project[b] | 6,100 millirem | $4\times10^{-3}$ |
| **Life-of-Project Worker Population** | 10,000 person-rem | 6 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2040) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2018–2019) | 0.93 millirem | $6\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by 38 years of occupational exposure.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

### 4.1.10.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

#### 4.1.10.5.1 Radiological Impacts on the Public

Table 4–27 presents estimated doses to the general population and the MEI under Alternative 3B. Activities that would generate radioactive air emissions would occur from 2006 through 2042. No radioactive air emissions are expected during the period of institutional control following tank closure that extends to 2141.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,200 person-rem, and the MEI would receive a cumulative dose of 33 millirem. Doses from this alternative could result in 1 LCF in the general population. There would be a probability of $2 \times 10^{-5}$ (1 chance in 50,000) of the MEI developing an LCF. The main source of radioactive air emissions would be the WTP during its operations from 2018 through 2040. Lower radioactive emissions would come from the nonthermal supplemental treatment technology of this alternative and result in lower offsite dose impacts as compared with the thermal supplemental treatment technologies of Alternatives 3A and 3C. The year of maximum impact would be 2040, with a population dose of 280 person-rem and an MEI dose of 8.5 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.3 million).

**Table 4–27. Tank Closure Alternative 3B Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,200 | | | 280 | |
| | 200-East Area | 1.1 | | | 0.000041 | |
| | 200-West Area | 0.98 | | | 0.00074 | |
| | **Total** | **1,200** | **1 ($7\times10^{-1}$)** | **2040** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[c]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[c]** |
| | WTP | 33 | | | 8.5 | |
| | 200-East Area | 0.12 | | | 0.0000035 | |
| | 200-West Area | 0.068 | | | 0.000049 | |
| | **Total** | **33** | **$2\times10^{-5}$** | **2040** | **8.5** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **8.3** | **$5\times10^{-6}$** | **2040** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

#### 4.1.10.5.2 Radiological Impacts on Workers

Table 4–28 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 38 years would receive a cumulative dose of 6,100 millirem, corresponding to a risk of $4 \times 10^{-3}$ (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 38 years of occupational exposure under this alternative was estimated to be 9,800 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 6 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Most of the collective worker dose under this alternative (5,800 person-rem, or 59 percent) would be associated with WTP, routine tank farm, and ETF operations. Approximately 1,200 person-rem, or 12 percent, of the collective worker dose would result from closure activities such as removal of contaminated soil from the BX and SX tank farms, decontamination and decommissioning activities, and installation of a modified RCRA Subtitle C barrier over the tank farms.

**Table 4–28. Tank Closure Alternative 3B Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 160 millirem | $1\times10^{-4}$ |
| Impact over life of project[b] | 6,100 millirem | $4\times10^{-3}$ |
| **Life-of-Project Worker Population** | 9,800 person-rem | 6 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2040) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2018–2019) | 0.90 millirem | $5\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by 38 years of occupational exposure.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–28. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

### 4.1.10.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

#### 4.1.10.6.1 Radiological Impacts on the Public

Table 4–29 presents estimated doses to the general population and the MEI under Alternative 3C. Activities that would generate radioactive air emissions would occur from 2006 through 2042. No radioactive air emissions are expected during the period of institutional control following tank closure that extends to 2141.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,700 person-rem, and the MEI would receive a cumulative dose of 49 millirem. Doses from this alternative could result in 1 LCF in the general population. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of radioactive air emissions would be the WTP during its operations from 2018 through 2039. The year of maximum impact would be 2040, with a population dose of 280 person-rem and an MEI dose of 8.6 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.3 million).

**Table 4–29. Tank Closure Alternative 3C Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,200 | | | 280 | |
| | 200-East Area | 250 | | | 1.1 | |
| | 200-West Area | 230 | | | 1.0 | |
| | **Total** | **1,700** | **1 (1)** | **2040** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[c]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[c]** |
| | WTP | 33 | | | 8.5 | |
| | 200-East Area | 9.8 | | | 0.044 | |
| | 200-West Area | 5.7 | | | 0.025 | |
| | **Total** | **49** | **$3\times10^{-5}$** | **2040** | **8.6** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **9.1** | **$5\times10^{-6}$** | **2040** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

#### 4.1.10.6.2 Radiological Impacts on Workers

Table 4–30 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 38 years would receive a cumulative dose of 6,100 millirem, corresponding to a risk of $4 \times 10^{-3}$ (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 38 years of occupational exposure under this alternative was estimated to be about 11,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 6 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Most of the collective worker dose under this alternative (5,800 person-rem, or 53 percent) would be associated with WTP, routine tank farm, and ETF operations. Approximately 1,200 person-rem, or 11 percent, of the collective worker dose would result from closure activities such as removal of contaminated soil from the BX and SX tank farms, decontamination and decommissioning activities, and installation of a modified RCRA Subtitle C barrier over the tank farms.

**Table 4–30. Tank Closure Alternative 3C Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 160 millirem | $1\times10^{-4}$ |
| Impact over life of project[b] | 6,100 millirem | $4\times10^{-3}$ |
| **Life-of-Project Worker Population** | 11,000 person-rem | 6 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2040) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2018–2019) | 0.94 millirem | $6\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by 38 years of occupational exposure.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–30. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

### 4.1.10.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

#### 4.1.10.7.1 Radiological Impacts on the Public

Table 4–31 presents estimated doses to the general population and the MEI under Alternative 4. Activities that would generate radioactive air emissions would occur from 2006 through 2045. No radioactive air emissions are expected during the period of institutional control following tank closure that extends to 2144.

Over the operational life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,400 person-rem, and the MEI would receive a cumulative dose of 37 millirem. Doses from this alternative could result in 1 LCF in the general population. There would be a probability of $2 \times 10^{-5}$ (1 chance in 50,000) of the MEI developing an LCF. The main sources of radioactive air emissions would be the WTP and the supplemental treatment facilities during their operations from 2009 through 2030. The year of maximum impact would be 2043, with a population dose of 280 person-rem and an MEI dose of 8.5 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.3 million).

**Table 4–31. Tank Closure Alternative 4 Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,200 | | | 280 | |
| | 200-East Area | 2.2 | | | 0.0048 | |
| | 200-West Area | 200 | | | 0.0049 | |
| | **Total** | **1,400** | **1 ($8\times10^{-1}$)** | **2043** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[c]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[c]** |
| | WTP | 33 | | | 8.5 | |
| | 200-East Area | 0.27 | | | 0.00061 | |
| | 200-West Area | 3.9 | | | 0.00038 | |
| | **Total** | **37** | **$2\times10^{-5}$** | **2043** | **8.5** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **9.2** | **$6\times10^{-6}$** | **2043** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

#### 4.1.10.7.2 Radiological Impacts on Workers

Table 4–32 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 530 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 21,000 millirem, corresponding to a risk of $1 \times 10^{-2}$ (1 chance in 100) of developing an LCF. The high average FTE worker dose would be due to the exhumation of the BX and SX tank farms and the underlying contaminated soils. As noted in Section 4.1.10, work would be controlled in accordance with regulations and worker protection practices to maintain worker doses below established limits so an actual worker would not receive the doses calculated for the average FTE worker.

The total effective dose equivalent to the involved worker population from the 41 years of occupational exposure under this alternative was estimated to be 43,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 26 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Most of the collective worker dose under this alternative (32,000 person-rem, or 74 percent) would be associated with deep soil removal from the SX tank farm.

**Table 4–32. Tank Closure Alternative 4 Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 530 millirem | $3\times10^{-4}$ |
| Impact over life of project[b] | 21,000 millirem | $1\times10^{-2}$ |
| **Life-of-Project Worker Population** | 43,000 person-rem | 26 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2043) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2034–2039) | 0.91 millirem | $5\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–32. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

### 4.1.10.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

#### 4.1.10.8.1 Radiological Impacts on the Public

Table 4–33 presents estimated doses to the general population and the MEI under Alternative 5. Activities that would generate radioactive air emissions would occur from 2006 through 2036. No radioactive air emissions are expected during operations or deactivation of storage facilities or during the period of institutional control following tank closure that extends to 2139.

Over the operational life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,400 person-rem, and the MEI would receive a cumulative dose of 37 millirem. Doses from this alternative could result in 1 LCF in the general population. There would be a probability of $2 \times 10^{-5}$ (1 chance in 50,000) of the MEI developing an LCF. The main source of radioactive air emissions would be the WTP, which includes the contribution from sulfate removal associated with pretreatment under this alternative. Another large source of radioactive air emissions would be Bulk Vitrification Facility operations in the 200-West Area. The year of maximum impact would be 2034, with a population dose of 280 person-rem and an MEI dose of 8.6 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.3 million).

**Table 4–33. Tank Closure Alternative 5 Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,200 | | | 280 | |
| | 200-East Area | 0.88 | | | 0.000019 | |
| | 200-West Area | 180 | | | 1.1 | |
| | **Total** | **1,400** | **1 ($8\times10^{-1}$)** | **2034** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[c]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[c]** |
| | WTP | 34 | | | 8.6 | |
| | 200-East Area | 0.10 | | | 0.0000017 | |
| | 200-West Area | 3.4 | | | 0.021 | |
| | **Total** | **37** | **$2\times10^{-5}$** | **2034** | **8.6** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **8.4** | **$5\times10^{-6}$** | **2034** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

#### 4.1.10.8.2 Radiological Impacts on Workers

Table 4–34 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 150 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 34 years would receive a cumulative dose of 5,100 millirem, corresponding to a risk of $3 \times 10^{-3}$ (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 34 years of occupational exposure under this alternative was estimated to be 8,500 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 5 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. The largest contributor to the collective worker dose under this alternative (3,200 person-rem, or 38 percent) would be WTP operations.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–34. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

**Table 4–34. Tank Closure Alternative 5 Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 150 millirem | $9\times10^{-5}$ |
| Impact over life of project[b] | 5,100 millirem | $3\times10^{-3}$ |
| **Life-of-Project Worker Population** | 8,500 person-rem | 5 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2034) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2018–2019) | 0.94 millirem | $6\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by 34 years of occupational exposure.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

### 4.1.10.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.10.9.1 Radiological Impacts on the Public

##### 4.1.10.9.1.1 Base Case

Table 4–35 presents estimated doses to the general population and the MEI under Alternative 6A, Base Case. Activities under this case that would generate radioactive air emissions would occur from 2006 through 2166. Due to the long timeframe involved, the doses over the life of the project would not be received by the same members of the population or the same MEI, but are presented to provide a basis for comparison with other alternatives.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,700 person-rem, and the MEI would receive a cumulative dose of 49 millirem. Doses from this alternative could result in 1 LCF in the general population. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of radioactive air emissions would be the WTP during its operations from 2018 through 2163. The year of maximum impact would be 2163, with a population dose of 280 person-rem and an MEI dose of 8.6 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.3 million).

**Table 4–35. Tank Closure Alternative 6A, Base Case, Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,700 | | | 280 | |
| | 200-East Area | 36 | | | 0.041 | |
| | 200-West Area | 0.55 | | | 0.039 | |
| | **Total** | **1,700** | **1 (1)** | **2163** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose[c] (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[d]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[d]** |
| | WTP | 45 | | | 8.5 | |
| | 200-East Area | 4.1 | | | 0.0046 | |
| | 200-West Area | 0.042 | | | 0.0027 | |
| | **Total** | **49** | **$3\times10^{-5}$** | **2163** | **8.6** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **10** | **$6\times10^{-6}$** | **2163** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Impacts are provided for comparison to other alternatives. The life-of-project dose would not be received by one individual person due to the duration of this alternative. The MEI dose from 70 years of exposure at the average dose rate would be 21 millirem, with a corresponding lifetime risk of an LCF of $1 \times 10^{-5}$; the onsite MEI dose from 40 years of exposure would be 2.5 millirem, with a lifetime LCF risk of $2\times10^{-6}$.

d Probability of an LCF in the MEI is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

#### 4.1.10.9.1.2 Option Case

Table 4–36 presents estimated doses to the general population and the MEI under Alternative 6A, Option Case. Activities under this case that would generate radioactive air emissions would occur from 2006 through 2166. As with the Base Case, due to the long timeframe involved, the doses over the life of the project would not be received by the same members of the population or the same MEI, but are presented to provide a basis for comparison with other alternatives.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,800 person-rem, and the MEI would receive a cumulative dose of 53 millirem. Doses in this case could result in 1 LCF in the general population. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of radioactive air emissions would be the WTP during its operations from 2018 through 2163. The higher dose over the life of the project of the Option Case compared with the Base Case under Alternative 6A is primarily due to excavating the B and T Area cribs and trenches (ditches) and processing the contaminated soil in the PPF. The year of maximum impact would be 2163, with a population dose of 280 person-rem and an MEI dose of 8.6 millirem.

**Table 4–36. Tank Closure Alternative 6A, Option Case, Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | Dose (person-rem) | Number of Latent Cancer Fatalities[b] | Year of Maximum Impact | Dose (person-rem per year) | Number of Latent Cancer Fatalities[b] |
| General population | WTP | 1,700 | | | 280 | |
| | 200-East Area | 45 | | | 0.052 | |
| | 200-West Area | 45 | | | 0.050 | |
| | **Total** | **1,800** | **1 (1)** | **2163** | **280** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dosec (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[d]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[d]** |
| | WTP | 45 | | | 8.5 | |
| | 200-East Area | 5.0 | | | 0.0056 | |
| | 200-West Area | 3.1 | | | 0.0033 | |
| | **Total** | **53** | **$3\times10^{-5}$** | **2163** | **8.6** | **$5\times10^{-6}$** |
| Onsite MEI | **Total** | **15** | **$9\times10^{-6}$** | **2163** | **1.4** | **$8\times10^{-7}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Impacts are provided for comparison to other alternatives. The life-of-project dose would not be received by one individual person due to the duration of this alternative. The MEI dose from 70 years of exposure at the average dose rate would be 23 millirem, with a corresponding lifetime risk of an LCF of $1 \times 10^{-5}$; the onsite MEI dose from 40 years of exposure would be 3.7 millirem, with a lifetime LCF risk of $2\times10^{-6}$.

d Probability of an LCF in the MEI is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.4 millirem. The increased risk of an LCF from this dose would be $8 \times 10^{-7}$ (1 chance in 1.3 million).

### 4.1.10.9.2 Radiological Impacts on Workers

#### 4.1.10.9.2.1 Base Case

Table 4–37 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 420 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 17,000 millirem, corresponding to a risk of $1 \times 10^{-2}$ (1 chance in 100) of developing an LCF. The high average FTE worker dose would be due to exhumation of the tank farms and underlying contaminated soils. As noted in Section 4.1.10, work would be controlled in accordance with regulations and worker protection practices to maintain worker doses below established limits so an actual worker would not receive the doses calculated for the average FTE worker.

**Table 4–37. Tank Closure Alternative 6A, Base Case, Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 420 millirem | $2\times10^{-4}$ |
| Impact over life of project[b] | 17,000 millirem | $1\times10^{-2}$ |
| **Life-of-Project Worker Population** | 120,000 person-rem | 72 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2163) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2054–2061) | 0.93 millirem | $6\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

The total effective dose equivalent to the involved worker population from the 161 years of occupational exposure under this alternative was estimated to be 120,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 72 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. A large contributor to the collective worker dose (38,000 person-rem, or 32 percent) under this alternative would be the WTP's 146 years of operation. Other large contributors to collective worker dose (69,000 person-rem, or 58 percent) would be PPF operations and deep soil removal from the T, TX, and SX tank farms.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–37. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

#### 4.1.10.9.2.2 Option Case

Table 4–38 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 400 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 16,000 millirem, corresponding to a risk of $1 \times 10^{-2}$ (1 chance in 100) of developing an LCF. The high average FTE worker dose would be due to exhumation of the tank farms and underlying contaminated soils. Although exhuming the B and T Area cribs and trenches (ditches) would add to the collective worker dose, the associated dose rate for this work would be comparatively low, thus lowering the average FTE worker dose. As noted in Section 4.1.10, work would be controlled in accordance with regulations and worker protection practices to maintain worker doses below established limits so an actual worker would not receive the doses calculated for the average FTE worker.

**Table 4–38. Tank Closure Alternative 6A, Option Case, Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 400 millirem | $2\times10^{-4}$ |
| Impact over life of project[b] | 16,000 millirem | $1\times10^{-2}$ |
| **Life-of-Project Worker Population** | 120,000 person-rem | 75 |
| **Noninvolved Worker (Year[s] of Maximum Impact)** | | |
| At the 242-A Evaporator (2163) | 3.0 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2138–2140) | 0.96 millirem | $6\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

The total effective dose equivalent to the involved worker population from the 161 years of occupational exposure under this alternative was estimated to be 120,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 75 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. A large contributor to the collective worker dose (38,000 person-rem, or 32 percent) under this alternative would be the WTP's 146 years of operation. Other large contributors to collective worker dose (73,000 person-rem, or 61 percent) would be PPF operations and deep soil removal from the T, TX, and SX tank farms.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–38. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

### 4.1.10.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.10.10.1 Radiological Impacts on the Public

##### 4.1.10.10.1.1 Base Case

Table 4–39 presents estimated doses to the general population and the MEI under Alternative 6B, Base Case. Activities that would generate radioactive air emissions would occur from 2006 through 2100. Due to the long timeframe involved, the doses over the life of the project would not be received by the same members of the population or the same MEI, but are presented to provide a basis for comparison with other alternatives.

**Table 4–39. Tank Closure Alternative 6B, Base Case, Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | **Dose (person-rem)** | **Number of Latent Cancer Fatalities[b]** | **Year of Maximum Impact** | **Dose (person-rem per year)** | **Number of Latent Cancer Fatalities[b]** |
| General population | WTP | 1,600 | | | 320 | |
| | 200-East Area | 33 | | | 0.50 | |
| | 200-West Area | 34 | | | 0.47 | |
| | **Total** | **1,700** | **1 (1)** | **2040** | **320** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | **Dose[c] (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[d]** | **Year of Maximum Impact** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[d]** |
| | WTP | 42 | | | 9.7 | |
| | 200-East Area | 3.8 | | | 0.060 | |
| | 200-West Area | 2.3 | | | 0.033 | |
| | **Total** | **49** | **$3\times10^{-5}$** | **2040** | **9.8** | **$6\times10^{-6}$** |
| Onsite MEI | **Total** | **12** | **$7\times10^{-6}$** | **2040** | **1.7** | **$1\times10^{-6}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Impacts are provided for comparison to other alternatives. The life-of-project dose would not be received by one individual person due to the duration of this alternative. The MEI dose from 70 years of exposure at the average dose rate would be 36 millirem, with a corresponding lifetime risk of an LCF of $2\times10^{-5}$; the onsite MEI dose from 40 years of exposure would be 5.1 millirem, with a lifetime LCF risk of $3\times10^{-6}$.

d Probability of an LCF in the MEI is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,700 person-rem, and the MEI would receive a dose of 49 millirem. One LCF is expected in the general population as a result of this alternative. There would be a probability of $3\times10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of the doses would be radioactive air emissions from the WTP during its operations from 2018 through 2043. The year of maximum impact would be 2040, with a population dose of 320 person-rem and an MEI dose of 9.8 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.7 millirem. The increased risk of an LCF from this dose would be $1\times10^{-6}$ (1 chance in 1 million).

#### 4.1.10.10.1.2 Option Case

Table 4–40 presents estimated doses to the general population and the MEI for the Alternative 6B, Option Case. Activities that would have radioactive air emissions would occur from 2006 through 2100. Due to the long timeframe involved, the doses over the life of the project would not be received by the same members of the population or the same MEI, but are presented to provide a basis for comparison with other alternatives.

**Table 4–40. Tank Closure Alternative 6B, Option Case, Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | Dose (person-rem) | Number of Latent Cancer Fatalities[b] | Year of Maximum Impact | Dose (person-rem per year) | Number of Latent Cancer Fatalities[b] |
| General population | WTP | 1,600 | | | 320 | |
| | 200-East Area | 42 | | | 0.65 | |
| | 200-West Area | 42 | | | 0.57 | |
| | **Total** | **1,700** | **1 (1)** | **2040** | **320** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | Dose[c] (millirem) | Lifetime Risk of a Latent Cancer Fatality[d] | Year of Maximum Impact | Dose (millirem per year) | Lifetime Risk of a Latent Cancer Fatality[d] |
| | WTP | 42 | | | 9.7 | |
| | 200-East Area | 4.7 | | | 0.075 | |
| | 200-West Area | 2.9 | | | 0.039 | |
| | **Total** | **50** | **$3\times10^{-5}$** | **2040** | **9.8** | **$6\times10^{-6}$** |
| Onsite MEI | **Total** | **15** | **$9\times10^{-6}$** | **2040** | **1.7** | **$1\times10^{-6}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Impacts are provided for comparison to other alternatives. The life-of-project dose would not be received by one individual person due to the duration of this alternative. The MEI dose from 70 years of exposure at the average dose rate would be 37 millirem, with a corresponding lifetime risk of an LCF of $2 \times 10^{-5}$; the onsite MEI dose from 40 years of exposure would be 6.2 millirem, with a lifetime LCF risk of $4 \times 10^{-6}$.

d Probability of an LCF in the MEI is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,700 person-rem, and the MEI would receive a dose of 50 millirem. One LCF is expected in the general population as a result of this alternative. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of the doses would be radioactive air emissions from the WTP during its operations from 2018 through 2043. The higher dose over the life of the project of the Option Case compared with that of the Base Case under Alternative 6B is primarily due to excavating the B and T Area cribs and trenches (ditches) and processing the contaminated soil in the PPF. The year of maximum impact would be 2040, with a population dose of 320 person-rem and an MEI dose of 9.8 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.7 millirem. The increased risk of an LCF from this dose would be $1 \times 10^{-6}$ (1 chance in 1 million).

#### 4.1.10.10.2 Radiological Impacts on Workers

##### 4.1.10.10.2.1 Base Case

Table 4–41 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 890 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 36,000 millirem, corresponding to a risk of $2 \times 10^{-2}$ (1 chance in 50) of developing an LCF. The high average FTE worker dose would be due to exhumation of tank farms and underlying contaminated soils. The average FTE worker dose would be higher under Alternative 6B, Base and Option Cases, than under Alternative 6A, Base and Option Cases, because of the shorter duration of the project. Activities with lower average dose rates under Alternative 6A go on for a much longer time; the effect is a lower average dose across the entire project. As noted in Section 4.1.10, work would be controlled in accordance with regulations and worker protection practices to maintain worker doses below established limits so an actual worker would not receive the doses calculated for the average FTE worker.

**Table 4–41. Tank Closure Alternative 6B, Base Case, Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 890 millirem | $5\times10^{-4}$ |
| Impact over life of project[b] | 36,000 millirem | $2\times10^{-2}$ |
| **Life-of-Project Worker Population** | 82,000 person-rem | 49 |
| **Noninvolved Worker (Year of Maximum Impact)** | | |
| At the 242-A Evaporator (2040) | 3.5 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2040) | 1.4 millirem | $9\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

The total effective dose equivalent to the involved worker population from the 96 years of occupational exposure under this alternative was estimated to be 82,000 person-rem. The lower collective worker dose under Alternative 6B (both cases) compared with that under Alternative 6A would primarily be due to the shorter period of WTP and routine tank farm operations. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 49 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Large contributors to the worker population dose under this alternative (69,000 person-rem, or 84 percent) would be PPF operations and deep soil removal from the T, TX, and SX tank farms.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–41. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

#### 4.1.10.10.2.2 Option Case

Table 4–42 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 800 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 32,000 millirem, corresponding to a risk of $2 \times 10^{-2}$ (1 chance in 50) of developing an LCF. The high average FTE worker dose would be due to exhumation of the tank farms and underlying contaminated soils. Although exhuming the B and T Area cribs and trenches (ditches) would add to the collective worker dose, the associated dose rate for this work would be comparatively low, thus lowering the average FTE worker dose. As noted in Section 4.1.10, work would be controlled in accordance with regulations and worker protection practices to maintain worker doses below established limits so an actual worker would not receive the doses calculated for the average FTE worker.

**Table 4–42. Tank Closure, Alternative 6B, Option Case, Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 800 millirem | $5\times10^{-4}$ |
| Impact over life of project[b] | 32,000 millirem | $2\times10^{-2}$ |
| **Life-of-Project Worker Population** | 85,000 person-rem | 51 |
| **Noninvolved Worker (Year of Maximum Impact)** | | |
| At the 242-A Evaporator (2040) | 3.6 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2040) | 1.7 millirem | $1\times10^{-6}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

The total effective dose equivalent to the involved worker population from the 96 years of occupational exposure under this alternative was estimated to be 85,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 51 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit individual worker dose, as discussed in Section 4.1.10. Large contributors to the worker population dose under this alternative (71,000 person-rem, or 84 percent) would be PPF operations and deep soil removal from the T, SX, and TX tank farms.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the years of maximum impact are shown in Table 4–42. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

### 4.1.10.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

#### 4.1.10.11.1 Radiological Impacts on the Public

Table 4–43 presents estimated doses to the general population and the MEI under Alternative 6C. Activities that would generate radioactive air emissions would occur from 2006 through 2045.

**Table 4–43. Tank Closure Alternative 6C Normal Operations Public Health Impacts of Atmospheric Radionuclide Releases**

| Receptor | Facility | Impacts over Life of Project[a] | | Peak Annual Impacts | | |
|---|---|---|---|---|---|---|
| | | Dose (person-rem) | Number of Latent Cancer Fatalities[b] | Year of Maximum Impact | Dose (person-rem per year) | Number of Latent Cancer Fatalities[b] |
| General population | WTP | 1,600 | | | 320 | |
| | 200-East Area | 0.93 | | | 0.026 | |
| | 200-West Area | 0.91 | | | 0.025 | |
| | **Total** | **1,600** | **1 (1)** | **2040** | **320** | **0 ($2\times10^{-1}$)** |
| Maximally exposed individual | | Dose (millirem) | Lifetime Risk of a Latent Cancer Fatality[c] | Year of Maximum Impact | Dose (millirem per year) | Lifetime Risk of a Latent Cancer Fatality[c] |
| | WTP | 42 | | | 9.7 | |
| | 200-East Area | 0.11 | | | 0.0030 | |
| | 200-West Area | 0.063 | | | 0.0017 | |
| | **Total** | **43** | **$3\times10^{-5}$** | **2040** | **9.7** | **$6\times10^{-6}$** |
| Onsite MEI | **Total** | **9.1** | **$5\times10^{-6}$** | **2040** | **1.6** | **$1\times10^{-6}$** |

a Impacts accrued over the operational life of the project analyzed in this alternative.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. The result, calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem), is shown in parentheses (see Appendix K, Section K.1.1.6).

c Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** MEI=maximally exposed individual; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.2.1.

Over the life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 1,600 person-rem, and the MEI would receive a dose of 43 millirem. Given the risk factor of 0.0006 LCFs per rem (DOE 2003h), 1 LCF is expected in the general population as a result of this alternative. There would be a probability of $3 \times 10^{-5}$ (1 chance in 33,000) of the MEI developing an LCF. The main source of radioactive air emissions would be the WTP during its operations from 2018 through 2043. The year of maximum impact would be 2040, with a population dose of 320 person-rem and an MEI dose of 9.7 millirem.

An onsite MEI who spends a normal workday at US Ecology would receive a maximum annual dose of 1.6 millirem. The increased risk of an LCF from this dose would be $1 \times 10^{-6}$ (1 chance in 1 million).

#### 4.1.10.11.2 Radiological Impacts on Workers

Table 4–44 presents dose and risk estimates for an involved FTE worker and a noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, lower than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a cumulative dose of 6,400 millirem, corresponding to a risk of $4 \times 10^{-3}$ (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 41 years of occupational exposure under this alternative was estimated to be 11,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem to this population dose yields an estimate of 7 LCFs. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. The largest contributor to the worker population dose under this alternative (6,300 person-rem, or 57 percent) is associated with operations at the WTP.

**Table 4–44. Tank Closure Alternative 6C Normal Operations Radiological Impacts on Workers**

| Receptor | Dose | Latent Cancer Fatality Risk[a] |
|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | |
| Average annual impact | 160 millirem | $1\times10^{-4}$ |
| Impact over life of project[b] | 6,400 millirem | $4\times10^{-3}$ |
| **Life-of-Project Worker Population** | 11,000 person-rem | 7 |
| **Noninvolved Worker (Year of Maximum Impact)** | | |
| At the 242-A Evaporator (2040) | 3.4 millirem | $2\times10^{-6}$ |
| At the Environmental Restoration Disposal Facility (2040) | 1.1 millirem | $7\times10^{-7}$ |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[b] Impact over the life of the project is the average dose a full-time-equivalent radiation worker would receive working on this project. It is determined by multiplying the average annual dose by an assumed career length of 40 years.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.1.

Estimated doses and risks to noninvolved workers at the 242-A Evaporator and the ERDF in the year of maximum impact are shown in Table 4–44. Doses to noninvolved workers would be a small fraction of the DOE-recommended Administrative Control Level of 500 millirem per year.

#### 4.1.10.12 Worker Chemical Risks

Workers involved in performing activities associated with the storage, retrieval, and processing of tank waste and the closure of tank farm facilities could be exposed to chemical vapors. Chemical exposure is a concern because the tanks are continuously vented to the atmosphere, and workers would need to access parts of the tank farm system to monitor or retrieve the waste. The primary route of chemical exposure to workers during routine operations was assumed to be inhalation.

Estimates of worker exposure to chemicals and resulting health effects are highly dependent on the modeling assumptions used. If a worker is assumed to be very close to the chemical emission point, the predicted consequences might vary from zero to extreme (severe, irreversible health effects), depending on the assumed duration of the release and exposure and the location of the worker with respect to the emission point and wind direction. Therefore, no attempt was made to estimate involved worker exposure to chemical releases associated with routine operations.

Based on historical reports of effects of tank farm exposures, workers exposed to tank farm vapors during waste retrieval, waste treatment, and tank closure activities could experience headaches, burning sensations in the nose and throat, nausea, and impaired pulmonary function. Past experience implies that if these impacts were experienced, they would be transient and would have no long-lasting deleterious effects. To avoid this potential health risk, workers in certain areas of the tank farms would be required to use supplied-air respirators. Through compliance with applicable requirements and the scrutiny provided by internal and external review of chemical exposure issues, it is expected that involved worker exposure would be maintained below the thresholds identified by the Occupational Safety and Health Administration and the American Conference of Governmental Industrial Hygienists.

## 4.1.11 Public and Occupational Health and Safety—Facility Accidents

This section addresses potential impacts on workers and the public associated with accidents that may occur under the alternatives. For each alternative, radiological impacts of postulated accident scenarios were quantified for an MEI living near Hanford, the offsite population living within 80 kilometers (50 miles) of the facility, and a noninvolved worker assumed to be 100 meters (110 yards) from the facility. Hazardous chemical impacts were also evaluated. For an involved worker, accident consequences were not quantified. While involved workers are expected to be near the Hanford tank farms during routine tank farm operations, as is the case under Tank Closure Alternative 1: No Action, or in the WTP or other waste treatment facilities during facility operations, their number and location relative to a postulated accident are unknown. In the event of an accident involving chemicals or radioactive materials, workers near an accident could be at risk of serious injury or fatality. Safety procedures, safety equipment, and protective barriers are typical features that would prevent or minimize worker impacts. Additionally, following initiation of accident/site emergency alarms, workers in adjacent areas of the facility would evacuate in accordance with the technical area and facility emergency operating procedures and training. Therefore, involved worker impacts are not discussed further relative to the alternatives. The impacts of selected intentional acts of destruction scenarios are addressed in Appendix K, Section K.3.11.

There would be no radiological accidents associated with facility construction, including construction of the WTP, under any action alternative. Further, any hazardous chemical accidents associated with facility construction would be typical of those normally associated with industrial construction materials, hazards, and practices. Projected operational accident consequences of each alternative are presented in the following sections. Details of the methodology for assessing the potential impacts on workers and the public associated with postulated accidents are presented in Appendix K, Section K.3.

### 4.1.11.1 Alternative 1: No Action

#### 4.1.11.1.1 Radiological Impacts of Airborne Releases

Under Tank Closure Alternative 1, reasonably foreseeable accidents that could occur include (1) hydrogen burn in a waste storage tank and (2) tank dome collapse. The accident selected to represent a severe accident is the seismically induced waste tank dome collapse.

The consequences of a seismically induced waste tank dome collapse, if it were to occur, are shown in Table 4–45. The annual risks of LCFs for this accident, which were obtained by multiplying the consequences by the likelihood (frequency per year) that the accident would occur, are shown in Table 4–46.

**Table 4–45. Tank Closure Alternative 1 Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (i.e., TK53) corresponds with the code in the accident's description in Appendix K, Section K.3.4.
[b] Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.
[c] Based on a population of 589,668 persons residing within 80 kilometers (50 miles) of the 200-West Area (see Appendix K, Section K.2.1.1.3.2).
[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** LCF=latent cancer fatality.
**Source:** Appendix K, Section K.3.7.1.

**Table 4–46. Tank Closure Alternative 1 Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |

[a] The alphanumeric code following the accident's title (i.e., TK53) corresponds with the code in the accident's description in Appendix K, Section K.3.4.
[b] Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.
[c] Based on a population of 589,668 persons residing within 80 kilometers (50 miles) of the 200-West Area (see Appendix K, Section K.2.1.1.3.2).
[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Source:** Appendix K, Section K.3.7.1.

#### 4.1.11.1.2 Hazardous Chemical Impacts

Various hazardous chemicals exist in the waste tanks. Because the chemicals that exist in the tank waste are mixed with the radioactive material, any accident event is expected to release both hazardous chemicals and radioactive materials. Due to the quantity and nature of the radioactive material in the waste tanks, the human health consequences of an accidental release would be dominated by the impacts of the radioactive components. Therefore, hazardous chemical human health impacts were not analyzed separately.

### 4.1.11.2 Alternative 2A: Existing WTP Vitrification; No Closure

#### 4.1.11.2.1 Radiological Impacts of Airborne Releases

Table 4–47 shows the consequences of the postulated set of accidents for the MEI, the general population (the offsite population within 80 kilometers [50 miles]), and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–48 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

**Table 4–47. Tank Closure Alternative 2A Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($4\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | 0.000014 | $9\times10^{-9}$ | 0.25 | 0 ($1\times10^{-4}$) | 0.043 | $3\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatality; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–48. Tank Closure Alternative 2A Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | $5\times10^{-4}$ | $4\times10^{-12}$ | 0 ($7\times10^{-8}$) | $1\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–48) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–47).

#### 4.1.11.2.2 Hazardous Chemical Impacts

Various hazardous chemicals exist in the waste tanks, and others are used in the tank closure and waste treatment processes. The chemicals that exist in the tank waste are mixed with the radioactive material; thus, any accident event is expected to release both hazardous chemicals and radioactive materials. Due to the quantity and nature of the radioactive material in the waste tanks, the human health consequences of an accidental release would be dominated by the impacts of the radioactive components. Therefore, hazardous chemical human health impacts of concern are primarily associated with the tank closure and waste treatment processes.

Two chemicals used in the WTP processes, nitric acid and ammonia, whose impacts are considered representative of the impacts that may result from the accidental release of any other chemical associated with the tank closure and treatment processes, have been selected for accident analysis. The selection of these two chemicals is based on their large inventories, potential for release, chemical properties, and human health effects. For both chemicals, an accident scenario is postulated in which a break in a tank or piping occurs, allowing the chemical to be released over a short period. The cause of the break could be mechanical failure, corrosion, mechanical impact, malevolent act, or natural phenomenon. The frequency of these types of events is in the range of 0.001 to 0.01 per year. The nitric acid pools within a berm surrounding the storage tank and evaporates, forming a plume that disperses into the environment. Ammonia is stored as a liquid under pressure and is released from its storage tank in a gaseous form. In both cases, the plume moves away from the point of release in the direction of the prevailing wind and potentially impacts workers and the public.

Table 4–49 shows the estimated concentrations of each chemical at specified distances for comparison with the 60-minute Acute Exposure Guideline Levels (AEGLs) 2 and 3 (EPA 2007). The levels of concern for ammonia are 160 ppm for AEGL-2 and 1,100 ppm for AEGL-3. The levels of concern for nitric acid are 24 ppm for AEGL-2 and 92 ppm for AEGL-3. The results indicate that AEGL-2 and AEGL-3 thresholds are not exceeded beyond the nearest site boundary. For the noninvolved worker 100 meters (110 yards) from the accident, both the AEGL-2 and AEGL-3 thresholds would be exceeded for the ammonia release, but not for the nitric acid release.

**Table 4–49. Tank Closure Alternatives Chemical Impacts of Accidents**

| Chemical | Quantity Released (liters) | AEGL-2[a] | | AEGL-3[b] | | Concentration (ppm) | |
|---|---|---|---|---|---|---|---|
| | | Limit (ppm) | Distance to Limit (meters) | Limit (ppm) | Distance to Limit (meters) | Noninvolved Worker at 100 meters | Nearest Site Boundary at 8,600 meters |
| Ammonia | 43,500 | 160 | 2,450 | 1,100 | 730 | 41,000 | 27.0 |
| Nitric acid | 64,400 | 24 | <30 | 92 | <30 | 4.7 | 0.004 |

[a] AEGL-2 is the airborne concentration (expressed as ppm or milligrams per cubic meter) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting, adverse health effects or an impaired ability to escape (EPA 2007).

[b] AEGL-3 is the airborne concentration (expressed as ppm or milligrams per cubic meters) of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death (EPA 2007).

**Note:** To convert liters to gallons, multiply by 0.26417; meters to yards, by 1.0936.

**Key:** AEGL=Acute Exposure Guideline Level; ppm=parts per million.

**Source:** Appendix K, Section K.3.9.1.

### 4.1.11.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

#### 4.1.11.3.1 Radiological Impacts of Airborne Releases

Table 4–50 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–51 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

**Table 4–50. Tank Closure Alternative 2B Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day) | 0.000043 | $3\times10^{-8}$ | 0.74 | 0 ($4\times10^{-4}$) | 0.13 | $8\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

a The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

b Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

c Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

d The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatalities; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–51. Tank Closure Alternative 2B Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day) | $5\times10^{-4}$ | $1\times10^{-11}$ | 0 ($2\times10^{-7}$) | $4\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–51) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–50).

#### 4.1.11.3.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

### 4.1.11.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

#### 4.1.11.4.1 Radiological Impacts of Airborne Releases

Table 4–52 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–53 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–53) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–52).

#### 4.1.11.4.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

**Table 4–52. Tank Closure Alternative 3A Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | 0.000014 | $9\times10^{-9}$ | 0.25 | 0 ($1\times10^{-4}$) | 0.043 | $3\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Bulk vitrification waste receipt tank failure – unmitigated (200-East Area) (BV61) | 0.000000028 | $2\times10^{-11}$ | 0.00049 | 0 ($3\times10^{-7}$) | 0.000083 | $5\times10^{-8}$ |
| Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61) | 0.0000035 | $2\times10^{-9}$ | 0.021 | 0 ($1\times10^{-5}$) | 0.0032 | $2\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | 0.0000022 | $1\times10^{-9}$ | 0.038 | 0 ($2\times10^{-5}$) | 0.0025 | $1\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | 0.0000066 | $4\times10^{-9}$ | 0.040 | 0 ($2\times10^{-5}$) | 0.0024 | $1\times10^{-6}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatalities; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–53. Tank Closure Alternative 3A Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | $5\times10^{-4}$ | $4\times10^{-12}$ | 0 ($7\times10^{-8}$) | $1\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Bulk vitrification waste receipt tank failure – unmitigated (200-East Area) (BV61) | $5\times10^{-4}$ | $8\times10^{-15}$ | 0 ($1\times10^{-10}$) | $3\times10^{-11}$ |
| Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61) | $5\times10^{-4}$ | $1\times10^{-12}$ | 0 ($6\times10^{-9}$) | $1\times10^{-9}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | $5\times10^{-4}$ | $6\times10^{-13}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | $5\times10^{-4}$ | $2\times10^{-12}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

a The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

b Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

c Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

d The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MEI=maximally exposed individual; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

### 4.1.11.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

#### 4.1.11.5.1 Radiological Impacts of Airborne Releases

Table 4–54 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–55 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables

were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

**Table 4–54. Tank Closure Alternative 3B Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feeder preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | 0.000014 | $9\times10^{-9}$ | 0.25 | 0 ($1\times10^{-4}$) | 0.043 | $3\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71) | 0.000000028 | $2\times10^{-11}$ | 0.00049 | 0 ($3\times10^{-7}$) | 0.000083 | $5\times10^{-8}$ |
| Cast stone feed receipt tank failure – unmitigated (200-West Area) (CS71) | 0.0000035 | $2\times10^{-9}$ | 0.021 | 0 ($1\times10^{-5}$) | 0.0032 | $2\times10^{-6}$ |
| Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | 0.0000022 | $1\times10^{-9}$ | 0.038 | 0 ($2\times10^{-5}$) | 0.0025 | $1\times10^{-6}$ |
| Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | 0.0000066 | $4\times10^{-9}$ | 0.040 | 0 ($2\times10^{-5}$) | 0.0024 | $1\times10^{-6}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatality; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

## Table 4–55. Tank Closure Alternative 3B Annual Cancer Risks from Accidents

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | $5\times10^{-4}$ | $4\times10^{-12}$ | 0 ($7\times10^{-8}$) | $1\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71) | $5\times10^{-4}$ | $8\times10^{-15}$ | 0 ($1\times10^{-10}$) | $3\times10^{-11}$ |
| Cast stone feed receipt tank failure – unmitigated (200-West Area) (CS71) | $5\times10^{-4}$ | $1\times10^{-12}$ | 0 ($6\times10^{-9}$) | $1\times10^{-9}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | $5\times10^{-4}$ | $6\times10^{-13}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | $5\times10^{-4}$ | $2\times10^{-12}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

a The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the scenario's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

b Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

c Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

d The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MEI=maximum exposed individual; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–55) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–54).

#### 4.1.11.5.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

### 4.1.11.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

#### 4.1.11.6.1 Radiological Impacts of Airborne Releases

Table 4–56 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–57 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–57) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–56).

**Table 4–56. Tank Closure Alternative 3C Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | 0.000014 | $9\times10^{-9}$ | 0.25 | 0 ($1\times10^{-4}$) | 0.043 | $3\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Steam reforming feed receipt tank failure – unmitigated (200-East Area) (SRF1) | 0.000000028 | $2\times10^{-11}$ | 0.00049 | 0 ($3\times10^{-7}$) | 0.000083 | $5\times10^{-8}$ |
| Steam reforming feed receipt tank failure – unmitigated (200-West Area) (SRF1) | 0.0000035 | $2\times10^{-9}$ | 0.021 | 0 ($1\times10^{-5}$) | 0.0032 | $2\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | 0.0000022 | $1\times10^{-9}$ | 0.038 | 0 ($2\times10^{-5}$) | 0.0025 | $1\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | 0.0000066 | $4\times10^{-9}$ | 0.040 | 0 ($2\times10^{-5}$) | 0.0024 | $1\times10^{-6}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among t he population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatalities; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–57. Tank Closure Alternative 3C Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT 23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | $5\times10^{-4}$ | $4\times10^{-12}$ | 0 ($7\times10^{-8}$) | $1\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Steam reforming feed receipt tank failure – unmitigated (200-East Area) (SRF1) | $5\times10^{-4}$ | $8\times10^{-15}$ | 0 ($1\times10^{-10}$) | $3\times10^{-11}$ |
| Steam reforming feed receipt tank failure – unmitigated (200-West Area) (SRF1) | $5\times10^{-4}$ | $1\times10^{-12}$ | 0 ($6\times10^{-9}$) | $1\times10^{-9}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | $5\times10^{-4}$ | $6\times10^{-13}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | $5\times10^{-4}$ | $2\times10^{-12}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

a The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

b Increased risk of a latent cancer fatality, taking into account the probability (frequency) of the accident.

c Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

d The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MEI=maximally exposed individual; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

#### 4.1.11.6.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

### 4.1.11.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

#### 4.1.11.7.1 Radiological Impacts of Airborne Releases

Table 4–58 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–59 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–59) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–58).

#### 4.1.11.7.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

**Table 4–58. Tank Closure Alternative 4 Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | 0.000014 | $9\times10^{-9}$ | 0.25 | 0 ($1\times10^{-4}$) | 0.043 | $3\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71) | 0.000000028 | $2\times10^{-11}$ | 0.00049 | 0 ($3\times10^{-7}$) | 0.000083 | $5\times10^{-8}$ |
| Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61) | 0.0000035 | $2\times10^{-9}$ | 0.021 | 0 ($1\times10^{-5}$) | 0.0032 | $2\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | 0.0000022 | $1\times10^{-9}$ | 0.038 | 0 ($2\times10^{-5}$) | 0.0025 | $1\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | 0.0000066 | $4\times10^{-9}$ | 0.040 | 0 ($2\times10^{-5}$) | 0.0024 | $1\times10^{-6}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatalities; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–59. Tank Closure Alternative 4 Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day) | $5\times10^{-4}$ | $4\times10^{-12}$ | 0 ($7\times10^{-8}$) | $1\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71) | $5\times10^{-4}$ | $8\times10^{-15}$ | 0 ($1\times10^{-10}$) | $3\times10^{-11}$ |
| Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61) | $5\times10^{-4}$ | $1\times10^{-12}$ | 0 ($6\times10^{-9}$) | $1\times10^{-9}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | $5\times10^{-4}$ | $6\times10^{-13}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | $5\times10^{-4}$ | $2\times10^{-12}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

a The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

b Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

c Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

d The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MEI=maximally exposed individual; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

### 4.1.11.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

#### 4.1.11.8.1 Radiological Impacts of Airborne Releases

Table 4–60 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–61 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably

foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

**Table 4–60. Tank Closure Alternative 5 Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (45 MTG/day) | 0.000021 | $1\times10^{-8}$ | 0.37 | 0 ($2\times10^{-4}$) | 0.065 | $4\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×45 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71) | 0.000000028 | $2\times10^{-11}$ | 0.00049 | 0 ($3\times10^{-7}$) | 0.000083 | $5\times10^{-8}$ |
| Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61) | 0.0000035 | $2\times10^{-9}$ | 0.021 | 0 ($1\times10^{-5}$) | 0.0032 | $2\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | 0.0000022 | $1\times10^{-9}$ | 0.038 | 0 ($2\times10^{-5}$) | 0.0025 | $1\times10^{-6}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | 0.0000066 | $4\times10^{-9}$ | 0.040 | 0 ($2\times10^{-5}$) | 0.0024 | $1\times10^{-6}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatalities; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–61. Tank Closure Alternative 5 Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (45 MTG/day) | $5\times10^{-4}$ | $6\times10^{-12}$ | 0 ($1\times10^{-7}$) | $2\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×45 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71) | $5\times10^{-4}$ | $8\times10^{-15}$ | 0 ($1\times10^{-10}$) | $3\times10^{-11}$ |
| Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61) | $5\times10^{-4}$ | $1\times10^{-12}$ | 0 ($6\times10^{-9}$) | $1\times10^{-9}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81) | $5\times10^{-4}$ | $6\times10^{-13}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81) | $5\times10^{-4}$ | $2\times10^{-12}$ | 0 ($1\times10^{-8}$) | $7\times10^{-10}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

a The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

b Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

c Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

d The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MEI=maximally exposed individual; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–61) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–60).

#### 4.1.11.8.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

### 4.1.11.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.11.9.1 Radiological Impacts of Airborne Releases

#### 4.1.11.9.1.1 Base Case

Table 4–62 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–63 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

**Table 4–62. Tank Closure Alternative 6A Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (15 MTG/day) | 0.029 | $2\times10^{-5}$ | 500 | 0 ($3\times10^{-1}$) | 83 | $1\times10^{-1}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (15 MTG/day) | 0.046 | $3\times10^{-5}$ | 810 | 0 ($5\times10^{-1}$) | 160 | $2\times10^{-1}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (15×0 MTG/day) | 0.058 | $4\times10^{-5}$ | 1,000 | 0 ($6\times10^{-1}$) | 180 | $2\times10^{-1}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LCF=latent cancer fatalities; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–63. Tank Closure Alternative 6A Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (15 MTG/day) | $5\times10^{-4}$ | $9\times10^{-9}$ | 0 ($1\times10^{-4}$) | $5\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (15 MTG/day) | $5\times10^{-4}$ | $1\times10^{-8}$ | 0 ($2\times10^{-4}$) | $9\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (15×0 MTG/day) | $5\times10^{-4}$ | $2\times10^{-8}$ | 0 ($3\times10^{-4}$) | $1\times10^{-4}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; MEI=maximally exposed individual; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–63) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $3 \times 10^{-4}$ per year (about 1 chance in 3,600 per year). For the offsite MEI, the increased risk of an LCF would be $2 \times 10^{-8}$ per year (about 1 chance in 55 million per year). For a noninvolved worker, the increased risk of an LCF would be $1 \times 10^{-4}$ per year (about 1 chance in 9,000 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–62).

#### 4.1.11.9.1.2 Option Case

The radiological impacts of accidental airborne releases associated with the Option Case would be the same as those associated with the Base Case.

### 4.1.11.9.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios under the Base and Option Cases are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

### 4.1.11.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.11.10.1 Radiological Impacts of Airborne Releases

##### 4.1.11.10.1.1 Base Case

Table 4–64 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–65 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

**Table 4–64. Tank Closure Alternative 6B Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day) | 0.000043 | $3\times10^{-8}$ | 0.74 | 0 ($4\times10^{-4}$) | 0.13 | $8\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatalities; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–65) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–64).

**Table 4–65. Tank Closure Alternative 6B Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day) | $5\times10^{-4}$ | $1\times10^{-11}$ | 0 ($2\times10^{-7}$) | $4\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MEI=maximally exposed individual; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

#### 4.1.11.10.1.2 Option Case

The radiological impacts of accidental airborne releases associated with the Option Case would be the same as those associated with the Base Case.

### 4.1.11.10.2 Hazardous Chemical Impacts

#### 4.1.11.10.2.1 Base and Option Cases

Potential human health impacts of postulated chemical release scenarios for the Base and Option Cases are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

## 4.1.11.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

### 4.1.11.11.1 Radiological Impacts of Airborne Releases

Table 4–66 shows the consequences of the postulated set of accidents for the MEI, the general population, and a noninvolved worker. The consequences are the projected impacts assuming the accident occurs. Table 4–67 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the range of impacts of reasonably foreseeable accidents that could occur at the facilities. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–67) is the seismically induced WTP collapse and failure (accident WT41). Taking the likelihood of this accident into account, the increased risk of a single LCF occurring in the offsite population would be $2 \times 10^{-2}$ per year (about 1 chance in 50 per year). For the offsite MEI, the increased risk of an LCF would be $1 \times 10^{-6}$ per year (about 1 chance in 770,000 per year). For a noninvolved worker, the increased risk of an LCF would be $8 \times 10^{-3}$ per year (about 1 chance in 130 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the exposure to radioactivity and risk of developing an LCF would depend on the distance and other factors, but generally would be higher. If this accident were to occur, it would have the highest consequences (see Table 4–66).

**Table 4–66. Tank Closure Alternative 6C Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | 0.0013 | $8\times10^{-7}$ | 7.6 | 0 ($5\times10^{-3}$) | 1.4 | $8\times10^{-4}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | 0.0070 | $4\times10^{-6}$ | 120 | 0 ($7\times10^{-2}$) | 24 | $3\times10^{-2}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | 0.88 | $5\times10^{-4}$ | 15,000 | 9 | 2,900 | 1 |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | 0.011 | $7\times10^{-6}$ | 200 | 0 ($1\times10^{-1}$) | 33 | $4\times10^{-2}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | 0.019 | $1\times10^{-5}$ | 320 | 0 ($2\times10^{-1}$) | 63 | $8\times10^{-2}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day) | 0.000043 | $3\times10^{-8}$ | 0.74 | 0 ($4\times10^{-4}$) | 0.13 | $8\times10^{-5}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day) | 4.3 | $3\times10^{-3}$ | 75,000 | $5\times10^{1}$ | 13,000 | 1 |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | 0.00021 | $1\times10^{-7}$ | 1.3 | 0 ($8\times10^{-4}$) | 0.22 | $1\times10^{-4}$ |
| IHLW glass canister drop – unmitigated (SH91) | 0.00026 | $2\times10^{-7}$ | 4.6 | 0 ($3\times10^{-3}$) | 0.91 | $5\times10^{-4}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased likelihood of a latent cancer fatality, assuming the accident occurs, except at high individual doses (hundreds of rem or more), where acute radiation injury may cause death within weeks. Value cannot exceed 1.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; LCF=latent cancer fatalities; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

**Table 4–67. Tank Closure Alternative 6C Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | MEI[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Spray release from jumper pit during waste retrieval – unmitigated (TK51) | $1.1\times10^{-2}$ | $8\times10^{-9}$ | 0 ($5\times10^{-5}$) | $9\times10^{-6}$ |
| Spray leak in transfer line during excavation – unmitigated (PT23) | $1\times10^{-4}$ | $4\times10^{-10}$ | 0 ($7\times10^{-6}$) | $3\times10^{-6}$ |
| Pretreatment Facility waste feed receipt vessel or piping leak – unmitigated (PT22) | $5\times10^{-4}$ | $3\times10^{-7}$ | 0 ($5\times10^{-3}$) | $2\times10^{-3}$ |
| Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day) | $5\times10^{-4}$ | $3\times10^{-9}$ | 0 ($6\times10^{-5}$) | $2\times10^{-5}$ |
| HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day) | $5\times10^{-4}$ | $6\times10^{-9}$ | 0 ($1\times10^{-4}$) | $4\times10^{-5}$ |
| Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day) | $5\times10^{-4}$ | $1\times10^{-11}$ | 0 ($2\times10^{-7}$) | $4\times10^{-8}$ |
| Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day) | $5\times10^{-4}$ | $1\times10^{-6}$ | 0 ($2\times10^{-2}$) | $8\times10^{-3}$ |
| Seismically induced waste tank dome collapse – unmitigated (TK53) | $5\times10^{-4}$ | $6\times10^{-11}$ | 0 ($4\times10^{-7}$) | $7\times10^{-8}$ |
| IHLW glass canister drop – unmitigated (SH91) | $1\times10^{-3}$ | $2\times10^{-10}$ | 0 ($3\times10^{-6}$) | $5\times10^{-7}$ |

[a] The alphanumeric code following the accident's title (e.g., TK51) corresponds with the code in the accident's description in Appendix K, Section K.3.4. The term "*Z*×*Y* MTG/day," read as "*Z* by *Y* MTG/day," refers to a WTP design capacity of *Z* MTG/day of HLW and *Y* MTG/day of LAW; for example, 6×30, 6×45, 6×90, or 15×0 MTG/day.

[b] Increased risk of a latent cancer fatality to the individual, taking into account the probability (frequency) of the accident.

[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MEI=maximally exposed individual; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.

**Source:** Appendix K, Section K.3.7.1.

#### 4.1.11.11.2 Hazardous Chemical Impacts

The potential human health impacts of the postulated chemical release scenarios are expected to be the same as those described under Tank Closure Alternative 2A in Section 4.1.11.2.2.

### 4.1.11.12 Intentional Destructive Acts

This section addresses potential impacts of intentional destructive acts at tank farm and WTP facilities. To protect against such actions, safeguards and security measures are employed at all DOE facilities. In accordance with DOE orders, DOE conducts vulnerability assessments and risk analyses of facilities and equipment under its jurisdiction to evaluate the physical protection elements, technologies, and administrative controls needed to protect DOE assets. DOE also protects against espionage, sabotage, and theft of radioactive, chemical, or biological materials; classified information and matter; non-nuclear weapon components; and critical technologies. Before startup of any new or substantially modified operations, DOE would conduct an in-depth, site-specific safeguards and security inspection to ensure that existing programs satisfy DOE requirements. Any inadequacies would be resolved before startup of operations. Release scenarios and impacts resulting from intentional destructive acts may be similar to a number of the accident scenarios analyzed in this EIS. Additional scenarios representing intentional destructive acts that may not be represented by the accident analyses were also considered. The potential

for and consequences of the intentional destructive act scenarios would be essentially the same under each of the alternatives, except for Alternative 1: No Action, for which the scenarios involving the WTP would not apply.

**Explosive Device in Underground Waste Tank**. It was postulated that intentionally initiated explosions occur that displace a large portion of the soil overburden, breach the tank dome, and disperse a portion of the tank waste into the atmosphere. In accordance with the recommendation from *Airborne Release Fractions/Rates and Respirable Fractions for Nonreactor Nuclear Facilities*, Vol. 1, *Analysis of Experimental Data* (DOE Handbook 3010-94), the respirable release would be less than the TNT [trinitrotoluene]-equivalent weight of the explosive charge. Analysis results indicate that the radiological impacts of an explosive device in an underground waste tank would be about four times greater than the impacts of the most severe accident scenario that involved the same inventory of radioactive material (TK53, seismically induced waste tank dome collapse). The offsite population dose was estimated to be 4.9 person-rem, with no ($3 \times 10^{-3}$) resulting additional LCFs. The MEI dose would be 0.00083 rem, corresponding to an increased risk of an LCF of $5 \times 10^{-7}$. The noninvolved worker dose would be 0.88 rem, corresponding to an increased risk of an LCF of $5 \times 10^{-4}$.

**Aircraft or Ground Vehicle Impact on WTP**. A vehicle or aircraft crash and/or explosions initiated by an insider were postulated. It was assumed that these acts would be sufficiently energetic to breach a portion of the HLW Vitrification Facility exterior wall and the radiation shield wall that protects the two HLW melter feed preparation vessels. For purposes of this analysis, it was postulated that the two vessels were breached, causing the contents to spill into the cell. At the same time, aircraft or vehicle fuel was assumed to enter the cell and burn. The spilled radioactive waste slurry was assumed to heat to the boiling point, and radioactive material was assumed to be released to the environment through holes in the building walls. Analysis results indicate that the radiological impacts would be less than one-tenth of those calculated for the most severe accident scenario that involved the same inventory of radioactive material (WT41, seismically induced WTP collapse and failure – unmitigated). The offsite population dose was estimated to be 4,400 person-rem, which would result in 3 additional LCFs. The MEI dose would be 0.25 rem with an increased risk of an LCF of $2 \times 10^{-4}$. The noninvolved worker dose would be 860 rem, which could result in a near-term fatality.

**Intentional Breach of WTP Ammonia Tank.** An intentional destructive act was postulated whereby an explosion causes massive damage to the WTP ammonia tank. The entire 43,500 liters (11,500 gallons) of liquid ammonia were assumed to vaporize over a period of 1 minute. Under this scenario, exposed persons could experience life-threatening health effects or death at distances up to 8 kilometers (5 miles), about 10 times farther than for the accident scenario that involved the same chemical inventory (tank failure with release of entire contents in 30 minutes).

The impacts and mitigation of intentional destructive acts are discussed in more detail in Appendix K, Section K.3.11.

### 4.1.12 Public and Occupational Health and Safety—Transportation

Impacts of transporting radioactive materials are predominantly categorized as radiological or nonradiological impacts. Radiological impacts are those associated with the accidental release of radioactive materials and the effects of low levels of radiation emitted during normal (incident-free) transportation. Nonradiological impacts are those associated with transportation, regardless of the nature of the cargo, such as accidents resulting in death or injury when there is no release of radioactive material.

Packages containing radioactive materials emit low levels of radiation during incident-free transportation. The amount of radiation emitted depends on the kind and amount of material being transported. U.S. Department of Transportation (DOT) regulations require that packages containing radioactive

materials have sufficient radiation shielding to limit the radiation to an acceptable level of 10 millirems per hour at 2 meters (6.6 feet) from the transporter. For incident-free transportation, the potential human health impacts of the radiation field surrounding the transportation packages were estimated for transportation workers and the general population along the route (off traffic, or off-link), people sharing the route (in traffic, or on-link), people at rest areas, and people at stops along the route. The RADTRAN computer program (Weiner et al. 2009) was used to estimate the incident-free impacts on transportation workers and populations, as well as the impact on an MEI (for example, a person stuck in traffic, a gas station attendee, an inspector) who could be a worker or a member of the public.

Transportation accidents involving radioactive materials present both nonradiological and radiological risks to workers and the public. Nonradiological impacts of potential transportation accidents include traffic accident fatalities. A release of radioactive material during transportation accidents would occur only when the package carrying the material is subjected to accident forces that exceed the package design standard. The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing the individual risks from all accident severities, irrespective of their likelihood of occurrence. The analysis of accident risks takes into account a spectrum of accident severities ranging from high-probability accidents of low severity (e.g., fender bender) to hypothetical high-severity accidents that have a low probability of occurrence. Only as a result of a severe fire and/or a powerful collision, which are of extremely low probability, could a transportation package of the type used to transport radioactive material off site under the alternatives of this EIS be damaged to the extent that there could be a release of radioactivity to the environment with substantial consequences.

In addition to calculating the radiological risks that would result from all accidents during transportation of radioactive waste, DOE assessed the highest consequences of a maximum reasonably foreseeable accident with a radioactive release frequency greater than $1 \times 10^{-7}$ (1 chance in 10 million) per year along the route. The consequences of the maximum reasonably foreseeable accident were determined for prevailing atmospheric conditions. The analysis used the RISKIND computer program to estimate doses to individuals and populations (Yuan et al. 1995). Results from this analysis are presented in Appendix H, Sections H.7.1 through H.7.3.

Incident-free health impacts and radiological accident health impacts are expressed in terms of additional LCFs, and nonradiological accident risk is expressed as additional immediate (traffic) fatalities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by 0.0006 LCFs per person-rem of exposure.

In determining transportation risks, per-shipment risk factors were calculated for incident-free and radiological accident conditions using RADTRAN in conjunction with the TRAGIS [Transportation Routing Analysis Geographic Information System] computer program (Johnson and Michelhaugh 2003) to choose transportation routes in accordance with DOT regulations. The TRAGIS program calculates transportation routes in terms of distances traveled in rural, urban, and suburban areas. It provides 2000 census–based population density estimates for each area along the routes to determine population radiological risk factors. The population densities were updated to be representative of 2010 using data from the 2010 census (Census 2010). For incident-free operations, the affected population includes individuals living within 800 meters (0.5 miles) of each side of the road or rail line. For radiological accident conditions, the affected population includes individuals living within 80 kilometers (50 miles) of the accident, and the MEI was assumed to be an individual located 100 meters (330 feet) directly downwind from the accident. Additional details on the analysis approach and on modeling and parameter selections are provided in Appendix H.

Table 4–68 provides the estimated number of waste shipments under each alternative by waste type. A shipment is defined as the amount of waste transported on a single truck or a single railcar.

**Table 4–68. Tank Closure Alternatives – Estimated Number of Radioactive Waste Shipments**

| | Number of Shipments | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Offsite Shipments | | Onsite Shipments | | | | | | | |
| Alternative | CH-TRU Waste[a] | RH-TRU Waste[a] | IHLW[b] | ILAW Glass | Bulk Vit. Waste | Cast Stone Waste | Steam Reforming Waste | CH-TRU Waste | RH-TRU Waste | Other Wastes[c] |
| 2A | N/A | N/A | 12,300 | 92,300 | N/A | N/A | N/A | N/A | N/A | 30 |
| 2B | N/A | N/A | 12,300 | 92,300 | N/A | N/A | N/A | N/A | N/A | 23,600 |
| 3A | 170 | 3,400 | 9,000 | 28,500 | 6,000 | N/A | N/A | 180 | 730 | 23,600 |
| 3B | 170 | 3,400 | 9,000 | 28,500 | N/A | 23,300 | N/A | 180 | 730 | 23,600 |
| 3C | 170 | 3,400 | 9,000 | 28,500 | N/A | N/A | 58,000 | 180 | 730 | 23,600 |
| 4 | 170 | 3,400 | 11,100 | 28,700 | 2,400 | 14,400 | N/A | 180 | 740 | 84,600 |
| 5 | 160 | 3,100 | 8,100 | 31,100 | 2,200 | 8,100[d] | N/A | 160 | 660 | 10 |
| 6A Base Case | N/A | N/A | 172,000 | 820 | N/A | N/A | N/A | N/A | N/A | 250,000 |
| 6A Option Case | N/A | N/A | 172,000 | 18,400 | N/A | N/A | N/A | N/A | N/A | 684,000 |
| 6B Base Case | N/A | N/A | 12,300 | 93,800 | N/A | N/A | N/A | N/A | N/A | 250,000 |
| 6B Option Case | N/A | N/A | 12,300 | 111,000 | N/A | N/A | N/A | N/A | N/A | 684,000 |
| 6C | N/A | N/A | 12,300 | 92,300 | N/A | N/A | N/A | N/A | N/A | 23,600 |

[a] Values are for truck shipments. Rail shipments are one-half of the values given.
[b] The IHLW canisters include 340 cesium and strontium high-level radioactive waste canisters.
[c] Other wastes include high-activity waste (equipment and soils), contaminated soil and grout from the Preprocessing Facility, and end-of-life WTP LAW melters, as applicable.
[d] This number includes 6,120 shipments of sulfate grout.

**Note:** No radioactive waste would be transported under Alternative 1. Transportation impacts under Alternative 1 are limited to those activities involving transport of construction materials (see Section 4.1.12.1). The number of shipments is rounded to the nearest ten between 10 and 1,000 shipments, and nearest hundred between 1,000 and 100,000 shipments.

**Key:** CH=contact-handled; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; N/A=not applicable; RH=remote-handled; TRU=transuranic; Vit.=vitrification; WTP=Waste Treatment Plant.

**Source:** Appendix H, Section H.7.1.

Table 4–69 summarizes the total offsite and onsite transportation impacts expected under each Tank Closure alternative. This table shows that the dose to the population along the offsite routes (see column 6 of Table 4–69: offsite rows) is expected to be between the lowest expected dose of about 170 person-rem under Tank Closure Alternative 5, and the highest expected dose of about 190 person-rem, associated with the transport of TRU waste to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, under Tank Closure Alternatives 3A, 3B, 3C, and 4. The additional LCFs that are expected from such exposures to the general population would be less than 1 for all alternatives, ranging from 0.10 to 0.11. Similarly, the lowest expected dose to the crew transporting wastes to offsite disposal facilities (see column 4 of Table 4–69: offsite rows) would be under Alternative 5 (about 570 person-rem), while the highest would be under Alternative 4 (about 630 person-rem ). The additional LCFs expected among the exposed transportation crews would be less than 1, ranging from 0.34 to 0.38. Under all of the alternatives, no combination of transports (off site and on site) is expected to result in an LCF among the exposed population or transportation crews. The expected number of offsite traffic fatalities from accidents involving radioactive material transport is 0 (0.35). Considering that the durations of alternatives range from 20 to over 150 years, and that traffic fatalities in the United States average about 40,000 per year, the expected risk of a traffic fatality is small.

**Table 4–69. Tank Closure Alternatives – Risks of Transporting Radioactive Waste**

| Alternative | Transport | Number of Shipments[a] | Incident-Free | | | | Accident | | One-Way Offsite Travel ($10^6$ km) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Crew | | Population | | | | |
| | | | Dose (person-rem) | Risk[b] | Dose (person-rem) | Risk[b] | Rad. Risk[b, c] | Nonrad. Risk[b] | |
| 2A | Off site | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | On site | 105,000 | 260 | 0.16 | 73 | 0.04 | $1.6\times10^{-13}$ | 0.04 | N/A |
| 2B | Off site | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | On site | 128,000 | 260 | 0.16 | 73 | 0.04 | $2.1\times10^{-9}$ | 0.05 | N/A |
| 3A | Off site | 3,600 | 620 | 0.37 | 190 | 0.11 | $4.3\times10^{-5}$ | 0.34 | 11.0 |
| | On site | 68,000 | 220 | 0.13 | 160 | 0.09 | $8.8\times10^{-8}$ | 0.03 | N/A |
| 3B | Off site | 3,600 | 620 | 0.37 | 190 | 0.11 | $4.3\times10^{-5}$ | 0.34 | 11.0 |
| | On site | 85,300 | 460 | 0.28 | 77 | 0.05 | $8.8\times10^{-8}$ | 0.04 | N/A |
| 3C | Off site | 3,600 | 620 | 0.37 | 190 | 0.11 | $4.3\times10^{-5}$ | 0.34 | 11.0 |
| | On site | 120,000 | 600 | 0.36 | 150 | 0.09 | $8.8\times10^{-8}$ | 0.05 | N/A |
| 4 | Off site | 3,600 | 630 | 0.38 | 190 | 0.11 | $4.3\times10^{-5}$ | 0.34 | 11.1 |
| | On site | 142,000 | 460 | 0.27 | 110 | 0.07 | $1.0\times10^{-7}$ | 0.06 | N/A |
| 5 | Off site | 3,200 | 570 | 0.34 | 170 | 0.10 | $3.9\times10^{-5}$ | 0.31 | 10.0 |
| | On site | 50,300 | 220 | 0.13 | 85 | 0.05 | $7.8\times10^{-8}$ | 0.02 | N/A |
| 6A Base | Off site | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | On site | 423,000 | 450 | 0.27 | 60 | 0.04 | $6.5\times10^{-8}$ | 0.15 | N/A |
| 6A Option | Off site | N/A | N/A | N/A | N/A | N/A | N/A | 0.00 | N/A |
| | On site | 874,000 | 870 | 0.52 | 100 | 0.06 | $9.4\times10^{-8}$ | 0.35 | N/A |
| 6B Base | Off site | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | On site | 356,000 | 560 | 0.34 | 89 | 0.05 | $6.5\times10^{-8}$ | 0.15 | N/A |
| 6B Option | Off site | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | On site | 808,000 | 980 | 0.59 | 130 | 0.08 | $9.4\times10^{-8}$ | 0.35 | N/A |
| 6C | Off site | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | On site | 128,000 | 260 | 0.16 | 73 | 0.04 | $2.1\times10^{-9}$ | 0.05 | N/A |

[a] Offsite shipments are based on truck transport of transuranic waste (current practice for transport to Waste Isolation Pilot Plant).
[b] Risk is expressed in terms of latent cancer fatalities, except for the nonradiological, where it refers to the number of accident fatalities.
[c] To calculate accident population dose (person-rem), divide the values in this column by 0.0006. For additional insight on how this dose is calculated, see the text in Section 4.1.12.

**Note:** No radioactive waste would be transported under Alternative 1. Transportation impacts under Alternative 1 are limited to those activities involving transport of construction materials (see Section 4.1.12.1). To convert kilometers to miles, multiply by 0.6214.

**Key:** km=kilometers; N/A=not applicable; nonrad.=nonradiological; rad.=radiological.

**Source:** Appendix H, Section H.7.1.

The risks to different receptors under incident-free transportation conditions were estimated on a per-trip or per-event basis because it is unlikely that the same person would be exposed to multiple events; for those that could have multiple exposures, the dose over the duration of transportation activities could be calculated by multiplying by the number of events or trips. The dose to the maximally exposed transportation worker is discussed for each alternative below. For a receptor who is a member of the public residing along a transportation route, the dose over the duration of transportation activities would depend on the number of truck or rail shipments passing a particular point and would be independent of the actual route being considered. The maximum dose to this resident, if all the materials were shipped along this route, would be about 1 millirem for all action alternatives. Refer to Appendix H, Table H–9, for additional results.

Table 4–70 summarizes the impacts of transporting nonradioactive feed and support materials required to construct new facilities, as well as materials required to immobilize, vitrify, or solidify the liquid waste and transport it to storage or burial locations. The construction materials considered are concrete, cement, sand/gravel/dirt, asphalt, steel, and piping. The materials required for waste solidification and transport include glass formers, fly ash, blast furnace slag, canisters, cylinders, and boxes. The table shows the impacts in terms of total kilometers, accidents, and fatalities for each alternative. The results in Table 4–70 indicate that, for the Tank Closure alternatives, the potential for traffic fatalities would be the largest under Alternative 6A, Option Case, which would have the potential for nine fatalities, followed by Alternative 3C and Alternative 6A, Base Case, which would have the potential for approximately five and four fatalities, respectively. Considering that the duration of Alternative 6A is over 150 years, the estimated annual fatality is very small.

**Table 4–70. Tank Closure Alternatives – Estimated Impacts of Construction and Operational Material Transport**

| Alternative | Total Distance Traveled (million kilometers) | Number of Accidents | Number of Traffic Fatalities |
|---|---|---|---|
| 1 | 1.0 | 0.21 | 0.01 |
| 2A | 50 | 10 | 0.65 |
| 2B | 64 | 13 | 0.84 |
| 3A | 91 | 18 | 1.2 |
| 3B | 93 | 19 | 1.2 |
| 3C | 410 | 82 | 5.3 |
| 4 | 120 | 24 | 1.6 |
| 5 | 88 | 18 | 1.2 |
| 6A Base | 290 | 60 | 3.8 |
| 6A Option | 700 | 140 | 9.2 |
| 6B Base | 140 | 28 | 1.8 |
| 6B Option | 270 | 55 | 3.5 |
| 6C | 71 | 14 | 0.92 |

**Note:** To convert kilometers to miles, multiply by 0.6214.
**Source:** Appendix H, Section H.8.

#### 4.1.12.1 Alternative 1: No Action

Under Tank Closure Alternative 1, transportation impacts would be limited to those activities involving transport of construction materials from onsite and/or offsite (local and regional) locations to Hanford to support construction activities, tank farm infrastructure and tank upgrades, and administrative control activities. The transportation impacts of these activities would be 1.0 million kilometers (0.6 million miles) traveled, 0 (0.21) traffic accidents, and 0 (0.01) traffic fatalities (see Table 4–70).

#### 4.1.12.2 Alternative 2A: Existing WTP Vitrification; No Closure

Under this alternative, no offsite radioactive waste shipments would be made. However, 105,000 truck shipments would be made to transport radioactive wastes to onsite storage and burial grounds (see Table 4–69).

##### 4.1.12.2.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities on site under this alternative was estimated at about 260 person-rem (see column 4 of Table 4–69); the dose to the public would be about 73 person-rem (see column 6 of Table 4–69). Accordingly, incident-free transportation of radioactive

material would result in 0 (0.16) LCFs among transportation workers and 0 (0.04) LCFs in the total affected population over the duration of transportation activities. LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by $6.0 \times 10^{-4}$ LCFs per person-rem. Note that the maximum annual dose to a transportation crewmember would be 100 millirem, unless the individual is a trained radiation worker, in which case the maximum annual dose would be 2 rem (DOE Standard 1098-2008). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is $1.2 \times 10^{-3}$. Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

#### 4.1.12.2.2 Impacts of Accidents During Transportation

As stated earlier, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of maximum reasonably foreseeable accidents and impacts of all foreseeable accidents (total transportation accidents).

Because no offsite radioactive waste shipments would be made under this alternative, the maximum reasonably foreseeable offsite transportation accident would have a probability of occurrence of less than 1 chance in 10 million per year. Therefore, no further impacts analyses have been performed.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of $2.7 \times 10^{-10}$ person-rem, resulting in $1.6 \times 10^{-13}$ LCFs, and traffic accidents resulting in 0 (0.04) fatalities.

#### 4.1.12.2.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The impacts in terms of total distance traveled, accidents, and traffic fatalities under this alternative would be 50 million kilometers (30.9 million miles), 10 traffic accidents, and 1 (0.65) fatality over the entire period from construction through deactivation. Considering that the duration of this alternative is about 75 years, the estimated annual impact is very small.

### 4.1.12.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

Under this alternative, no offsite radioactive waste shipments would be made. However, 128,000 truck shipments would be made to transport various radioactive wastes to onsite storage and burial grounds (see Table 4–69).

#### 4.1.12.3.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities on site under this alternative was estimated at about 260 person-rem; the dose to the public would be about 73 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.16) LCFs among transportation workers and 0 (0.04) LCFs in the total affected population over the duration of transportation activities.

#### 4.1.12.3.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident under this alternative has a probability of occurrence of less than 1 in 10 million per year. The consequences of such an accident would be similar to those described under Alternative 2A.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population (on site) of $3.5 \times 10^{-6}$ person-rem, resulting in $2.1 \times 10^{-9}$ LCFs, and traffic accidents resulting in 0 (0.05) fatalities.

#### 4.1.12.3.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and feed materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be about 64 million kilometers (40 million miles) traveled, 13 accidents, and 1 (0.84) fatality over the entire period from construction through deactivation and closure (see Table 4–70).

### 4.1.12.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Under this alternative, about 3,600 truck[3] shipments of remote-handled (RH) and contact-handled (CH) TRU waste would be made to WIPP. In addition, 68,000 truck shipments would be made on site to transport various radioactive wastes to local storage and burial grounds. The total distance traveled on public roads and rail carrying radioactive waste materials would be about 11 million kilometers (6.8 million miles) (see Table 4–69).

#### 4.1.12.4.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities (both off site and on site) under this alternative was estimated at about 840 person-rem; the dose to the public would be about 350 person-rem. Accordingly, incident-free transportation of radioactive material would result in 1 (0.50) LCF among transportation workers and 0 (0.20) LCFs in the total affected population over the duration of transportation activities. Note that the maximum annual dose to a transportation crewmember would be 100 millirem, unless the individual is a trained radiation worker, in which case the maximum annual dose would be 2 rem (DOE Standard 1098-2008). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is $1.2 \times 10^{-3}$. Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

#### 4.1.12.4.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 in 10 million per year) would involve a shipment of RH-TRU waste. The consequences of such an accident in terms of population dose in the rural, suburban, and urban zones would be 0.38, 16.2, and 110 person-rem, respectively. The likelihood of occurrence of such consequences over the entire duration of transport is less than $1.6 \times 10^{-3}$, $3.2 \times 10^{-5}$, and $9.4 \times 10^{-7}$ in rural, suburban, and urban zones, respectively. This accident could result in a dose of about 0.03 rem to an individual hypothetically exposed to the accident plume for 2 hours at a distance of 100 meters (330 feet), with a corresponding LCF risk of $1.6 \times 10^{-5}$.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.07 person-rem, resulting in $4.3 \times 10^{-5}$ LCFs, and traffic accidents resulting in 0 (0.37) fatalities. Nearly all of the risks would result from shipping waste to WIPP.

[3] Truck transportation is the preferred mode for transporting TRU waste to WIPP (DOE 1997).

#### 4.1.12.4.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be 91 million kilometers (57 million miles) traveled, 18 accidents, and 1 (1.2) fatality over the entire period from construction through deactivation and closure (see Table 4–70).

### 4.1.12.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Under this alternative, about 3,600 truck shipments of RH- and CH-TRU waste would be made to WIPP. In addition, 85,300 truck shipments would be made on site to transport various radioactive wastes to local storage and burial grounds. The total distance traveled on public roads and rail carrying radioactive waste materials would be about 11 million kilometers (6.8 million miles) (see Table 4–69).

#### 4.1.12.5.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities (both off site and on site) under this alternative was estimated at about 1,080 person-rem; the dose to the public would be about 267 person-rem. Accordingly, incident-free transportation of radioactive material would result in 1 (0.65) LCF among transportation workers and 0 (0.16) LCFs in the total affected population over the duration of transportation activities. Note that the maximum annual dose to a transportation crewmember would be 100 millirem, unless the individual is a trained radiation worker, in which case the maximum annual dose would be 2 rem (DOE Standard 1098-2008). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is $1.2 \times 10^{-3}$. Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

#### 4.1.12.5.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 in 10 million per year) would involve a shipment of RH-TRU waste. The consequences of such an accident would be similar to those described under Tank Closure Alternative 3A.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.07 person-rem, resulting in $4.3 \times 10^{-5}$ LCFs, and traffic accidents resulting in 0 (0.38) fatalities. Nearly all of the risks would result from shipping waste to WIPP.

#### 4.1.12.5.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be 93 million kilometers (58 million miles) traveled, 19 accidents, and 1 (1.2) fatality over the entire period from construction through deactivation and closure (see Table 4–70).

#### 4.1.12.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Under this alternative, about 3,600 truck shipments of RH- and CH-TRU waste would be made to WIPP. In addition, 120,000 truck shipments would be made on site to transport various radioactive wastes to local storage and burial grounds. The total distance traveled on public roads and rail carrying radioactive waste materials would be about 11 million kilometers (6.8 million miles) (see Table 4–69).

##### 4.1.12.6.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities (both off site and on site) under this alternative was estimated at about 1,220 person-rem; the dose to the public would be about 340 person-rem. Accordingly, incident-free transportation of radioactive material would result in 1 (0.73) LCF among transportation workers and 0 (0.20) LCFs in the total affected population over the duration of transportation activities. As stated earlier, note that the maximum annual dose to a transportation crewmember would be 100 millirem, unless the individual is a trained radiation worker, in which case the maximum annual dose would be 2 rem (DOE Standard 1098-2008). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is $1.2 \times 10^{-3}$. Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

##### 4.1.12.6.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 in 10 million per year) would involve a shipment of RH-TRU waste. The consequences of such an accident would be similar to those described under Tank Closure Alternative 3A.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.07 person-rem, resulting in $4.3 \times 10^{-5}$ LCFs, and traffic accidents resulting in 0 (0.39) fatalities. Nearly all of the risks would result from shipping waste to WIPP.

##### 4.1.12.6.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be about 410 million kilometers (255 million miles) traveled, 82 accidents, and 5 (5.3) fatalities over the entire period from construction through deactivation and closure (see Table 4–70).

#### 4.1.12.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

Under this alternative, about 3,600 truck shipments of TRU waste would be made to WIPP. In addition, 142,000 truck shipments would be made on site to transport various radioactive wastes to local storage and burial grounds. The total distance traveled on public roads and rail carrying radioactive waste materials would be about 11.1 million kilometers (6.9 million miles) (see Table 4–69).

##### 4.1.12.7.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities (both off site and on site) under this alternative was estimated at about 1,090 person-rem; the dose to the public would be about 300 person-rem. Accordingly, incident-free transportation of radioactive material would result

in 1 (0.65) LCF among transportation workers and 0 (0.18) LCFs in the total affected population over the duration of transportation activities. As stated earlier, note that the maximum annual dose to a transportation crewmember would be 100 millirem, unless the individual is a trained radiation worker, in which case the maximum annual dose would be 2 rem (DOE Standard 1098-2008). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is $1.2 \times 10^{-3}$. Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

#### 4.1.12.7.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 chance in 10 million per year) would involve a shipment of RH-TRU waste. The consequences of such an accident would be similar to those described under Tank Closure Alternative 3A.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.07 person-rem, resulting in $4.3 \times 10^{-5}$ LCFs, and traffic accidents resulting in 0 (0.40) fatalities. Nearly all of the risks would result from shipping waste to WIPP.

#### 4.1.12.7.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be about 120 million kilometers (74.7 million miles) traveled, 24 accidents, and 2 (1.6) fatalities over the entire period from construction through deactivation and closure (see Table 4–70).

### 4.1.12.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

Under this alternative, 3,200 truck shipments of TRU waste would be made to WIPP. In addition, 50,300 truck shipments would be made on site to transport various radioactive wastes to local storage and burial grounds. The total distance traveled on public roads and rail carrying radioactive waste materials would be about 10 million kilometers (6.2 million miles) (see Table 4–69).

#### 4.1.12.8.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities (both on and off site) under this alternative was estimated at about 790 person-rem; the dose to the public would be about 255 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.47) LCFs among transportation workers and 0 (0.15) LCFs in the total affected population over the duration of transportation activities.

#### 4.1.12.8.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 chance in 10 million per year) would involve a shipment of RH-TRU waste. The consequences of such an accident would be similar to those described under Tank Closure Alternative 3A.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.07 person-rem, resulting in $3.9 \times 10^{-5}$ LCFs, and traffic accidents resulting in 0 (0.33) fatalities. Nearly all of the risks would result from shipping waste to WIPP.

#### 4.1.12.8.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be about 88 million kilometers (55 million miles) traveled, 18 accidents, and 1 (1.2) fatality over the entire period from construction through deactivation and closure (see Table 4–70).

### 4.1.12.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

Under both the Base Case and the Option Case of this alternative, no offsite radioactive waste shipments would be made. However, about 423,000 and 874,000 truck shipments would be made on site to transport various radioactive wastes to local storage and burial grounds under the Base Case and Option Case, respectively (see Table 4–69).

#### 4.1.12.9.1 Impacts of Incident-Free Transportation

##### 4.1.12.9.1.1 Base Case

The dose to transportation workers from all transportation activities on site under this alternative was estimated at about 450 person-rem; the dose to the public would be about 60 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.27) LCFs among transportation workers and 0 (0.04) LCFs in the total affected population over the duration of transportation activities.

##### 4.1.12.9.1.2 Option Case

The dose to transportation workers from all transportation activities (on site) under this alternative was estimated at about 870 person-rem; the dose to the public would be about 100 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.52) LCFs among transportation workers and 0 (0.06) LCFs in the total affected population over the duration of transportation activities.

#### 4.1.12.9.2 Impacts of Accidents During Transportation

##### 4.1.12.9.2.1 Base Case

Because no offsite radioactive waste shipments would be made under this alternative, the maximum reasonably foreseeable offsite transportation accident would have a probability of occurrence of less than 1 chance in 10 million per year. Therefore, no further impact analyses have been performed.

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.0001 person-rem, resulting in $6.5 \times 10^{-8}$ LCFs, and traffic accidents resulting in 0 (0.15) fatalities.

##### 4.1.12.9.2.2 Option Case

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.0002 person-rem, resulting in $9.4 \times 10^{-8}$ LCFs, and traffic accidents resulting in 0 (0.35) fatalities.

#### 4.1.12.9.3 Impacts of Construction and Operational Material Transport

##### 4.1.12.9.3.1 Base Case

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be about 290 million kilometers (180 million miles) traveled, 60 accidents, and 4 (3.8) fatalities over the entire period from construction through deactivation and closure (see Table 4–70).

##### 4.1.12.9.3.2 Option Case

The impacts of transporting construction materials and materials for the production and transport of waste were evaluated. The transportation impacts under this alternative would be about 700 million kilometers (435 million miles) traveled, 140 accidents, and 9 (9.2) fatalities over the entire period from construction through deactivation and closure (see Table 4–70).

### 4.1.12.10 Alternative 6B: All Vitrification with Separations; Clean Closure

Under both cases of this alternative, no offsite radioactive waste shipments would be made. However, about 356,000 and 808,000 truck shipments would be made on site to transport various radioactive wastes to local storage and burial grounds under the Base Case and Option Case, respectively (see Table 4–69).

#### 4.1.12.10.1 Impacts of Incident-Free Transportation

##### 4.1.12.10.1.1 Base Case

The dose to transportation workers from all transportation activities on site under this alternative was estimated at about 560 person-rem; the dose to the public would be about 89 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.34) LCFs among transportation workers and 0 (0.05) LCFs in the total affected population over the duration of transportation activities.

##### 4.1.12.10.1.2 Option Case

The dose to transportation workers from all transportation activities on site under this alternative was estimated at about 980 person-rem; the dose to the public would be about 130 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.59) LCFs among transportation workers and 0 (0.08) LCFs in the total affected population over the duration of transportation activities.

#### 4.1.12.10.2 Impacts of Accidents During Transportation

##### 4.1.12.10.2.1 Base Case

The maximum reasonably foreseeable offsite transportation accident and its consequences would be similar to those described under Alternative 6A (see Section 4.1.12.9.2).

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.0001 person-rem, resulting in $6.5 \times 10^{-8}$ LCFs, and traffic accidents resulting in 0 (0.15) fatalities.

#### 4.1.12.10.2.2 Option Case

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of 0.0002 person-rem, resulting in $9.4 \times 10^{-8}$ LCFs, and traffic accidents resulting in 0 (0.35) fatalities.

#### 4.1.12.10.3 Impacts of Construction and Operational Material Transport

#### 4.1.12.10.3.1 Base Case

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be about 140 million kilometers (87 million miles) traveled, 28 accidents, and 2 (1.8) fatalities over the entire period from construction through deactivation and closure (see Table 4–70).

#### 4.1.12.10.3.2 Option Case

The impacts of transporting construction materials and materials for the production and transport of waste were evaluated. The transportation impacts under this alternative would be about 270 million kilometers (170 million miles) traveled, 55 accidents, and 4 (3.5) fatalities over the entire period from construction through deactivation and closure (see Table 4–70).

### 4.1.12.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Under this alternative, no offsite radioactive waste shipments would be made. However, 128,000 truck shipments would be made to transport various radioactive wastes to local storage facilities and burial grounds (see Table 4–69).

#### 4.1.12.11.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities on site under this alternative was estimated at about 260 person-rem; the dose to the public would be about 73 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.16) LCFs among transportation workers and 0 (0.04) LCFs in the total affected population over the duration of transportation activities.

#### 4.1.12.11.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident and its consequences are similar to those described under Alternative 2B (see Section 4.1.12.3.2).

The estimated total transportation accident risks under this alternative are a radiation dose risk to the population of $3.5 \times 10^{-6}$ person-rem, resulting in $2.1 \times 10^{-9}$ LCFs, and traffic accidents resulting in 0 (0.05) fatalities.

#### 4.1.12.11.3 Impacts of Construction and Operational Material Transport

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and feed materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, canisters) were evaluated. The transportation impacts under this alternative would be 71 million kilometers (44 million miles) traveled, 14 accidents, and 1 (0.92) fatality over the entire period from construction through deactivation and closure (see Table 4–70).

### 4.1.13 Environmental Justice

Per Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, DOE seeks to ensure that no group of people bears a disproportionate share of negative environmental consequences resulting from the proposed actions under the Tank Closure alternatives and options. This section addresses potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations. Public access to Hanford is restricted, so the majority of impacts would be associated with onsite activities and would not affect populations residing off site; thus, the potential for environmental justice concerns is small. Potential impacts on resource areas that could affect populations residing off site include public and occupational health and safety (during both normal operations and facility accidents) and air quality. Impacts on these resource areas were analyzed because of the potential for short-term environmental justice concerns. Definitions of terms associated with environmental justice and a description of the analysis methodology used are included in Appendix J.

#### 4.1.13.1 Alternative 1: No Action

Section 4.1.10.1.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 1. The radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–71 summarizes the average individual total doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Tank Closure Alternative 1 would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–71. Tank Closure Alternative 1 Average Individual Total Dose from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 0.12 | 0.14 |
| American Indian | 0.08 | 0.13 |
| Hispanic or Latino | 0.12 | 0.14 |
| Low-income | 0.12 | 0.13 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.1.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated

in Appendix J. Under Tank Closure Alternative 1, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 1 would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.1.1 discusses radiological impacts of airborne releases for facility accidents under Tank Closure Alternative 1. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 1 would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts under Tank Closure Alternative 1 are discussed in Section 4.1.4.1. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.1 discusses the potential human health risks of transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. The impacts of transporting construction materials to Hanford under this alternative would be very small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.2 Alternative 2A: Existing WTP Vitrification; No Closure

Section 4.1.10.2.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 2A. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–72 summarizes the average individual total doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 2A would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–72. Tank Closure Alternative 2A Average Individual Total Dose from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.9 | 3.4 |
| American Indian | 1.8 | 3.2 |
| Hispanic or Latino | 2.8 | 3.4 |
| Low-income | 2.8 | 3.2 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.2.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 2A. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 2A, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 2A would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.2.1 discusses radiological impacts of airborne releases for facility accidents under Tank Closure Alternative 2A. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 2A would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.2. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts. There would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations; the same would be true for nonradioactive air emissions.

Section 4.1.12.2 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

Section 4.1.10.3.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 2B. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to

radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–73 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between the average individual total doses. Therefore, Alternative 2B would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–73. Tank Closure Alternative 2B Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.8 | 3.3 |
| American Indian | 1.7 | 3.1 |
| Hispanic or Latino | 2.7 | 3.3 |
| Low-income | 2.7 | 3.1 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.3.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 2B. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 2B, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 2B would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.3.1 discusses radiological impacts of airborne releases for facility accidents under Tank Closure Alternative 2B. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 2B would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.3. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.3 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing

along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

Section 4.1.10.4.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 3A. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–74 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 3A would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–74. Tank Closure Alternative 3A Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.6 | 3.1 |
| American Indian | 1.7 | 2.9 |
| Hispanic or Latino | 2.6 | 3.1 |
| Low-income | 2.6 | 3.0 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.4.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 3A. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 3A, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 3A would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.4.1 discusses radiological impacts of airborne releases for facility accidents under Tank Closure Alternative 3A. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Tank Closure Alternative 3A would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.4. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.4 discusses the potential human health risks of transporting radioactive waste on site at Hanford and TRU waste to WIPP, as well as the risks of transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the radiological transport risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Section 4.1.10.5.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 3B. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–75 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 3B would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–75. Tank Closure Alternative 3B Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.0 | 2.3 |
| American Indian | 1.2 | 2.2 |
| Hispanic or Latino | 1.9 | 2.3 |
| Low-income | 1.9 | 2.2 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.5.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 3B. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 3B, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 3B would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.5.1 discusses radiological impacts of airborne releases for facility accidents under Tank Closure Alternative 3B. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 3B would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.5. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.5 discusses the potential human health risks of transporting radioactive waste on site at Hanford and TRU waste to WIPP, as well as the risks of transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the radiological transport risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Section 4.1.10.6.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 3C. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that

these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–76 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 3C would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–76. Tank Closure Alternative 3C Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.7 | 3.2 |
| American Indian | 1.7 | 3.0 |
| Hispanic or Latino | 2.7 | 3.2 |
| Low-income | 2.6 | 3.1 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.6.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 3C. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 3C, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 3C would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.6.1 discusses radiological impacts of airborne releases for facility accidents under Tank Closure Alternative 3C. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 3C would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.6. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.6 discusses the potential human health risks of transporting radioactive waste on site at Hanford and TRU waste to WIPP, as well as the risks of transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the radiological transport risks

shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

Section 4.1.10.7.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 4. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–77 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 4 would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–77. Tank Closure Alternative 4 Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.3 | 2.7 |
| American Indian | 1.4 | 2.5 |
| Hispanic or Latino | 2.2 | 2.7 |
| Low-income | 2.2 | 2.6 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.7.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 4. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 4, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 4 would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.7.1 discusses radiological impacts of airborne releases for facility accidents under Tank Closure Alternative 4. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 4 would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.7. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.7 discusses the potential human health risks of transporting radioactive waste on site at Hanford and TRU waste to WIPP, as well as the risks of transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the radiological transport risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

Section 4.1.10.8.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 5. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–78 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 5 would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–78. Tank Closure Alternative 5 Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.3 | 2.8 |
| American Indian | 1.5 | 2.6 |
| Hispanic or Latino | 2.3 | 2.8 |
| Low-income | 2.3 | 2.7 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.8.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 5. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 5, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 5 would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.8.1 discusses radiological impacts of airborne releases from facility accidents under Tank Closure Alternative 5. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 5 would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.8. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.8 discusses the potential human health risks of transporting radioactive waste on site at Hanford and TRU waste to WIPP, as well as the risks of transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the radiological transport risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority and low-income populations residing along the transportation routes.

### 4.1.13.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.13.9.1 Base Case

Section 4.1.10.9.1.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 6A, Base Case. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure

scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–79 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 6A, Base Case, would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–79. Tank Closure Alternative 6A, Base Case, Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.9 | 3.4 |
| American Indian | 1.8 | 3.2 |
| Hispanic or Latino | 2.8 | 3.4 |
| Low-income | 2.8 | 3.3 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.9.1.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 6A, Base Case. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 6A, Base Case, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 6A, Base Case, would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.9.1.1 discusses radiological impacts for airborne releases from facility accidents under Tank Closure Alternative 6A, Base Case. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 6A, Base Case, would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.9.1. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.9 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impacts of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority and low-income populations residing along the transportation routes.

#### 4.1.13.9.2 Option Case

Section 4.1.10.9.1.2 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 6A, Option Case. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–80 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 6A, Option Case, would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–80. Tank Closure Alternative 6A, Option Case, Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| | Average Individual Dose (millirem) | |
|---|---|---|
| **Subset Population** | **Subset Population** | **Remainder of Population** |
| Minority | 3.0 | 3.6 |
| American Indian | 1.9 | 3.3 |
| Hispanic or Latino | 2.9 | 3.5 |
| Low-income | 2.9 | 3.4 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.9.1.2 discusses radiological impacts on the offsite MEI at the far side of Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 6A, Option Case. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 6A, Option Case, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 6A, Option Case, would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.9.1.2 discusses radiological impacts of airborne releases from facility accidents under Tank Closure Alternative 6A, Option Case. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 6A, Option Case, would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.9.2. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.9 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impact of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority and low-income populations residing along the transportation routes.

### 4.1.13.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.13.10.1 Base Case

Section 4.1.10.10.1.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 6B, Base Case. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–81 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 6B, Base Case, would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–81. Tank Closure Alternative 6B, Base Case, Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.8 | 3.4 |
| American Indian | 1.8 | 3.2 |
| Hispanic or Latino | 2.8 | 3.4 |
| Low-income | 2.8 | 3.2 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.10.1.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 6B, Base Case. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 6B, Base Case, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 6B, Base Case, would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.10.1.1 discusses radiological impacts of airborne releases from facility accidents under Tank Closure Alternative 6B, Base Case. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 6B, Base Case, would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.10.1. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.10 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impact of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.10.2 Option Case

Section 4.1.10.10.1.2 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 6B, Option Case. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population

exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared to the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–82 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between average individual total doses. Therefore, Alternative 6B, Option Case, would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–82. Tank Closure Alternative 6B, Option Case, Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | 2.8 | 3.4 |
| American Indian | 1.8 | 3.2 |
| Hispanic or Latino | 2.8 | 3.4 |
| Low-income | 2.8 | 3.2 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.10.1.2 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 6B, Option Case. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 6B, Option Case, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 6B, Option Case, would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.10.1.2 discusses radiological impacts of airborne releases from facility accidents under Tank Closure Alternative 6B, Option Case. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 6B, Option Case, would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.10.2. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.10 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impact of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.1.13.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Section 4.1.10.11.1 discusses short-term impacts on the public resulting from normal operations under Tank Closure Alternative 6C. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations was compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–83 summarizes the average individual cumulative doses for the life of the project under this alternative. There were no appreciable differences between these average individual total doses. Therefore, Alternative 6C would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–83. Tank Closure Alternative 6C Average Individual Cumulative Doses from Radioactive Air Emissions over the Life of the Project**

| | Average Individual Dose (millirem) | |
|---|---|---|
| **Subset Population** | **Subset Population** | **Remainder of Population** |
| Minority | 2.7 | 3.2 |
| American Indian | 1.7 | 3.0 |
| Hispanic or Latino | 2.7 | 3.2 |
| Low-income | 2.7 | 3.1 |

**Source:** Appendix J, Section J.5.7.1.1.

Section 4.1.10.11.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Tank Closure Alternative 6C. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Alternative 6C, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be the equivalent of less than one-sixth of that received by the MEI from the general population. Therefore, Alternative 6C would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.1.11.11.1 discusses radiological impacts of airborne releases from facility accidents under Tank Closure Alternative 6C. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 6C would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.11. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; because there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.1.12.11 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impact of transporting construction materials to Hanford would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority and low-income populations residing along the transportation routes.

### 4.1.14 Waste Management

This section evaluates the impacts of waste generation associated with the various Tank Closure alternatives on the waste management infrastructure at Hanford. As summarized in Section 4.3 and detailed in Chapter 2, Waste Management alternatives were developed to manage the various waste volumes projected to be generated under the alternatives for Tank Closure, FFTF Decommissioning, and Waste Management. Section 4.3.14 of this EIS evaluates the impacts of waste generation associated with the construction, operations, deactivation, and closure of the waste management facilities.

The following analysis is consistent with DOE policy and DOE Manual 435.1-1, which require that DOE radioactive waste shall be treated, stored, and, in the case of low-level radioactive waste (LLW), disposed of at the site where the waste is generated, if practical, or at another DOE facility. The analysis of these Tank Closure alternatives is based on disposal of LLW, MLLW, and WTP LAW melters at Hanford. However, if DOE determines that use of Hanford's or another DOE site's waste management facilities is not practical or cost-effective, DOE may approve the use of non-DOE (i.e., commercial) facilities to store, treat, and dispose of such waste.

Included in this section is a discussion of the waste inventories generated under each of the Tank Closure alternatives. The inventories are divided into primary waste and secondary waste. Appendix D describes the development of the contaminant inventories of these waste streams.

#### PRIMARY WASTE

Under all Tank Closure alternatives except Alternative 1: No Action, primary waste would be produced. This primary waste could include HLW, including IHLW canisters, IHLW cesium and strontium canisters, other HLW, and in the case of Alternatives 6A and 6B, LAW melters; treated LAW, including ILAW canisters, bulk vitrification glass, cast stone waste, sulfate grout, steam reforming waste, RH-TRU waste, and CH-TRU waste; and melters, including HLW melters, LAW melters, and PPF melters.

### HIGH-LEVEL RADIOACTIVE WASTE

Under Tank Closure Alternatives 2A, 2B, 3A, 3B, 3C, 4, 5, 6A (Base and Option Cases), 6B (Base and Option Cases), and 6C, HLW would result as part of the retrieval of the tank waste.

Waste in the form of liquid, salt cake, and sludge is stored in 177 large and 61 smaller underground storage tanks in the Hanford 200 Areas. Most of the waste in the tanks is categorized as HLW, although some tanks are currently considered to contain only mixed TRU waste. Operationally, the tank farms are managed as if all of the waste were HLW. Waste retrieved from the storage tanks would be processed in the WTP Pretreatment Facility to separate it into a high-activity stream containing most of the radionuclides requiring long-term isolation and a low-activity stream containing most of the waste volume and the remaining radionuclides. In the WTP, the high-activity stream would be mixed with glass-forming materials and heated in an HLW melter to form a molten glass, a process called vitrification. The molten glass would then be poured into stainless steel canisters, where it would solidify into a solid form called IHLW. These alternatives would treat and dispose of existing waste and additional waste generated from the processing of the HLW.

However, under Tank Closure Alternatives 6A, 6B and 6C, all of the tank farm waste would be managed as if it were HLW. Under Alternative 6A all waste would be treated in HLW melters without pretreatment. Under Alternatives 6B and 6C, the LAW stream that is separated in the Pretreatment Facility would be sent to a separate vitrification facility, the LAW Vitrification Facility. The molten glass from the LAW melter would be poured into canisters of a different design than those used for high-activity waste (see Chapter 2, Section 2.3.2.1), where it would solidify into ILAW glass. The ILAW glass would be managed as HLW and placed into storage.

DOE expects that the IHLW canisters, and in the case of Tank Closure Alternatives 6B and 6C ILAW canisters, would be stored on site.

Storage of IHLW and ILAW would require ongoing facility maintenance and monitoring. Storage of IHLW and ILAW canisters is expected to result in no releases to the environment. Facilities with sufficient canister storage capacity would be constructed on site; impacts of constructing and operating storage facilities for IHLW and ILAW canisters are evaluated in the appropriate sections of this EIS.

Also under Tank Closure Alternatives 6A, 6B and 6C, all SSTs and associated ancillary equipment would be removed and considered HLW. The additional HLW would be stored on site in shielded boxes. Impacts of constructing and operating facilities with sufficient storage capacity are evaluated in the appropriate sections of this EIS. Storage of this HLW is expected to result in no releases to the environment; it would require ongoing facility maintenance and monitoring.

### CESIUM AND STRONTIUM CAPSULES

The cesium and strontium capsules were generated at Hanford during the 1970s and 1980s, when cesium and strontium isotopes were separated from other tank waste, converted to cesium chloride and strontium fluoride, and then encapsulated for long-term storage. Currently, there are 1,335 cesium capsules and 601 strontium capsules stored in the Waste Encapsulation and Storage Facility (WESF) pool cells. Most of the capsules are composed of an inner and outer capsule. Under all Tank Closure alternatives except Alternative 1, the cesium and strontium capsules would be processed for de-encapsulating and preparing the waste into a suitable WTP slurry feed. The waste slurry would then be stored in a DST prior to treatment through the WTP. This EIS analyzes the immobilization of the cesium and strontium slurry feed as a separate, 1-year long WTP campaign; however, the cesium and strontium slurry feed could be mixed with the late-stage tank waste feed for consistency.

Under Tank Closure Alternative 1, the cesium and strontium capsules would be stored indefinitely in the WESF, in a manner similar to the present; therefore, construction of a Cesium and Strontium Capsule Processing Facility would be unnecessary. Under all other alternatives analyzed in this EIS, the cesium and strontium waste would be vitrified in the WTP. The immobilization of cesium and strontium capsule waste would take place during a separate campaign, after the treatment of all tank HLW is completed in the WTP. The cesium and strontium WTP campaign is expected to add 1 year of processing time to the WTP HLW melters. The Cesium and Strontium Capsule Processing Facility would be built such that processing of cesium canisters could begin approximately 14 months prior to the completion of the WTP's processing of tank HLW.

Based on estimated production rates, the Cesium and Strontium Capsule Processing Facility would require 26 months to de-encapsulate all cesium and strontium capsules and prepare the cesium and strontium slurry feed. The WTP requires an estimated 12 months to vitrify the slurry feed. Thus, to maintain a continuous WTP feed, the Cesium and Strontium Capsule Processing Facility must begin operations 14 months in advance of the cesium and strontium campaign and pre-store this WTP feed in the DSTs. It was estimated that an additional 340 canisters would be produced during the cesium and strontium treatment campaign (CEES 2006).

**TREATED LOW-ACTIVITY TANK WASTE**

Under Tank Closure Alternatives 2A and 2B, the LAW that is separated in the WTP Pretreatment Facility would be sent to the LAW Vitrification Facility for treatment, where it would be treated to create an immobilized waste form, ILAW. The impacts of providing treatment are evaluated in the appropriate sections of this EIS. The ILAW glass would be sent directly to an onsite Integrated Disposal Facility (IDF), a permitted landfill at Hanford with separate, expandable cells—one for the disposal of LLW and another for the disposal of MLLW. The disposal facility would include an RCRA-compliant liner and leachate collection system; upon closure it would be covered with a modified RCRA Subtitle C barrier (see Appendix E, Section E.3.4.1). The facility would be similar in configuration to the ERDF.

Under Tank Closure Alternatives 3A, 3B, 3C, and 4, additional waste forms other than ILAW glass would be created from immobilizing tank LAW using the supplemental treatment technologies of bulk vitrification (Alternative 3A), cast stone (Alternative 3B), or steam reforming (Alternative 3C) (see Chapter 2, Section 2.3.2), or both bulk vitrification and cast stone (Alternative 4). The LAW stream treated in the supplemental treatment facilities would result from the pretreatment separation of tank waste into high- and low-activity waste streams. In the 200-East Area, the separation would occur in the WTP Pretreatment Facility; in the 200-West Area, it would occur in a Solid-Liquid Separations Facility. A Bulk Vitrification Facility, a Cast Stone Facility, or a Steam Reforming Facility would be built in both the 200-East and 200-West Areas; in the case of Alternative 4, a Cast Stone Facility would be built in the 200-East Area and a Bulk Vitrification Facility would be built in the 200-West Area. Facilities with sufficient treatment capacity to immobilize the LAW would be provided under each of these technologies. The WTP and bulk vitrification glass, cast stone waste, or steam reforming waste would be sent directly to an onsite IDF. The disposal facility would include an RCRA-compliant liner and leachate collection system; upon closure it would be capped with a modified RCRA Subtitle C barrier (see Appendix E, Section E.3.4.1). The facility would be similar in configuration to the ERDF. The impacts of providing treatment are evaluated in the appropriate sections of this EIS. There would be no impacts on the existing Hanford waste management system. Some of the other tank waste, currently considered to be TRU waste, would be processed to become a solid mixed TRU waste form that would meet the WIPP Waste Acceptance Criteria.

Under Tank Closure Alternative 5, the LAW would be treated the same as under Alternative 4 with an additional pretreatment step in the Pretreatment Facility that would yield sulfate grout waste. Like Alternative 4, some of the tank waste would be processed to cast stone waste and some to bulk vitrification glass. The LAW stream that is separated in the Pretreatment Facility would be further processed to remove sulfate (see Chapter 2, Section 2.3.2.6). The sulfate waste stream would be solidified with cementitious material to create sulfate grout. The remaining LAW stream would be sent to and processed in the LAW Vitrification Facility. Sufficient treatment capacity to immobilize the sulfate waste stream and the LAW would be provided under this Tank Closure alternative. The impacts of providing treatment are evaluated in the appropriate sections of this EIS. The ILAW glass, bulk vitrification glass, cast stone waste, and sulfate grout waste would be sent directly to an onsite IDF. The disposal facility would include an RCRA-compliant liner and leachate collection system; upon closure it would be capped with a modified RCRA Subtitle C barrier (see Appendix E, Section E.3.4.1). The facility would be similar in configuration to the ERDF.

Under Tank Closure Alternatives 6B and 6C, the LAW stream that is separated in the Pretreatment Facility would be managed as HLW, as discussed above under "High-Level Radioactive Waste."

**WASTE TREATMENT PLANT MELTERS**

Under all alternatives except Alternative 1, WTP HLW melters, LAW melters, and, in the case of Alternatives 6A, 6B, and 6C, PPF melters would become a waste stream following service. WTP HLW and LAW melters that reach the end of their useful lives or fail may be treated by size reduction before being disposed of or placed in storage. Because WTP melters would be minimally treated (size reduction) before disposal or storage, impacts of this waste treatment on the existing Hanford waste management system would be negligible.

It is anticipated that the HLW melters would require long-term storage. The LAW melters would be disposed of as MLLW under Tank Closure Alternatives 2A, 2B, 3A, 3B, 3C, 4, and 5, and as HLW under Alternatives 6B and 6C. Storage of HLW melters is expected to result in no releases to the environment. Impacts of constructing and operating facilities with sufficient storage capacity under these Tank Closure alternatives for the WTP HLW and LAW melters are evaluated in the appropriate sections of this EIS. For more on WTP melters, see Appendix E, Section E.1.2.4.4.

For the LAW melters disposed of as MLLW, disposal would take place in an RCRA-compliant, onsite IDF. The impacts of providing such disposal capacity in an IDF are addressed under the corresponding Waste Management alternatives. The long-term impacts of radioactive and chemical releases from disposed LAW melters on groundwater quality and human health are evaluated in Chapter 5, Sections 5.1.1 and 5.1.2, respectively. For more on LAW melters, see Appendix E, Section E.1.2.4.4.

The retired PPF melters used in processing soils contaminated by past tank leaks would be disposed of on site in an IDF. Disposal of the retired PPF melters is addressed under the corresponding Waste Management alternatives. Long-term impacts of retired PPF melter disposal on groundwater quality and human health are evaluated in Chapter 5, Sections 5.1.1 and 5.1.2, respectively.

**MIXED TRANSURANIC WASTE**

Under Tank Closure Alternatives 3A, 3B, 3C, 4, and 5, some of the waste stored in tanks in the 200 Area, currently considered mixed TRU waste (see Chapter 2, Section 2.3.2.4), is expected to have a low activity level, allowing it to be managed as CH-waste. This waste would be treated and packaged using mobile units provided by this project. The remainder of the TRU waste has a high level of activity, necessitating use of a shielded facility and remote processing for treatment. A single facility for remotely processing the high-activity waste would be constructed in the 200-East Area. Impacts of constructing and operating facilities with additional TRU waste treatment and certification capacity are evaluated in the appropriate sections of this EIS.

The *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement (WIPP SEIS-II)* analyzed the receipt and disposal at WIPP of 57,000 cubic meters (2.01 million cubic feet) of CH-TRU waste and 29,000 cubic meters (1.02 million cubic feet) of RH-TRU waste from Hanford (DOE 1997:S-10). The CH-TRU and RH-mixed TRU waste generated from solidifying tank waste under these Tank Closure alternatives would be within the WIPP-analyzed capacities allocated to Hanford. As reported in the *WIPP SEIS-II*, the Consultation and Cooperation Agreement with the State of New Mexico currently limits the total volume of RH-TRU waste shipped to WIPP from all DOE sites to 7,080 cubic meters (250,000 cubic feet) (DOE 1997:S-7).

**SECONDARY WASTE**

Under all Tank Closure alternatives, secondary waste would be produced. This secondary waste could include LLW (including closure waste), MLLW (including closure waste), mixed TRU waste, hazardous waste, nonhazardous waste, and liquid process waste; Alternatives 6A, 6B, and 6C would produce PPF glass, another form of secondary waste.

**LOW-LEVEL AND MIXED LOW-LEVEL RADIOACTIVE WASTES**

The secondary LLW (e.g., personal protective equipment, tools, filters, empty containers) would be generated during routine operations and the administrative control period. LLW is typically not treated or only minimally treated (e.g., compacted) before disposal. Therefore, this waste treatment would cause no impacts on the Hanford waste management system. The LLW would be sent directly to disposal. Therefore, long-term storage facilities would not be required.

The secondary MLLW (e.g., personal protective equipment, tools, job waste, soil [in the case of closure activities]) would be generated during operations, deactivation, and closure. Through a combination of on- and offsite capabilities, secondary MLLW would be treated to meet RCRA land-disposal-restriction treatment standards prior to disposal.

PPF glass canisters generated from the treatment of the soils in the PPF are also included as MLLW under Alternatives 6A and 6B. The process would generate a liquid waste stream that has the radionuclides and chemicals removed from the soils. A melter cell would be installed in the PPF to process this liquid waste into a PPF glass suitable for onsite disposal. This waste would be disposed of as MLLW on site in an IDF. The long-term impacts on groundwater and human health of radioactive and chemical releases from the PPF glass are evaluated in Chapter 5, Sections 5.1.1 and 5.1.2.

Under Tank Closure Alternatives 2B, 3A, 3B, 3C, 4, 5, and 6C, Waste Management Alternative 2, Disposal Group 1, or Waste Management Alternative 3, Disposal Group 1, would be chosen for the disposal of treated LAW (except under Alternative 6C) and all other LLW and MLLW. As described under Waste Management Alternative 2, an IDF would be constructed and operated in the 200-East Area IDF (IDF-East) for the disposal of tank waste and all other LLW and MLLW; under Waste Management Alternative 3, two IDFs would be constructed and operated: IDF-East for tank waste only and a 200-West

Area IDF (IDF-West) for the other LLW and MLLW. The RPPDF would be constructed and operated for disposal of equipment and soils associated with clean closure activities that are not highly contaminated. Under Waste Management Alternative 2, Disposal Group 1, IDF-East and RPPDF operations would be completed in 2050, with IDF capacity at 1.2 million cubic meters (1.6 million cubic yards) and RPPDF capacity at 1.08 million cubic meters (1.41 million cubic yards). Under Waste Management Alternative 3, Disposal Group 1, IDF-East, IDF-West, and RPPDF operations would be completed in 2050. IDF-East's capacity would be at 1.1 million cubic meters (1.43 million cubic yards); IDF-West's, at 90,000 cubic meters (118,000 cubic yards); and the RPPDF's, at 1.08 million cubic meters (1.41 million cubic yards). Under Waste Management Alternatives 2 and 3, the IDF(s) and RPPDF would be covered with engineered modified RCRA Subtitle C barriers to reduce water infiltration and potential for intrusion. A 100-year postclosure care period would follow.

Under Tank Closure Alternatives 2A and 6B, Waste Management Alternative 2, Disposal Group 2, or Waste Management Alternative 3, Disposal Group 2, would be chosen for disposal of treated LAW (except under Alternative 6B) and all other LLW and MLLW. As described under Waste Management Alternative 2, IDF-East would be constructed and operated for the disposal of tank waste and all other LLW and MLLW; under Waste Management Alternative 3, two IDFs would be constructed and operated: IDF-East for tank waste only and IDF-West for the other LLW and MLLW. Under Alternative 6B, the RPPDF would be constructed and operated for disposal of equipment and soils resulting from clean closure activities. Under Waste Management Alternative 2, Disposal Group 2, IDF-East and RPPDF operations would be completed in 2100, with IDF capacity at 425,000 cubic meters (556,000 cubic yards) and RPPDF capacity at 8.37 million cubic meters (10.45 million cubic yards). Under Waste Management Alternative 3, Disposal Group 2, IDF-East and RPPDF operations would be completed in 2100 and IDF-West operations in 2050. IDF-East's capacity would be at 340,000 cubic meters (445,000 cubic yards); IDF-West's, at 90,000 cubic meters (118,000 cubic yards); and the RPPDF's, at 8.37 million cubic meters (10.9 million cubic yards). Under both Waste Management action alternatives, the IDF(s) and RPPDF would be covered with engineered modified RCRA Subtitle C barriers to reduce water infiltration and potential for intrusion. A 100-year postclosure care period would follow.

Under Tank Closure Alternative 6A, Waste Management Alternative 2, Disposal Group 3, or Waste Management Alternative 3, Disposal Group 3, would be chosen for disposal of tank waste and all other LLW and MLLW. As described under Waste Management Alternative 2, IDF-East would be constructed and operated for the disposal of tank waste and all other LLW and MLLW; under Waste Management Alternative 3, two IDFs would be constructed and operated: IDF-East for tank waste only and IDF-West for the other LLW and MLLW. Under Alternative 6C, the RPPDF would be constructed and operated for disposal of equipment and soils resulting from clean closure activities. Under Waste Management Alternative 2, Disposal Group 3, IDF-East and RPPDF operations would be completed in 2100, with IDF capacity at 425,000 cubic meters (556,000 cubic yards) and RPPDF capacity at 8.37 million cubic meters (10.9 million cubic yards). Under Waste Management Alternative 3, Disposal Group 3, IDF-East and RPPDF operations would be completed in 2165 and IDF-West operations in 2050. IDF-East's capacity would be at 340,000 cubic meters (445,000 cubic yards); IDF-West's, at 90,000 cubic meters (118,000 cubic yards); and the RPPDF's, at 8.37 million cubic meters (10.9 million cubic yards). Under both Waste Management Alternatives 2 and 3, the IDF(s) and RPPDF would be covered with engineered modified RCRA Subtitle C barriers to reduce water infiltration and potential for intrusion. A 100-year postclosure care period would follow.

Under Tank Closure Alternatives 1, 2, and 3, trenches 31 and 34 in the existing low-level radioactive waste burial grounds (LLBGs) would continue to receive LLW and MLLW from onsite, non-Comprehensive Environmental Response, Compensation, and Liability Act (non-CERCLA) generators. Under Tank Closure Alternative 1, waste would be received until 2035, and under Tank Closure Alternatives 2 and 3, waste would be received until filled to capacity, but not later than 2050. No construction activities would be necessary because the trenches are currently in operation.

### MIXED TRANSURANIC WASTE

Secondary mixed TRU waste (e.g., equipment, tools, filters, empty containers) would be generated during waste retrieval and operations of treatment facilities and tanks.

Under all Tank Closure alternatives except Alternative 1, Waste Management Alternatives 2 and 3 analyze the management of mixed TRU waste at Hanford, including the secondary mixed TRU waste generated under the Tank Closure alternatives. Waste Management Alternatives 2 and 3 analyze the construction and operations of a new storage facility in Building 2403-WD that has a capacity of 17,500 drums, as well as two expansions of the Waste Receiving and Processing Facility (WRAP): (1) additional LLW, MLLW, and CH-TRU waste processing capability at the Central Waste Complex (CWC) to match existing capability at the current WRAP, assuming the current rate of 300 containers per month for LLW, MLLW, and CH-TRU waste processing needs would be doubled; and (2) RH-TRU waste processing capability at WRAP, assuming this expansion is required and would match the current WRAP throughput of 300 containers per month using two full-shift operations. The secondary mixed TRU waste would be treated if necessary, packaged, certified (at WRAP or a mobile facility) for disposal at WIPP, and placed into storage.

It is anticipated that TRU waste would be disposed of at WIPP. The *WIPP SEIS-II* analyzed the receipt and disposal at WIPP of 57,000 cubic meters (2.01 million cubic feet) of CH-TRU waste and 29,000 cubic meters (1.02 million cubic feet) of RH-TRU waste from Hanford (DOE 1997:S-10). The 206 cubic meters (7,270 cubic feet) of TRU waste generated under the Tank Closure alternatives would be within the capacity allocated to Hanford and less than the amount evaluated in this EIS.

### HAZARDOUS WASTE

Hazardous waste is dangerous waste as defined in the *Washington Administrative Code* (WAC 173-303). Hazardous waste generated during construction and operations would be packaged in DOT-approved containers and shipped off site to permitted commercial recycling, treatment, and disposal facilities. Hanford shipped 182,177 kilograms (401,632 pounds) of hazardous waste off site in 2005 (Poston et al. 2006). Under all Tank Closure alternatives except Alternative 1, during the period of active construction, operations, and closure, the average annual hazardous waste generation would include 2 peak years with generation of approximately 31,500 cubic meters (1.11 million cubic feet). Management of the additional waste generated under the Tank Closure alternatives would require additional planning, coordination, and establishment of satellite accumulation areas, but because the waste would be treated and disposed of at offsite commercial facilities, the additional waste load would have a minor impact at Hanford.

### NONHAZARDOUS WASTE

Any nonhazardous solid waste generated during facility construction, operations, deactivation, and closure under the Tank Closure alternatives would be packaged and transported in conformance with standard industrial practice. Solid waste such as office paper, metal cans, and plastic and glass bottles that can be recycled would be sent off site for that purpose. The remaining nonhazardous solid waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

**LIQUID PROCESS WASTE**

Process waste, including liquid secondary LLW, would be generated by the activities performed to retrieve, separate, and treat tank waste. Process liquids with substantial levels of radioactivity would be returned to the DST system for management. Dilute process waste such as cooling waters or steam condensates would be routed to the Hanford facilities whose mission it is to manage such wastes. It was assumed that the ETF and the TEDF, or their equivalents, would continue to be available to manage dilute process liquids generated under the Tank Closure alternatives. Wastewater management is further discussed in Section 4.1.6.

**WASTE MINIMIZATION**

In 2006, Hanford recycled 1,115 metric tons (1,230 tons) of sanitary and hazardous wastes. Affirmative procurement at Hanford achieved 100 percent of the 2006 goal. Hanford generated 4,278 cubic meters (5,595 cubic yards) of cleanup and stabilization goal waste (i.e., LLW, MLLW, and hazardous waste) (Poston et al. 2006).

All Tank Closure alternatives would result in additional waste generation. Closure and cleanup waste generation activities would be scrutinized to identify opportunities for waste minimization at Hanford. Waste would be minimized where feasible by (1) reusing or recycling material; (2) processing waste to reduce its quantity, volume, or toxicity; (3) substituting materials or processes that generate hazardous waste with others that result in less hazardous waste; and (4) segregating waste materials to prevent contamination of nonradioactive and nonhazardous materials.

#### 4.1.14.1 Alternative 1: No Action

This section describes the impacts of Tank Closure Alternative 1 on the waste management system at Hanford. As described in Chapter 2, Section 2.4.2, no new facilities would be constructed to process tank waste. Activities under way to construct the WTP and Canister Storage Building would be terminated. The environmental and socioeconomic impacts of ongoing activities and subsequent administrative control activities are evaluated in the applicable sections of this EIS.

Under this Tank Closure alternative, Waste Management Alternative 1, No Action, would be chosen. The scope of Waste Management Alternative 1 is based on the requirements of DOE's January 6, 2006, Settlement Agreement with the State of Washington (as amended on June 5, 2008) regarding *State of Washington v. Bodman*, Civil No. 2:03-cv-05018-AAM, signed by DOE, Ecology, the Washington State Attorney General's Office, and the U.S. Department of Justice; the January 6, 2006, Memorandum of Understanding between DOE and Ecology (DOE and Ecology 2006); and the June 30, 2004, "Record of Decision for the Solid Waste Program, Hanford Site, Richland, WA: Storage and Treatment of Low-Level Waste and Mixed Low-Level Waste; Disposal of Low-Level Waste and Mixed Low-Level Waste, and Storage, Processing, and Certification of Transuranic Waste for Shipment to the Waste Isolation Pilot Plant" (69 FR 39449).

#### 4.1.14.1.1 Waste Inventories

Table 4–84 presents the estimated waste volumes generated under Tank Closure Alternative 1.

#### 4.1.14.1.2 High-Level Radioactive Waste

Under Tank Closure Alternative 1, the WTP would not be completed. Therefore, no IHLW canisters would be generated. The waste in the DSTs and SSTs would continue to be monitored over a 100-year administrative control period.

#### 4.1.14.1.3 Treated Low-Activity Tank Waste

The low-activity fraction of the tank waste would not be separated under this alternative. Therefore, no treated low-activity, tank-derived waste would be generated.

#### 4.1.14.1.4 Waste Treatment Plant Melters

The WTP for vitrifying HLW and tank LAW would not be completed under Tank Closure Alternative 1. Therefore, no WTP melters requiring storage or disposal would be generated.

#### 4.1.14.1.5 Secondary Waste

##### 4.1.14.1.5.1 Mixed Transuranic Waste

Secondary mixed TRU waste would not be generated by cessation of current WTP construction or by routine operations and monitoring activities that would occur during the administrative control period.

##### 4.1.14.1.5.2 Low-Level Radioactive Waste

As shown in Table 4–84, 35 cubic meters (1,240 cubic feet) of LLW would be generated under Tank Closure Alternative 1; this amount is consistent with that accounted for under Waste Management Alternative 1. The waste would be processed at the CWC and would be disposed of in LLBG 218-W-5 trenches 31 and 34. No barriers would be constructed over trenches 31 and 34, the CWC, WRAP, or the T Plant complex. There would be a 100-year administrative control period through 2135.

##### 4.1.14.1.5.3 Mixed Low-Level Radioactive Waste

Secondary MLLW would be generated during the period of routine operations. Mixed waste would require treatment to meet land-disposal-restriction requirements prior to disposal. The amount of MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 1.

## Table 4–84. Tank Closure Alternative 1 Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | |
|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year |
| **High-Level Radioactive Waste** | | | | | | | |
| IHLW (0 canisters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | |
| ILAW (0 canisters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Bulk vitrification glass | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Cast stone waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Steam reforming waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| RH-TRU waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| CH-TRU waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **WTP Melters** | | | | | | | |
| HLW melters (0 melters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| LAW melters (0 melters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Secondary Waste** | | | | | | | |
| LLW | N/A | 21 | 14 | N/A | 35 | 2008 | 7 |
| MLLW | N/A | 21 | N/A | N/A | 21 | 2006–2008 | 7 |
| Mixed TRU waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Hazardous waste[a] | 12 | N/A | N/A | N/A | 12 | 2006–2008 | 4 |
| Nonradioactive-nonhazardous waste[b] | N/A | N/A | 307 | N/A | 307 | 2008–2107 | 3 |

[a] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.

[b] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters. To convert cubic meters to cubic feet, multiply by 35.315.

**Key:** CH=contact-handled; HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste; N/A=not applicable; RH=remote-handled; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** SAIC 2010a.

#### 4.1.14.1.5.4 Hazardous Waste

Hazardous waste generated during the cessation of construction would be packaged in DOT-approved containers and shipped off site to permitted commercial recycling, treatment, and disposal facilities.

#### 4.1.14.1.5.5 Nonhazardous Waste

A small amount (307 cubic meters [10,800 cubic feet]) of nonhazardous waste would be generated from cessation of current WTP construction or by routine operations and monitoring activities that would occur during the administrative control period. This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

#### 4.1.14.1.5.6 Liquid Process Waste

No liquid process waste would be generated from cessation of current WTP construction or by routine operations and monitoring activities that would occur during the administrative control period.

### 4.1.14.2 Alternative 2A: Existing WTP Vitrification; No Closure

#### 4.1.14.2.1 Waste Inventories

Table 4–85 presents the estimated waste volumes generated under Alternative 2A.

#### 4.1.14.2.2 High-Level Radioactive Waste

As shown in Table 4–85, 14,200 cubic meters (501,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

#### 4.1.14.2.3 Treated Low-Activity Tank Waste

As shown in Table 4–85, the 213,000 cubic meters (7.52 million cubic feet) of ILAW glass that would be generated under this Tank Closure alternative is within the capacity of Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2.

#### 4.1.14.2.4 Waste Treatment Plant Melters

As shown in Table 4–85, the volume of HLW melters generated is 3,680 cubic meters (130,000 cubic feet). DOE expects that the HLW melters would be stored on site.

The volume of LAW melters generated under this Tank Closure alternative would be 7,700 cubic meters (272,000 cubic feet). This amount is within the capacity of Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2.

## Table 4–85. Tank Closure Alternative 2A Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)[a] |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (12,000 canisters) | N/A | 14,200 | N/A | N/A | 14,200 | 2018–2092 | 190 | N/A |
| Cesium and strontium (340 canisters)[b] | N/A | 400 | N/A | N/A | 400 | 2093 | 400 | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | | |
| ILAW (92,250 canisters) | N/A | 213,000 | N/A | N/A | 213,000 | 2018–2092 | 2,840 | 213,000 |
| **WTP Melters** | | | | | | | | |
| HLW melters (30 melters) | N/A | 3,680 | N/A | N/A | 3,680 | Various | 245 | N/A |
| LAW melters (30 melters) | N/A | 7,700 | N/A | N/A | 7,700 | Various | 513 | 7,700 |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 31,700 | 1,240 | 1,330 | 34,300 | 2018–2193 | 536 | 34,300 |
| MLLW | N/A | 31,700 | 3,270 | 4,200 | 39,200 | 2078–2192 | 840 | 39,300 |
| Mixed TRU waste | N/A | 219 | N/A | N/A | 219 | 2053–2092 | 3 | N/A |
| Hazardous waste[c] | 193 | 63,300 | 15,700 | N/A | 79,200 | 2092–2094 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[d] | N/A | 254 | 2,390 | 540 | 3,190 | 2094 | 320 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF capacities:<br>Waste Management Alternative 2, Disposal Group 2: 200-East Area 425,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 2: 200-East Area 1,080,000 $m^3$, 200-West Area 90,000 $m^3$ | | | | | Total waste to IDF(s): 294,200 $m^3$ | | | |

[a] Construction of the RPPDF is not required for this Tank Closure alternative.
[b] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[c] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[d] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal. Total may not equal the sum of the contributions due to rounding.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417.

**Key:** HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.2.5 Secondary Waste

##### 4.1.14.2.5.1 Mixed Transuranic Waste

As shown in Table 4–85, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.2.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Table 4–85, Tank Closure Alternative 2A accounts for the disposal of 34,300 cubic meters (1.21 million cubic feet) of LLW and 39,200 cubic meters (1.38 million cubic feet) of MLLW that would be generated by the tank closure program. LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF(s) are evaluated under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2.

##### 4.1.14.2.5.3 Hazardous Waste

As shown in Table 4–85, a total of 79,200 cubic meters (2.80 million cubic feet) of hazardous waste would be generated during construction and operations. For 3 peak years (2092–2094), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year.

##### 4.1.14.2.5.4 Nonhazardous Waste

As shown in Table 4–85, the estimated volume of nonhazardous waste would be 3,190 cubic meters (113,000 cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

##### 4.1.14.2.5.5 Liquid Process Waste

As shown in Table 4–85, the estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons). This waste would be treated on site.

### 4.1.14.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

#### 4.1.14.3.1 Waste Inventories

Table 4–86 presents the estimated waste volumes generated under Alternative 2B. Under this Tank Closure alternative, closure activities would include the removal of ancillary equipment and the top 4.6 meters (15 feet) of soil from two tank farms. This tank closure waste would be disposed of in the new RPPDF.

#### 4.1.14.3.2 High-Level Radioactive Waste

As shown in Table 4–86, 14,200 cubic meters (501,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

## Table 4–86. Tank Closure Alternative 2B Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (12,000 canisters) | N/A | 14,200 | N/A | N/A | 14,200 | 2018–2039 | 547 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2040 | 400 | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | | |
| ILAW (92,250 canisters) | N/A | 213,000 | N/A | N/A | 213,000 | 2018–2043 | 8,190 | 213,000 (IDF) |
| **WTP Melters** | | | | | | | | |
| HLW melters (11 melters) | N/A | 1,350 | N/A | N/A | 1,350 | Various | 245 | N/A |
| LAW melters (31 melters) | N/A | 8,000 | N/A | N/A | 8,000 | Various | 1,540 | 8,000 (IDF) |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 27,500 | 968 | 9,180 | 37,600 | 2040 | 2,800 | 37,600 (IDF) |
| MLLW | N/A | 27,500 | 2,870 | 6,580 | 36,900 | 2040 | 3,020 | 36,900 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 679 | 679 | 2038–2040 | 226 | 679 (RPPDF) |
| Closure MLLW[c] | N/A | N/A | N/A | 468,000 | 468,000 | 2032–2037 | 78,000 | 468,000 (RPPDF) |
| Mixed TRU waste | N/A | 206 | N/A | N/A | 206 | 2029–2043 | 8 | N/A |
| Hazardous waste[d] | 170 | 63,300 | 16,100 | 106 | 79,600 | 2039–2040 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[e] | N/A | 254 | 976 | 677 | 1,910 | 2044 | 594 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 $m^3$, RPPDF 1,080,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 1: IDF-E 1,100,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 1,080,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 296,000 $m^3$/469,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[c] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[d] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[e] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.3.3 Treated Low-Activity Tank Waste

As shown in Table 4–86, the 213,000 cubic meters (7.52 million cubic feet) of ILAW glass that would be generated under this Tank Closure alternative is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Long-term impacts of radioactive and chemical releases from disposed ILAW are evaluated in Chapter 5.

#### 4.1.14.3.4 Waste Treatment Plant Melters

As shown in Table 4–86, the volume of LAW melters generated under this Tank Closure alternative would be 8,000 cubic meters (283,000 cubic feet); this volume is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. As shown in Table 4–86, the volume of HLW melters generated under this Tank Closure alternative would be 1,350 cubic meters (47,700 cubic feet). DOE expects that the HLW melters would be stored on site.

#### 4.1.14.3.5 Secondary Waste

##### 4.1.14.3.5.1 Mixed Transuranic Waste

As shown in Table 4–86, the 206 cubic meters (7,280 cubic feet) of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternatives 2 and 3; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.3.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Table 4–86, Tank Closure Alternative 2B accounts for the disposal of 37,600 cubic meters (1.33 million cubic feet) of LLW, 679 cubic meters (24,000 cubic feet) of LLW generated by tank closure, and 36,900 cubic meters (1.3 million cubic feet) of MLLW generated by tank closure. LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.3.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the removal of ancillary equipment and the excavation of contaminated soil to a depth of approximately 4.6 meters (15 feet) from selected tank farms. This large quantity of tank closure MLLW (468,000 cubic meters [16.5 million cubic feet]) is included as a waste stream under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1, for disposal in a new disposal facility, the RPPDF, located between the 200-East and 200-West Areas, after confirmation that the waste stream meets the appropriate land-disposal-restriction treatment standards, such as the alternative soil treatment standards (40 CFR 268.49). Land use, transportation, groundwater, and long-term human health impacts of closure waste disposal in the RPPDF under this Tank Closure alternative are evaluated in the appropriate sections of this EIS.

#### 4.1.14.3.5.4 Hazardous Waste

A total of 79,600 cubic meters (2.81 million cubic feet) of hazardous waste would be generated during construction and operations. For 2 peak years (2039–2040), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year.

#### 4.1.14.3.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 1,910 cubic meters (67,300 cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

#### 4.1.14.3.5.6 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons). This waste would be treated on site.

### 4.1.14.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

#### 4.1.14.4.1 Waste Inventories

Table 4–87 presents the estimated waste volumes generated under Alternative 3A. Under this Tank Closure alternative, closure activities would include the removal of ancillary equipment and the top 4.6 meters (15 feet) of soil from two tank farms. This tank closure waste would be disposed of in the new RPPDF.

#### 4.1.14.4.2 High-Level Radioactive Waste

As shown in Table 4–87, 10,300 cubic meters (364,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

#### 4.1.14.4.3 Treated Low-Activity Tank Waste

As shown in Table 4–87, the 168,800 cubic meters (5.96 million cubic feet) of ILAW generated by the two treatment processes under this Tank Closure alternative is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Long-term impacts of radioactive and chemical releases from WTP and bulk vitrification glass on groundwater quality and human health are evaluated in Chapter 5.

#### 4.1.14.4.3.1 Mixed Transuranic Waste

The 1,500 cubic meters (53,000 cubic feet) of CH-mixed and 2,140 cubic meters (75,600 cubic feet) of RH-mixed TRU waste generated from solidifying tank waste under this Tank Closure alternative would be within the WIPP-analyzed capacities allocated to Hanford.

## Table 4–87. Tank Closure Alternative 3A Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (8,700 canisters) | N/A | 10,300 | N/A | N/A | 10,300 | 2018–2039 | 469 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2040 | 400 | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | | |
| ILAW (28,510 canisters) | N/A | 65,800 | N/A | N/A | 65,800 | 2018–2039 | 2,990 | 65,800 (IDF) |
| Bulk vitrification glass | N/A | 103,000 | N/A | N/A | 103,000 | 2018–2039 | 4,670 | 103,000 (IDF) |
| CH-TRU waste | N/A | 1,500 | N/A | N/A | 1,500 | 2009–2010 | 750 | N/A |
| RH-TRU waste | N/A | 2,140 | N/A | N/A | 2,140 | 2015–2019 | 428 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (9 melters) | N/A | 1,100 | N/A | N/A | 1,100 | Various | 245 | N/A |
| LAW melters (9 melters) | N/A | 2,260 | N/A | N/A | 2,260 | Various | 513 | 2,260 (IDF) |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 17,400 | 1,980 | 9,180 | 28,600 | 2035 | 1,750 | 28,600 (IDF) |
| MLLW | N/A | 31,200 | 3,920 | 6,580 | 41,700 | 2040 | 2,500 | 41,700 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 679 | 679 | 2034–2036 | 226 | 679 (IDF) |
| Closure MLLW[c] | N/A | N/A | N/A | 468,000 | 468,000 | 2028–2033 | 78,000 | 468,000 (RPPDF) |
| Mixed TRU waste | N/A | 206 | N/A | N/A | 206 | 2027–2039 | 9 | 206 (RPPDF) |
| Hazardous waste[d] | 196 | 63,300 | 16,100 | 106 | 79,700 | 2039 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[e] | N/A | 254 | 723 | 677 | 1,660 | 2041 | 356 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 $m^3$, RPPDF 1,080,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 1: IDF-E 1,100,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 1,080,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 242,000 $m^3$/468,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[c] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[d] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[e] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** CH=contact handed; HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RH=remote-handled; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.4.4 Waste Treatment Plant Melters

As shown in Table 4–87 the volume of LAW melters generated under this Tank Closure alternative would be 2,260 cubic meters (79,800 cubic feet); this volume is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

As shown in Table 4–87, the volume of HLW melters generated under this Tank Closure alternative would be 1,100 cubic meters (47,700 cubic feet). DOE expects that the HLW melters would be stored on site.

#### 4.1.14.4.5 Secondary Waste

##### 4.1.14.4.5.1 Mixed Transuranic Waste

As shown in Table 4–87, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.4.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Table 4–87, Tank Closure Alternative 3A accounts for the disposal of 28,600 cubic meters (1.01 million cubic feet) of LLW, 679 cubic meters (24,000 cubic feet) of LLW generated by tank closure, and 41,700 cubic meters (1.47 million cubic feet) of MLLW generated by tank closure. LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.4.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the removal of ancillary equipment and the excavation of contaminated soil to a depth of approximately 4.6 meters (15 feet) from selected tank farms. This large quantity of tank closure MLLW (468,000 cubic meters [16.5 million cubic feet]) is included as a waste stream under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1, for disposal in a new disposal facility, the RPPDF, located between the 200-East and 200-West Areas, after confirmation that the waste stream meets the appropriate land-disposal-restriction treatment standards, such as the alternative soil treatment standards (40 CFR 268.49).

##### 4.1.14.4.5.4 Hazardous Waste

A total of 79,700 cubic meters (2.81 million cubic feet) of hazardous waste would be generated during construction and operations. For 1 peak year (2039), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year.

#### 4.1.14.4.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 1,660 cubic meters (58,600 cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

#### 4.1.14.4.5.6 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons). This waste would be treated on site.

### 4.1.14.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

#### 4.1.14.5.1 Waste Inventories

Table 4–88 presents the estimated waste volumes generated under Alternative 3B. Under this Tank Closure alternative, closure activities would include the removal of ancillary equipment and the top 4.6 meters (15 feet) of soil from two tank farms. This tank closure waste would be disposed of in the new RPPDF.

#### 4.1.14.5.2 High-Level Radioactive Waste

As shown in Table 4–88, 10,300 cubic meters (364,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

#### 4.1.14.5.3 Treated Low-Activity Tank Waste

As shown in Table 4–88, the 299,000 cubic meters (10.6 million cubic feet) of ILAW generated by the two treatment processes under this Tank Closure alternative is within the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.5.3.1 Mixed Transuranic Waste

Under this Tank Closure alternative, 1,500 cubic meters (53,000 cubic feet) of CH-mixed and 2,140 cubic meters (75,600 cubic feet) of RH-mixed TRU waste would be generated. This volume would be within the WIPP-analyzed capacities allocated to Hanford.

#### 4.1.14.5.4 Waste Treatment Plant Melters

As shown in Table 4–88, the 2,260 cubic meters (79,800 cubic feet) of LAW melters generated under this Tank Closure alternative is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

As shown in Table 4–88, the volume of HLW melters generated under this Tank Closure alternative would be 1,100 cubic meters (38,800 cubic feet). DOE expects that the HLW melters would be stored on site.

## Table 4–88. Tank Closure Alternative 3B Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (8,700 canisters) | N/A | 10,300 | N/A | N/A | 10,300 | 2018–2039 | 469 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2040 | 400 | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | | |
| ILAW (28,510 canisters) | N/A | 65,800 | N/A | N/A | 65,800 | 2018–2039 | 2,990 | 65,800 (IDF) |
| Cast stone waste | N/A | 233,000 | N/A | N/A | 233,000 | 2018–2039 | 10,600 | 233,000 (IDF) |
| CH-TRU waste | N/A | 1,500 | N/A | N/A | 1,500 | 2009–2010 | 750 | N/A |
| RH-TRU waste | N/A | 2,140 | N/A | N/A | 2,140 | 2015–2019 | 428 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (9 melters) | N/A | 1,100 | N/A | N/A | 1,100 | Various | 245 | N/A |
| LAW melters (9 melters) | N/A | 2,260 | N/A | N/A | 2,260 | Various | 513 | 2,260 (IDF) |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 10,900 | 2,020 | 9,180 | 22,100 | 2035 | 1,680 | 22,100 (IDF) |
| MLLW | N/A | 24,500 | 4,000 | 6,580 | 35,100 | 2040 | 2,550 | 35,100 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 679 | 679 | 2034–2036 | 226 | 679 (RPPDF) |
| Closure MLLW[c] | N/A | N/A | N/A | 468,000 | 468,000 | 2028–2032 | 76,900 | 468,000 (RPPDF) |
| Mixed TRU waste | N/A | 206 | N/A | N/A | 206 | 2027–2039 | 9 | N/A |
| Hazardous waste[d] | 196 | 63,300 | 16,100 | 106 | 79,700 | 2039 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[e] | N/A | N/A | 698 | 677 | 1,380 | 2041 | 343 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 $m^3$, RPPDF 1,080,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 1: IDF-E 1,100,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 1,080,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 358,000 $m^3$/469,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from the decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[c] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[d] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[e] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** CH=contact-handled; HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RH=remote-handled; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.5.5 Secondary Waste

##### 4.1.14.5.5.1 Mixed Transuranic Waste

As shown in Table 4–88, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.5.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Table 4–88, Tank Closure Alternative 3B accounts for the disposal of 22,100 cubic meters (780,000 cubic feet) of LLW, 679 cubic meters (24,000 cubic feet) of LLW generated by tank closure, and 35,100 cubic meters (1.24 million cubic feet) of MLLW generated by tank closure. LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.5.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the removal of ancillary equipment and the excavation of contaminated soil to a depth of approximately 4.6 meters (15 feet) from selected tank farms. This large quantity of tank closure MLLW (468,000 cubic meters [16.5 million cubic feet]) is included as a waste stream under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1, for disposal in a new disposal facility, the RPPDF, located between the 200-East and 200-West Areas, after confirmation that the waste stream meets the appropriate land-disposal-restriction treatment standards, such as the alternative soil treatment standards (40 CFR 268.49). Land use, transportation, groundwater, and long-term human health impacts of closure waste disposal in the RPPDF under this Tank Closure alternative are evaluated in the appropriate sections of this *TC & WM EIS*.

##### 4.1.14.5.5.4 Hazardous Waste

A total of 79,300 cubic meters (2.8 million cubic feet) of hazardous waste would be generated during construction and operations. For 1 peak year (2039), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year.

##### 4.1.14.5.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 1,380 cubic meters (48,700 cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

##### 4.1.14.5.5.6 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons). This waste would be treated on site.

#### 4.1.14.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

##### 4.1.14.6.1 Waste Inventories

Table 4–89 presents the estimated waste volumes generated under Alternative 3C. Under this Tank Closure alternative, closure activities would include the removal of ancillary equipment and the top 4.6 meters (15 feet) of soil from two tank farms. This tank closure waste would be disposed of in the new RPPDF.

##### 4.1.14.6.2 High-Level Radioactive Waste

As shown in Table 4–89, 10,300 cubic meters (364,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

##### 4.1.14.6.3 Treated Low-Activity Tank Waste

As shown in Table 4–89, the 327,000 cubic meters (11.5 million cubic feet) of ILAW generated by the two treatment processes under this Tank Closure alternative is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Long-term impacts of radioactive and chemical releases from WTP and steam reforming waste on groundwater quality and human health are evaluated in Chapter 5.

###### 4.1.14.6.3.1 Mixed Transuranic Waste

The 1,500 cubic meters (53,000 cubic feet) of CH-mixed and 2,140 cubic meters (75,600 cubic feet) of RH-mixed TRU waste generated from solidifying tank waste under this Tank Closure alternative would be within the WIPP-analyzed capacities allocated to Hanford.

##### 4.1.14.6.4 Waste Treatment Plant Melters

As shown in Table 4–89, the 2,260 cubic meters (79,800 cubic feet) of LAW melters generated under this Tank Closure alternative is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

As shown in Table 4–89, the volume of HLW melters generated under this Tank Closure alternative would be 1,100 cubic meters (38,800 cubic feet). DOE expects that the HLW melters would be stored on site.

## Table 4–89. Tank Closure Alternative 3C Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (8,700 canisters) | N/A | 10,300 | N/A | N/A | 10,300 | 2018–2039 | 469 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2040 | 400 | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | | |
| ILAW (28,510 canisters) | N/A | 65,800 | N/A | N/A | 65,800 | 2018–2039 | 2,990 | 65,800 (IDF) |
| Cast stone waste | N/A | 261,000 | N/A | N/A | 261,000 | 2018–2039 | 11,900 | 261,000 (IDF) |
| CH-TRU waste | N/A | 1,500 | N/A | N/A | 1,500 | 2009–2010 | 750 | N/A |
| RH-TRU waste | N/A | 2,140 | N/A | N/A | 2,140 | 2015–2019 | 428 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (9 melters) | N/A | 1,100 | N/A | N/A | 1,100 | Various | 245 | N/A |
| LAW melters (9 melters) | N/A | 2,260 | N/A | N/A | 2,260 | Various | 513 | 2,260 (IDF) |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 10,700 | 1,980 | 9,180 | 21,800 | 2040 | 1,650 | 21,800 (IDF) |
| MLLW | N/A | 10,900 | 3,650 | 6,580 | 21,100 | 2040 | 2,180 | 21,100 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 679 | 679 | 2034–2036 | 226 | 679 (RPPDF) |
| Closure MLLW[c] | N/A | N/A | N/A | 468,000 | 468,000 | 2028–2033 | 78,000 | 468,000 (RPPDF) |
| Mixed TRU waste | N/A | 206 | N/A | N/A | 206 | 2027–2039 | 9 | N/A |
| Hazardous waste[d] | 196 | 63,300 | 16,100 | 106 | 79,700 | 2039 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[e] | N/A | 254 | 765 | 677 | 1,700 | 2041 | 377 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 $m^3$, RPPDF 1,080,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 1: IDF-E 1,100,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 1,080,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 372,000 $m^3$/469,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[c] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[d] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[e] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** CH=contact-handled; HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RH=remote-handled; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.6.5 Secondary Waste

##### 4.1.14.6.5.1 Mixed Transuranic Waste

As shown in Table 4–89, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.6.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Table 4–89, Tank Closure Alternative 3C accounts for the disposal of 21,800 cubic meters (770,000 cubic feet) of LLW, 679 cubic meters (24,000 cubic feet) of LLW generated by tank closure, and 21,100 cubic meters (746,000 cubic feet) of MLLW generated by tank closure. LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.6.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the removal of ancillary equipment and the excavation of contaminated soil to a depth of approximately 4.6 meters (15 feet) from selected tank farms. This large quantity of tank closure MLLW (468,000 cubic meters [16.5 million cubic feet]) is included as a waste stream under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1, for disposal in a new disposal facility, the RPPDF, located between the 200-East and 200-West Areas, after confirmation that the waste stream meets the appropriate land-disposal-restriction treatment standards, such as the alternative soil treatment standards (40 CFR 268.49). Land use, transportation, groundwater, and long-term human health impacts of closure waste disposal in the RPPDF under this Tank Closure alternative are evaluated in the appropriate sections of this EIS.

##### 4.1.14.6.5.4 Hazardous Waste

A total of 79,700 cubic meters (2.81 million cubic feet) of hazardous waste would be generated during construction and operations. For 1 peak year (2039), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year.

##### 4.1.14.6.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 1,700 cubic meters (60,000 cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

##### 4.1.14.6.5.6 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons). This waste would be treated on site.

### 4.1.14.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

#### 4.1.14.7.1 Waste Inventories

Table 4–90 presents the estimated waste volumes generated under Alternative 4. Under this Tank Closure alternative, closure activities would include removal from two tank farms of tanks and soils beneath the tanks that have been contaminated by past tank leaks. Some of these wastes would be sent to the PPF for treatment prior to disposal. The liquid waste streams from the treatment would be routed to the WTP and incorporated into the IHLW and ILAW glass streams. The majority of the waste volume from the closure wastes would be disposed of in the RPPDF.

#### 4.1.14.7.2 High-Level Radioactive Waste

As shown in Table 4–90, 12,800 cubic meters (452,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

#### 4.1.14.7.3 Treated Low-Activity Tank Waste

As shown in Table 4–90, the 251,000 cubic meters (8.86 million cubic feet) of ILAW generated by the three treatment processes under this Tank Closure alternative is within the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.7.3.1 Mixed Transuranic Waste

The 1,510 cubic meters (53,300 cubic feet) of CH-mixed and 2,160 cubic meters (76,300 cubic feet) of RH-mixed TRU waste generated from solidifying tank waste under this Tank Closure alternative would be within the WIPP-analyzed capacities allocated to Hanford.

#### 4.1.14.7.4 Waste Treatment Plant Melters

As shown in Table 4–90, the 2,570 cubic meters (90,800 cubic feet) of LAW melters generated under this Tank Closure alternative is within the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

As shown in Table 4–90, the volume of HLW melters generated under this Tank Closure alternative would be 1,230 cubic meters (43,400 cubic feet). DOE expects that the HLW melters would be stored on site.

## Table 4–90. Tank Closure Alternative 4 Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (10,800 canisters) | N/A | 12,800 | N/A | N/A | 12,800 | 2018–2042 | 512 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2043 | 400 | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | | |
| ILAW (28,690 canisters) | N/A | 66,200 | N/A | N/A | 66,200 | 2018–2042 | 2,650 | 66,200 (IDF) |
| Cast stone waste | N/A | 144,000 | N/A | N/A | 144,000 | 2018–2039 | 6,540 | 144,000 (IDF) |
| Bulk vitrification glass | N/A | 40,500 | N/A | N/A | 40,500 | 2018–2039 | 1,840 | 40,500 (IDF) |
| CH-TRU waste | N/A | 1,510 | N/A | N/A | 1,510 | 2009–2010 | 755 | N/A |
| RH-TRU waste | N/A | 2,160 | N/A | N/A | 2,160 | 2015–2019 | 432 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (10 melters) | N/A | 1,230 | N/A | N/A | 1,230 | Various | 245 | N/A |
| LAW melters (10 melters) | N/A | 2,570 | N/A | N/A | 2,570 | Various | 513 | 2,570 (IDF) |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 14,900 | 2,590 | 21,300 | 38,800 | 2043 | 2,230 | 38,800 (IDF) |
| MLLW | N/A | 14,600 | 5,080 | 23,800 | 43,500 | 2043 | 7,650 | 43,500 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 2,400 | 2,400 | 2022–2033 | 200 | 2,400 (RPPDF) |
| Closure MLLW[c] | N/A | N/A | N/A | 1,010,000 | 1,010,000 | 2034–2041 | 101,000 | 1,010,000 (RPPDF) |
| Mixed TRU waste | N/A | 412 | N/A | N/A | 412 | 2013–2042 | 14 | N/A |
| Hazardous waste[d] | 224 | 63,900 | 15,700 | 128 | 79,900 | 2042–2043 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[e] | N/A | 254 | 937 | 519,000 | 520,000 | 2022–2044 | 35,000 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 $m^3$, RPPDF 1,080,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 1: IDF-E 1,100,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 1,080,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 336,000 $m^3$/1,010,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[c] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[d] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[e] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** CH=contact-handled; HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RH=remote-handled; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.7.5 Secondary Waste

##### 4.1.14.7.5.1 Mixed Transuranic Waste

As shown in Table 4–90, the 412 cubic meters (14,500 cubic feet) of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.7.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Table 4–90, Tank Closure Alternative 4 accounts for the disposal of 38,800 cubic meters (1.4 million cubic feet) of LLW, 2,400 cubic meters (84,800 cubic feet) of LLW generated by tank closure, and 43,500 cubic meters (1.54 million cubic feet) of MLLW generated by tank closure. LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.7.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the clean closure of the BX and SX tank farms. This large quantity of tank closure MLLW (approximately 1.01 million cubic meters [35.7 million cubic feet]) is included as a waste stream under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1, for disposal of in a new disposal facility, the RPPDF, located between the 200-East and 200-West Areas, after confirmation that the waste stream meets the appropriate land-disposal-restriction treatment standards, such as the alternative soil treatment standards (40 CFR 268.49). Land use, transportation, groundwater, and long-term human health impacts of closure waste disposal in the RPPDF under this Tank Closure alternative are evaluated in the appropriate sections of this EIS.

##### 4.1.14.7.5.4 Hazardous Waste

A total of 79,900 cubic meters (2.82 million cubic feet) of hazardous waste would be generated during construction and operations. For 2 peak years (2042–2043), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year.

##### 4.1.14.7.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 520,000 cubic meters (18.4 million cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

##### 4.1.14.7.5.6 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be approximately 9,690 liters (2,560 gallons). This waste would be treated on site.

#### 4.1.14.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

##### 4.1.14.8.1 Waste Inventories

Table 4–91 presents the estimated waste volumes generated under Tank Closure Alternative 5. Under this Tank Closure alternative, the SST system at Hanford would be closed as an RCRA hazardous waste landfill unit under WAC-173-303 and DOE Order 435.1, as applicable, or decommissioned under DOE Order 430.1B. No contaminated soil would be removed at the BX or SX tank farm.

##### 4.1.14.8.2 High-Level Radioactive Waste

As shown in Table 4–91, 9,240 cubic meters (326,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

##### 4.1.14.8.3 Treated Low-Activity Tank Waste

As shown in Table 4–91, the 178,200 cubic meters (6.3 million cubic feet) of ILAW generated by the four treatment processes under this Tank Closure alternative is within the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Long-term impacts of radioactive and chemical constituents from the ILAW glass, bulk vitrification glass, cast stone waste, and sulfate grout waste on groundwater quality and human health are evaluated in Sections 4.6.6.3 and 4.6.13, respectively.

###### 4.1.14.8.3.1 Mixed Transuranic Waste

Under this alternative, 39 cubic meters (1,380 cubic feet) of CH-mixed and 55 cubic meters (1,940 cubic feet) of RH-mixed TRU waste would be generated. This amount is within the WIPP-analyzed capacities allocated to Hanford.

##### 4.1.14.8.4 Waste Treatment Plant Melters

As shown in Table 4–91, the volume of LAW melters generated under this Tank Closure alternative would be 2,460 cubic meters (86,900 cubic feet); this volume is included in the capacity of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

As shown in Table 4–91, the volume of HLW melters generated under this Tank Closure alternative would be 858 cubic meters (30,300 cubic feet). DOE expects that the HLW melters would be stored on site.

## Table 4–91. Tank Closure Alternative 5 Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (7,800 canisters) | N/A | 9,240 | N/A | N/A | 9,240 | 2018–2033 | 578 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2034 | 400 | N/A |
| **Treated Low-Activity Tank Waste** | | | | | | | | |
| ILAW (31,100 canisters) | N/A | 71,800 | N/A | N/A | 71,800 | 2018–2033 | 4,490 | 71,800 (IDF) |
| Bulk vitrification glass | N/A | 36,600 | N/A | N/A | 36,600 | 2018–2033 | 2,290 | 36,600 (IDF) |
| Cast stone waste | N/A | 50,000 | N/A | N/A | 50,000 | 2018–2033 | 3,130 | 50,000 (IDF) |
| Sulfate grout | N/A | 19,800 | N/A | N/A | 19,800 | 2018–2033 | 1,240 | 19,800 (IDF) |
| CH-TRU waste | N/A | 39 | N/A | N/A | 39 | 2009–2010 | 19 | N/A |
| RH-TRU waste | N/A | 55 | N/A | N/A | 55 | 2015–2019 | 11 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (7 melters) | N/A | 858 | N/A | N/A | 858 | Various | 245 | N/A |
| LAW melters (10 melters) | N/A | 2,460 | N/A | N/A | 2,460 | Various | 770 | 2,460 (IDF) |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 14,800 | 2,130 | 3,750 | 20,600 | 2034 | 1,940 | 20,600 (IDF) |
| MLLW | N/A | 14,600 | 4,290 | 3,670 | 22,600 | 2034 | 2,550 | 22,600 (IDF) |
| Closure MLLW[b] | N/A | N/A | 3,060 | N/A | 3,060 | 2012–2022 | 278 | 3,060 (RPPDF) |
| Mixed TRU waste | N/A | 183 | N/A | N/A | 183 | 2024–2033 | 10 | N/A |
| Hazardous waste[c] | 204 | 63,200 | 15,700 | 48 | 79,200 | 2033–2034 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[d] | N/A | 254 | 1,630 | 138 | 2,030 | 2035 | 409 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2012–2022 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 $m^3$, RPPDF 1,080,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 1: IDF-E 1,100,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 1,080,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 224,000 $m^3$/3,060 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[c] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[d] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** CH=contact-handled; HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RH=remote-handled; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.8.5 Secondary Waste

##### 4.1.14.8.5.1 Mixed Transuranic Waste

As shown in Table 4–91, 183 cubic meters (6,460 cubic feet) of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternatives 2 and 3; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.8.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Table 4–91, Tank Closure Alternative 5 accounts for the disposal of 20,600 cubic meters (727,000 cubic feet) of LLW and 22,600 cubic meters (798,000 cubic feet) of MLLW generated by tank closure. LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.8.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, ancillary equipment would not be removed and soil would not be excavated from tank farms. The quantity of MLLW (3,060 cubic meters [108,000 cubic feet]) generated by decontamination and decommissioning of the structures over the tank farms is included as a waste stream under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1, for disposal in a new disposal facility, the RPPDF, located between the 200-East and 200-West Areas, after confirmation that the waste stream meets the appropriate land-disposal-restriction treatment standards, such as the alternative soil treatment standards (40 CFR 268.49). Land use, transportation, groundwater, and long-term human health impacts of closure waste disposal in the RPPDF under this Tank Closure alternative are evaluated in the appropriate sections of this EIS.

##### 4.1.14.8.5.4 Hazardous Waste

A total of 79,200 cubic meters (280,000 cubic feet) of hazardous waste would be generated during construction and operations. For 2 peak years (2033–2034), hazardous waste would be generated at 31,400 cubic meters (111,000 cubic feet) per year.

##### 4.1.14.8.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 2,030 cubic meters (71,700 cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

##### 4.1.14.8.5.6 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons). This waste would be treated on site.

### 4.1.14.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

#### 4.1.14.9.1 Waste Inventories

##### 4.1.14.9.1.1 Base and Option Cases

Tables 4–92 and 4–93 present the estimated waste volumes generated under Tank Closure Alternative 6A, Base Case and Option Case, respectively. Under this Tank Closure alternative, closure activities include clean closure of all 12 SST farms in the 200-East and 200-West Areas. Clean closure of the tank farms would encompass extensive tank and ancillary equipment removal, all of which would be managed as HLW.

Tank closure waste that is not treated as HLW would be disposed of in the new RPPDF, to be located between the 200-East and 200-West Areas. The RPPDF would be similar to the IDF(s).

#### 4.1.14.9.2 High-Level Radioactive Waste

##### 4.1.14.9.2.1 Base and Option Cases

As shown in Tables 4–92 and 4–93, under both the Base Case and the Option Case, 203,000 cubic meters (7.17 million cubic feet) of IHLW canisters, 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters, and 337,000 cubic meters (11.9 million cubic feet) of additional HLW would be generated. DOE expects that the IHLW canisters would be stored on site. The additional HLW would be stored on site in shielded boxes.

#### 4.1.14.9.3 Treated Low-Activity Tank Waste

##### 4.1.14.9.3.1 Base and Option Cases

Under this alternative the tank waste stream would not be separated in the Pretreatment Facility, and all waste would be managed as HLW.

#### 4.1.14.9.4 Waste Treatment Plant Melters

##### 4.1.14.9.4.1 Base and Option Cases

As shown in Tables 4–92 and 4–93, the volume of HLW melters generated under this Tank Closure alternative would be 17,800 cubic meters (629,000 cubic feet) under both the Base Case and the Option Case. DOE expects that the HLW melters would be stored on site.

Also shown in Tables 4–92 and 4–93, the volume of PPF melters generated under this Tank Closure alternative is 3,060 cubic meters (4,010 cubic yards) under the Base Case and 17,900 cubic meters (632,000 cubic feet) under the Option Case. This amount is within the IDF capacities of Waste Management Alternative 2, Disposal Group 3, and Waste Management Alternative 3, Disposal Group 3. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 3, and Waste Management Alternative 3, Disposal Group 3.

## Table 4–92. Tank Closure Alternative 6A, Base Case, Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (171,300 canisters) | N/A | 203,000 | N/A | N/A | 203,000 | 2018–2162 | 1,410 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2163 | 400 | N/A |
| Other HLW | N/A | N/A | N/A | 337,000 | 337,000 | 2088–2099 | 6,410 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (145 melters) | N/A | 17,800 | N/A | N/A | 17,800 | Various | 613 | N/A |
| PPF melters (25 melters) | N/A | N/A | N/A | 3,060 | 3,060 | Various | 123 | 3,060 (IDF) |
| **Secondary Waste** | | | | | | | | |
| PPF glass (700 canisters) | N/A | N/A | N/A | 1,600 | 1,600 | 2042–2162 | 13 | 1,600 (IDF) |
| LLW | N/A | 17,900 | 4,560 | 70,300 | 93,000 | 2138–2140 | 1,110 | 93,000 (IDF) |
| MLLW | N/A | 15,900 | 20,300 | 72,900 | 109,000 | 2163 | 3,160 | 109,000 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 4,070 | 4,070 | (c) | 194 | 4,070 (RPPDF) |
| Closure MLLW[d] | N/A | N/A | N/A | 2,410,000 | 2,410,000 | 2054–2061 | 90,100 | 2,410,000 (RPPDF) |
| Mixed TRU waste | N/A | 530 | N/A | N/A | 530 | 2013–2162 | 4 | N/A |
| Hazardous waste[e] | 1,980 | 64,200 | 15,700 | 317 | 82,200 | 2162–2163 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[f] | N/A | 254 | 13,600 | 2,580,000 | 2,590,000 | 2088–2099 | 44,100 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 3: IDF-E 425,000 $m^3$, RPPDF 8,370,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 3: IDF-E 340,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 8,370,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 207,000 $m^3$/2,414,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[c] Peak generation coincides with deactivation of the containment structures during 2062–2064; 2085–2087; 2108–2110; 2123–2125; 2138–2140; 2146–2148; and 2162–2164.
[d] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[e] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[f] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; PPF=Preprocessing Facility; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

## Table 4–93. Tank Closure Alternative 6A, Option Case, Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (171,330 canisters) | N/A | 203,000 | N/A | N/A | 203,000 | 2018–2162 | 1,410 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2163 | 400 | N/A |
| Other HLW | N/A | N/A | N/A | 337,000 | 337,000 | 2088–2099 | 6,410 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (145 melters) | N/A | 17,800 | N/A | N/A | 17,800 | Various | 613 | N/A |
| PPF melters (146 melters) | N/A | N/A | N/A | 17,900 | 17,900 | Various | 735 | 17,900 (IDF) |
| **Secondary Waste** | | | | | | | | |
| PPF glass (18,320 canisters) | N/A | N/A | N/A | 42,300 | 42,300 | 2042–2162 | 349 | 42,300 (IDF) |
| LLW | N/A | 16,600 | 5,200 | 114,000 | 136,000 | 2146–2148 | 1,730 | 136,000 (IDF) |
| MLLW | N/A | 15,400 | 19,700 | 117,000 | 152,000 | 2139–2140 | 3,180 | 152,000 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 5,430 | 5,430 | 2085–2087<br>2146–2148 | 420 | 5,430 (RPPDF) |
| Closure MLLW[c] | N/A | N/A | N/A | 8,310,000 | 8,310,000 | 2054–2061 | 175,000 | 8,310,000 (RPPDF) |
| Mixed TRU waste | N/A | 530 | N/A | N/A | 530 | 2013–2041 | 4 | N/A |
| Hazardous waste[d] | 1,730 | 64,200 | 15,700 | 430 | 82,000 | 2162–2163 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[e] | N/A | 254 | 13,600 | 3,240,000 | 3,250,000 | 2065–2076 | 52,100 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 3: IDF-E 425,000 $m^3$, RPPDF 8,370,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 3: IDF-E 340,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 8,370,000 $m^3$ | | | | | Option Case total waste to IDF(s)/ RPPDF: 348,000 $m^3$/8,320,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[c] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[d] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[e] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; PPF=Preprocessing Facility; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.9.5 Secondary Waste

##### 4.1.14.9.5.1 Mixed Transuranic Waste

As shown in Tables 4–92 and 4–93, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 3, and Waste Management Alternative 3, Disposal Group 3; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.9.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Tables 4–92 and 4–93, under Tank Closure Alternative 6A, 93,400 cubic meters (3.3 million cubic feet) of LLW would be generated under the Base Case and 136,000 cubic meters (4.80 million cubic feet) of LLW, under the Option Case; 4,070 cubic meters (144,000 cubic feet) of closure LLW would be generated under the Base Case and 5,430 cubic meters (192,000 cubic feet) of closure LLW, under the Option Case; and 109,000 cubic meters (3.85 million cubic feet) of MLLW would be generated under the Base Case and 152,000 cubic meters (5.4 million cubic feet) of MLLW, under the Option Case by tank closure.

LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 3, and Waste Management Alternative 3, Disposal Group 3. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 3, and Waste Management Alternative 3, Disposal Group 3.

##### 4.1.14.9.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the removal of ancillary equipment and the excavation of contaminated soil from selected tank farms. This large quantity of tank closure waste includes approximately 2.41 million cubic meters (approximately 85.1 million cubic feet) of MLLW under the Base Case and approximately 8.3 million cubic meters (approximately 293 million cubic feet) of MLLW under the Option Case. Under both cases, the contaminated soil would be disposed of in the RPPDF. Land use, transportation, groundwater, and long-term human health impacts of disposing of the closure wastes in the RPPDF under this Tank Closure alternative are evaluated under Waste Management Alternative 2, Disposal Group 3, and Waste Management Alternative 3, Disposal Group 3.

PPF treatment of the soils would generate 1,880 cubic meters (66,400 cubic feet) of PPF glass under the Base Case and 42,300 cubic meters (1.49 million cubic feet) under the Option Case. These canisters would be disposed of in an onsite IDF.

##### 4.1.14.9.5.4 Hazardous Waste

A total of 82,200 cubic meters (2.90 million cubic feet) of hazardous waste under the Base Case and 82,000 cubic meters (2.90 million cubic feet) under the Option Case would be generated during construction and operations. For 2 peak years (2162–2163), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year under either case.

#### 4.1.14.9.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be approximately 2.59 million cubic meters (approximately 91.5 million cubic feet) under the Base Case and approximately 3.25 million cubic meters (approximately 155 million cubic feet) under the Option Case. This waste will be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

#### 4.1.14.9.5.6 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons) under both the Base Case and the Option Case. This waste would be treated on site.

### 4.1.14.10 Alternative 6B: All Vitrification with Separations; Clean Closure

#### 4.1.14.10.1 Waste Inventories

#### 4.1.14.10.1.1 Base and Option Cases

Tables 4–94 and 4–95 present the estimated waste volumes generated under Tank Closure Alternative 6B, Base Case and Option Case, respectively. Under this Tank Closure alternative, closure activities include clean closure of all 12 SST farms in the 200-East and 200-West Areas following deactivation. Clean closure of the tank farms would encompass extensive tank and ancillary equipment removal, all of which would be managed as HLW.

Tank closure waste that is not treated as HLW would be disposed of in the new RPPDF, to be located between the 200-East and 200-West Areas. The RPPDF would be similar to the IDF(s).

#### 4.1.14.10.2 High-Level Radioactive Waste

#### 4.1.14.10.2.1 Base and Option Cases

As shown in Tables 4–94 and 4–95, under both the Base Case and the Option Case, 14,200 cubic meters (501,000 cubic feet) of IHLW canisters, 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters, and 337,000 cubic meters (11.9 million cubic feet) of additional HLW would be generated. DOE expects that the IHLW canisters would be stored on site. The additional HLW would be stored on site in shielded boxes.

#### 4.1.14.10.3 Treated Low-Activity Tank Waste

#### 4.1.14.10.3.1 Base and Option Cases

The LAW stream that is separated in the Pretreatment Facility would be managed as HLW under this Tank Closure alternative.

## Table 4–94. Tank Closure Alternative 6B, Base Case, Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (12,000 canisters) | N/A | 14,200 | N/A | N/A | 14,200 | 2018–2039 | 646 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2040 | 400 | N/A |
| ILAW (93,000 canisters)[b] | N/A | 215,000 | N/A | N/A | 215,000 | 2018–2043 | 8,250 | N/A |
| Other HLW | N/A | N/A | N/A | 337,000 | 337,000 | 2023–2034 | 11,100 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (11 melters) | N/A | 1,350 | N/A | N/A | 1,350 | Various | 245 | N/A |
| LAW melters (31 melters) | N/A | 8,000 | N/A | N/A | 8,000 | Various | 1,540 | N/A |
| PPF melters (16 melters) | N/A | N/A | N/A | 1,960 | 1,960 | Various | 123 | 1,960 (IDF) |
| **Secondary Waste** | | | | | | | | |
| PPF glass (700 canisters) | N/A | N/A | N/A | 1,600 | 1,600 | 2023–2099 | 21 | 1,600 (IDF) |
| LLW | N/A | 27,800 | 1,690 | 70,400 | 99,900 | 2040 | 2,910 | 99,900 (IDF) |
| MLLW | N/A | 27,800 | 4,090 | 72,700 | 105,000 | 2040 | 2,980 | 105,000 (IDF) |
| Closure LLW[c] | N/A | N/A | N/A | 4,070 | 4,070 | (d) | 388 | 4,070 (RPPDF) |
| Closure MLLW[e] | N/A | N/A | N/A | 2,410,000 | 2,410,000 | 2035–2042 | 124,000 | 2,410,000 (RPPDF) |
| Mixed TRU waste | N/A | 412 | N/A | N/A | 412 | 2013–2043 | 13 | N/A |
| Hazardous waste[f] | 1,010 | 63,900 | 15,700 | 317 | 80,900 | 2039–2040 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[g] | N/A | 254 | 976 | 2,480,000 | 2,480,000 | 2023–2028 | 68,400 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 2: IDF-E 425,000 $m^3$, RPPDF 8,370,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 2: IDF-E 340,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 8,370,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 208,000 $m^3$/2,410,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] All ILAW to be managed as HLW.
[c] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[d] Peak occurs twice: 2043–2045 and 2097–2099.
[e] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[f] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[g] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; PPF=Preprocessing Facility; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

## Table 4–95. Tank Closure Alternative 6B, Option Case, Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (12,000 canisters) | N/A | 14,200 | N/A | N/A | 14,200 | 2018–2039 | 678 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2040 | 400 | N/A |
| ILAW (93,000 canisters)[b] | N/A | 215,000 | N/A | N/A | 215,000 | 2018–2043 | 8,260 | N/A |
| Other HLW | N/A | N/A | N/A | 337,000 | 337,000 | 2023–2034 | 11,100 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (11 melters) | N/A | 1,350 | N/A | N/A | 1,350 | Various | 245 | N/A |
| LAW melters (31 melters) | N/A | 8,000 | N/A | N/A | 8,000 | Various | 1,540 | N/A |
| PPF melters (93 melters) | N/A | N/A | N/A | 11,400 | 11,400 | Various | 735 | 11,400 (IDF) |
| **Secondary Waste** | | | | | | | | |
| PPF glass (18,320 canisters) | N/A | N/A | N/A | 42,300 | 42,300 | 2023–2099 | 549 | 42,300 (IDF) |
| LLW | N/A | 27,800 | 1,690 | 114,000 | 143,000 | 2040 | 3,630 | 143,000 (IDF) |
| MLLW | N/A | 27,800 | 4,090 | 117,000 | 149,000 | 2040 | 3,700 | 149,000 (IDF) |
| Closure LLW[c] | N/A | N/A | N/A | 5,430 | 5,430 | 2097–2099 | 614 | 5,430 (RPPDF) |
| Closure MLLW[d] | N/A | N/A | N/A | 8,310,000 | 8,310,000 | 2035–2042 | 227,000 | 8,310,000 (RPPDF) |
| Mixed TRU waste | N/A | 412 | N/A | N/A | 412 | 2013–2043 | 13 | N/A |
| Hazardous waste[e] | 1,010 | 63,900 | 15,700 | 430 | 81,000 | 2039–2040 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[f] | N/A | 254 | 1,200 | 3,240,000 | 3,240,000 | 2050–2061 | 79,600 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 2: IDF-E 425,000 $m^3$, RPPDF 8,370,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 2: IDF-E 340,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 8,370,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 346,000 $m^3$/8,315,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] All ILAW to be managed as HLW.
[c] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal is complete.
[d] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[e] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[f] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; PPF=Preprocessing Facility; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.10.4 Waste Treatment Plant Melters

##### 4.1.14.10.4.1 Base and Option Cases

As shown in Tables 4–94 and 4–95, the volume of HLW melters generated under this Tank Closure alternative would be 1,350 cubic meters (47,700 cubic feet) under both the Base Case and the Option Case. The volume of LAW melters generated under this Tank Closure alternative would be 8,000 cubic meters (283,000 cubic feet) under both the Base Case and the Option Case. DOE expects that the HLW and LAW melters would be stored on site.

Also shown in Tables 4–94 and 4–95, the volume of PPF melters generated under this Tank Closure alternative is 1,960 cubic meters (69,200 cubic feet) under the Base Case and 11,400 cubic meters (403,000 cubic feet) under the Option Case. This amount is within the IDF capacities of Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2.

#### 4.1.14.10.5 Secondary Waste

##### 4.1.14.10.5.1 Mixed Transuranic Waste

As shown in Tables 4–94 and 4–95, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2; therefore, this volume should not impact existing TRU waste treatment and storage facilities and would be within the capacity allocated to Hanford for disposal at WIPP (DOE 1997:S-10).

##### 4.1.14.10.5.2 Low-Level and Mixed Low-Level Radioactive Wastes

As shown in Tables 4–94 and 4–95, under Tank Closure Alternative 6B, LLW and MLLW volumes generated by tank closure under the Base and Option Cases, respectively, would be 99,800 and 143,000 cubic meters (3.52 million and 5.05 million cubic feet) of LLW; 4,070 and 5,430 cubic meters (144,000 and 192,000 cubic feet) of closure LLW; and 105,000 and 149,000 cubic meters (3.71 million and 5.26 million cubic feet) of MLLW.

LLW and MLLW would be disposed of in an IDF. The amount of LLW and MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2. Therefore, no long-term storage capacity would be needed; the impacts of treating and disposing of this waste in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2.

##### 4.1.14.10.5.3 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the removal of ancillary equipment and the excavation of contaminated soil from selected tank farms. This large quantity of tank closure waste includes approximately 2.41 million cubic meters (approximately 85 million cubic feet) of MLLW under the Base Case and approximately 8.31 million cubic meters (approximately 293 million cubic feet) of MLLW under the Option Case. Under both cases, the contaminated soil would be disposed of in the RPPDF. Land use, transportation, groundwater, and long-term human health impacts of disposing of the closure wastes in the RPPDF under this Tank Closure alternative are evaluated under Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2.

PPF treatment of the soils would generate 1,960 cubic meters (69,216 cubic feet) of PPF glass under the Base Case and 42,300 cubic meters (1.49 million cubic feet) under the Option Case. These canisters would be disposed of in an onsite IDF.

#### 4.1.14.10.5.4 Mixed Transuranic Waste

As shown in Tables 4–94 and 4–95, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 2, and Waste Management Alternative 3, Disposal Group 2; therefore, this volume should not impact existing TRU waste treatment and storage facilities.

#### 4.1.14.10.5.5 Hazardous Waste

A total of 80,900 cubic meters (2.86 million cubic feet) of hazardous waste under the Base Case and 80,000 cubic meters (2.83 million cubic feet) under the Option Case would be generated during construction and operations. For 2 peak years (2092–2093), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year under the Base Case and 31,000 cubic meters (1,090,000 cubic feet) per year under the Option Case.

#### 4.1.14.10.5.6 Nonhazardous Waste

The estimated volume of nonhazardous waste would be approximately 2.48 million cubic meters (approximately 87.6 million cubic feet) under the Base Case and approximately 3.24 million cubic meters (approximately 1.14 million cubic feet) under the Option Case. This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

#### 4.1.14.10.5.7 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons) under both the Base Case and the Option Case. This waste would be treated on site.

### 4.1.14.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

#### 4.1.14.11.1 Waste Inventories

Table 4–96 presents the estimated waste volumes generated under Alternative 6C. Under this Tank Closure alternative, closure activities include removal of ancillary equipment and the top 4.6 meters (15 feet) of soil from two tank farms. This tank closure waste would be disposed of in the new RPPDF, to be located between the 200-East and 200-West Areas. The RPPDF would be similar to the IDF(s).

#### 4.1.14.11.2 High-Level Radioactive Waste

As shown in Table 4–96, 14,200 cubic meters (501,000 cubic feet) of IHLW canisters and 400 cubic meters (14,100 cubic feet) of cesium and strontium canisters would be generated. DOE expects that the IHLW canisters would be stored on site.

#### 4.1.14.11.3 Treated Low-Activity Tank Waste

The LAW stream that is separated in the Pretreatment Facility would be managed as HLW under this Tank Closure alternative.

## Table 4–96. Tank Closure Alternative 6C Waste Generation Volumes

| Waste Type | Project Phase | | | | | Peak Annual Generation | | Total Waste Volume to IDF(s)/RPPDF |
|---|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Waste Volume/Year | |
| **High-Level Radioactive Waste** | | | | | | | | |
| IHLW (12,000 canisters) | N/A | 14,200 | N/A | N/A | 14,200 | 2018–2039 | 646 | N/A |
| Cesium and strontium (340 canisters)[a] | N/A | 400 | N/A | N/A | 400 | 2040 | 400 | N/A |
| ILAW (92,250 canisters) | N/A | 213,000 | N/A | N/A | 213,000 | 2018–2043 | 8,190 | N/A |
| **WTP Melters** | | | | | | | | |
| HLW melters (11 melters) | N/A | 1,350 | N/A | N/A | 1,350 | Various | 245 | N/A |
| LAW melters (31 melters) | N/A | 8,000 | N/A | N/A | 8,000 | Various | 1,540 | 8,000 (IDF) |
| **Secondary Waste** | | | | | | | | |
| LLW | N/A | 27,500 | 968 | 6,170 | 34,700 | 2040 | 2,820 | 34,700 (IDF) |
| MLLW | N/A | 27,500 | 2,870 | 9,630 | 40,000 | 2040 | 3,020 | 40,000 (IDF) |
| Closure LLW[b] | N/A | N/A | N/A | 53 | 53 | 2038–2040 | 18 | 53 (RPPDF) |
| Closure MLLW[c] | N/A | N/A | N/A | 468,000 | 468,000 | 2032–2037 | 78,000 | 468,000 (RPPDF) |
| Mixed TRU waste | N/A | 206 | N/A | N/A | 206 | 2029–2043 | 8 | N/A |
| Hazardous waste[d] | 634 | 63,300 | 15,700 | 106 | 79,700 | 2039–2040 | 31,400 | N/A |
| Nonradioactive-nonhazardous waste[e] | N/A | 254 | 1,340 | 677 | 2,270 | 2044 | 594 | N/A |
| Liquid LLW (liters) | N/A | N/A | N/A | 9,690 | 9,690 | 2018–2028 | 881 | N/A |
| IDF and RPPDF capacities:<br>Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 $m^3$, RPPDF 1,080,000 $m^3$<br>Waste Management Alternative 3, Disposal Group 1: IDF-E 1,100,000 $m^3$, IDF-W 90,000 $m^3$, RPPDF 1,080,000 $m^3$ | | | | | Total waste to IDF(s)/RPPDF: 82,700 $m^3$/468,000 $m^3$ | | | |

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for analysis purposes, they were assumed to be HLW.
[b] Closure LLW is the waste from decontamination and decommissioning of the containment structure over the tank farms after soil removal was complete.
[c] Closure MLLW includes soil, rubble, and equipment removed during closure of the tank farms.
[d] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[e] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417. Total may not equal the sum of the contributions due to rounding.

**Key:** HLW=high-level radioactive waste; IDF=Integrated Disposal Facility; IDF-E=200-East Area Integrated Disposal Facility; IDF-W=200-West Area Integrated Disposal Facility; IHLW=immobilized high-level radioactive waste; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; $m^3$=cubic meters; MLLW=mixed low-level radioactive waste; N/A=not applicable; RPPDF=River Protection Project Disposal Facility; TRU=transuranic; WTP=Waste Treatment Plant.

**Source:** Appendix E, Table E–10; SAIC 2010a.

#### 4.1.14.11.4 Waste Treatment Plant Melters

As shown in Table 4–96, the volume of HLW melters generated under this Tank Closure alternative would be 1,350 cubic meters (47,700 cubic feet). The volume of LAW melters generated under this Tank Closure alternative would be 8,000 cubic meters (283,000 cubic feet). DOE expects that the HLW melters would be stored on site. The LAW melters would be disposed of in an IDF. This amount is within the IDF capacities of Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are included under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

#### 4.1.14.11.5 Secondary Waste

##### 4.1.14.11.5.1 Mixed Transuranic Waste

As shown in Table 4–96, the estimated volume of mixed TRU waste would be less than the waste volume assumed under both Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1; therefore, this volume should not impact existing TRU waste treatment and storage facilities.

##### 4.1.14.11.5.2 Low-Level Radioactive Waste

As shown in Table 4–96, under Tank Closure Alternative 6C, 34,700 cubic meters (1.23 million cubic feet) of LLW and 53 cubic meters (1,870 cubic feet) of closure LLW would be generated. The amount of LLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1. Therefore, the impacts of providing disposal capacity in an IDF are evaluated under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1.

##### 4.1.14.11.5.3 Mixed Low-Level Radioactive Waste

As shown in Table 4–96, under Tank Closure Alternative 6C, 40,000 cubic meters (1.41 million cubic feet) of MLLW would be generated. The amount of MLLW generated under this Tank Closure alternative is consistent with that accounted for under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1; therefore, the impacts of treating and disposing of this waste in an onsite IDF have already been evaluated.

##### 4.1.14.11.5.4 Closure Mixed Low-Level Radioactive Waste

Under this Tank Closure alternative, large quantities of MLLW would be generated by the removal of ancillary equipment and the excavation of contaminated soil to a depth of approximately 4.6 meters (15 feet) from selected tank farms. This large quantity of tank closure MLLW (468,000 cubic meters [16.6 million cubic feet]) is included as a waste stream under Waste Management Alternative 2, Disposal Group 1, and Waste Management Alternative 3, Disposal Group 1, for disposal in the RPPDF.

##### 4.1.14.11.5.5 Hazardous Waste

A total of 79,700 cubic meters (2.81 million cubic feet) of hazardous waste would be generated during construction and operations. For 2 peak years (2039–2040), hazardous waste would be generated at 31,400 cubic meters (1.11 million cubic feet) per year.

#### 4.1.14.11.5.6 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 2,270 cubic meters (80,200 cubic feet). This waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

#### 4.1.14.11.5.7 Liquid Process Waste

The estimated volume of low-level radioactive liquid process waste would be 9,690 liters (2,560 gallons). This waste would be treated on site.

### 4.1.15 Industrial Safety

Illness, injury, and death are possible outcomes of any industrial accident. The accepted standard for measuring the outcome of an industrial accident is the number of total recordable cases (TRCs) of illness, injury, and death. This section addresses potential impacts of illness, injury, and death associated with implementation of each of the alternatives. Appendix K, Section K.4, contains a description of the technique used to calculate the TRCs and fatalities, as well as definitions and other information used to perform this analysis.

A review of the data from 2001 through 2006 indicates that occupational injuries and illnesses incurred at Hanford have decreased. The TRC rate (2.0) for the DOE Office of River Protection was chosen because the work conducted up to this point is expected to be similar to work in the future. It is also expected that the safety practices, programs, and procedures will remain in place in the future. The DOE and contractor fatality incident rate was chosen because it represents all work conducted by DOE. Table 4–97 provides a list of the relevant TRC and fatality rates used in this analysis. These rates are based on DOE Office of River Protection and DOE-wide data reported in the Computerized Accident/Incident Reporting System, as well as private industry data maintained by the U.S. Bureau of Labor Statistics.

**Table 4–97. Total Recordable Cases and Fatality Incident Rates**

| Labor Category | Total Recordable Case Rate[a] | Fatality Rate[b] |
|---|---|---|
| DOE and contractor | 1.88 | 0.26 |
| Construction (DOE and contractor) | 2.4 | 0.0 |
| Operations/production (DOE and contractor) | 1.3 | 0.0 |
| DOE Office of River Protection | 2.0 | 0.0 |
| Idaho Operations Office | 1.5 | 0.0 |
| Private industry (BLS) | 5.0 | 4.0 |
| Construction (private industry) (BLS) | 6.7 | 11.8 |

[a] Average illness and injury cases per 200,000 labor hours from 2001–2006.
[b] Average fatality rate per 200 million labor hours from 2001–2006.
**Key:** BLS=U.S. Bureau of Labor Statistics; DOE=U.S. Department of Energy.
**Source:** BLS 2008, 2009; DOE 2007a, 2007b.

Using these incident rates and the projected labor hours, industrial safety impacts associated with each of the alternatives were determined (see Table 4–98). There are inherent uncertainties in estimating the number of TRCs and fatalities associated with future activities. Currently, there are no weighting factors assigned to the phases of an alternative that allow for normalizing the risks under each alternative. Therefore, when averaging the rate over all phases, this approach can result in slightly higher values for project operation and closure phases and lower values for activities that have higher risk of injury and illness.

**Table 4–98. Tank Closure Alternatives – Industrial Safety Impacts**

| Alternative | Labor Category | Million Labor Hours | Total Recordable Case Rate per 200,000 Labor Hours | Projected Total Recordable Cases | Fatality Rate per 200 Million Labor Hours | Projected Fatalities |
|---|---|---|---|---|---|---|
| 1 | Construction | 8.80 | 2.0 | 88.0 | 0.26 | 0.0114 |
| | Operations | 4.53 | 2.0 | 45.3 | 0.26 | 0.0059 |
| | Deactivation | 3.0 | 2.0 | 30.0 | 0.26 | 0.0039 |
| | Closure | 0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | **Total** | **16.3** | | **163** | | **0.02** |
| 2A | Construction | 186 | 2.0 | 1,860 | 0.26 | 0.24 |
| | Operations | 503 | 2.0 | 5,030 | 0.26 | 0.65 |
| | Deactivation | 18.9 | 2.0 | 189 | 0.26 | 0.025 |
| | Closure | 0.27 | 2.0 | 2.7 | 0.26 | 0.0004 |
| | **Total** | **708.0** | | **7,080** | | **0.92** |
| 2B | Construction | 145 | 2.0 | 1,450 | 0.26 | 0.19 |
| | Operations | 228 | 2.0 | 2,280 | 0.26 | 0.30 |
| | Deactivation | 7.86 | 2.0 | 78.6 | 0.26 | 0.01 |
| | Closure | 7.48 | 2.0 | 74.8 | 0.26 | 0.01 |
| | **Total** | **388.0** | | **3,880** | | **0.50** |
| 3A | Construction | 126 | 2.0 | 1,260 | 0.26 | 0.16 |
| | Operations | 206 | 2.0 | 2,060 | 0.26 | 0.27 |
| | Deactivation | 9.41 | 2.0 | 94.1 | 0.26 | 0.01 |
| | Closure | 7.48 | 2.0 | 74.8 | 0.26 | 0.01 |
| | **Total** | **349** | | **3,490** | | **0.45** |
| 3B | Construction | 125 | 2.0 | 1,250 | 0.26 | 0.16 |
| | Operations | 202 | 2.0 | 2,020 | 0.26 | 0.26 |
| | Deactivation | 9.24 | 2.0 | 92.4 | 0.26 | 0.01 |
| | Closure | 7.48 | 2.0 | 74.8 | 0.26 | 0.01 |
| | **Total** | **344** | | **3,440** | | **0.45** |
| 3C | Construction | 128 | 2.0 | 1,280 | 0.26 | 0.16 |
| | Operations | 212 | 2.0 | 2,120 | 0.26 | 0.28 |
| | Deactivation | 9.71 | 2.0 | 97.1 | 0.26 | 0.01 |
| | Closure | 7.48 | 2.0 | 74.8 | 0.26 | 0.01 |
| | **Total** | **357** | | **3,570** | | **0.46** |
| 4 | Construction | 156 | 2.0 | 1,560 | 0.26 | 0.20 |
| | Operations | 249 | 2.0 | 2,490 | 0.26 | 0.32 |
| | Deactivation | 10.3 | 2.0 | 103 | 0.26 | 0.01 |
| | Closure | 34.3 | 2.0 | 343 | 0.26 | 0.04 |
| | **Total** | **450** | | **4,500** | | **0.59** |

**Table 4–98. Tank Closure Alternatives – Industrial Safety Impacts (*continued*)**

| Alternative | Labor Category | Million Labor Hours | Total Recordable Case Rate per 200,000 Labor Hours | Projected Total Recordable Cases | Fatality Rate per 200 Million Labor Hours | Projected Fatalities |
|---|---|---|---|---|---|---|
| 5 | Construction | 129 | 2.0 | 1,290 | 0.26 | 0.17 |
| | Operations | 175 | 2.0 | 1,750 | 0.26 | 0.23 |
| | Deactivation | 10.1 | 2.0 | 101 | 0.26 | 0.01 |
| | Closure | 11.0 | 2.0 | 110 | 0.26 | 0.01 |
| | **Total** | **325** | | **3,250** | | **0.42** |
| 6A Base | Construction | 513 | 2.0 | 5,130 | 0.26 | 0.67 |
| | Operations | 1,460 | 2.0 | 14,600 | 0.26 | 1.90 |
| | Deactivation | 26.8 | 2.0 | 268 | 0.26 | 0.03 |
| | Closure | 59.7 | 2.0 | 597 | 0.26 | 0.08 |
| | **Total** | **2,060** | | **20,600** | | **2.67** |
| 6A Option | Construction | 513 | 2.0 | 5,130 | 0.26 | 0.67 |
| | Operations | 1,460 | 2.0 | 14,600 | 0.26 | 1.90 |
| | Deactivation | 26.7 | 2.0 | 267 | 0.26 | 0.03 |
| | Closure | 134 | 2.0 | 1,340 | 0.26 | 0.17 |
| | **Total** | **2,130** | | **21,300** | | **2.77** |
| 6B Base | Construction | 180 | 2.0 | 1,800 | 0.26 | 0.23 |
| | Operations | 271 | 2.0 | 2,710 | 0.26 | 0.35 |
| | Deactivation | 9.05 | 2.0 | 90.5 | 0.26 | 0.01 |
| | Closure | 54.8 | 2.0 | 548 | 0.26 | 0.07 |
| | **Total** | **515** | | **5,150** | | **0.67** |
| 6B Option | Construction | 180 | 2.0 | 1,800 | 0.26 | 0.23 |
| | Operations | 271 | 2.0 | 2,710 | 0.26 | 0.35 |
| | Deactivation | 9.05 | 2.0 | 90.5 | 0.26 | 0.01 |
| | Closure | 112 | 2.0 | 1,120 | 0.26 | 0.15 |
| | **Total** | **572** | | **5,720** | | **0.74** |
| 6C | Construction | 146 | 2.0 | 1,460 | 0.26 | 0.19 |
| | Operations | 228 | 2.0 | 2,280 | 0.26 | 0.30 |
| | Deactivation | 7.86 | 2.0 | 78.6 | 0.26 | 0.01 |
| | Closure | 7.48 | 2.0 | 74.8 | 0.26 | 0.01 |
| | **Total** | **389** | | **3,890** | | **0.51** |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate. Totals may not equal the sum of the contributions due to rounding.
**Source:** Labor hours compiled from Appendix I.

As shown in Figure 4–25, the higher industrial safety impacts are associated with those alternatives that require higher numbers of labor hours.

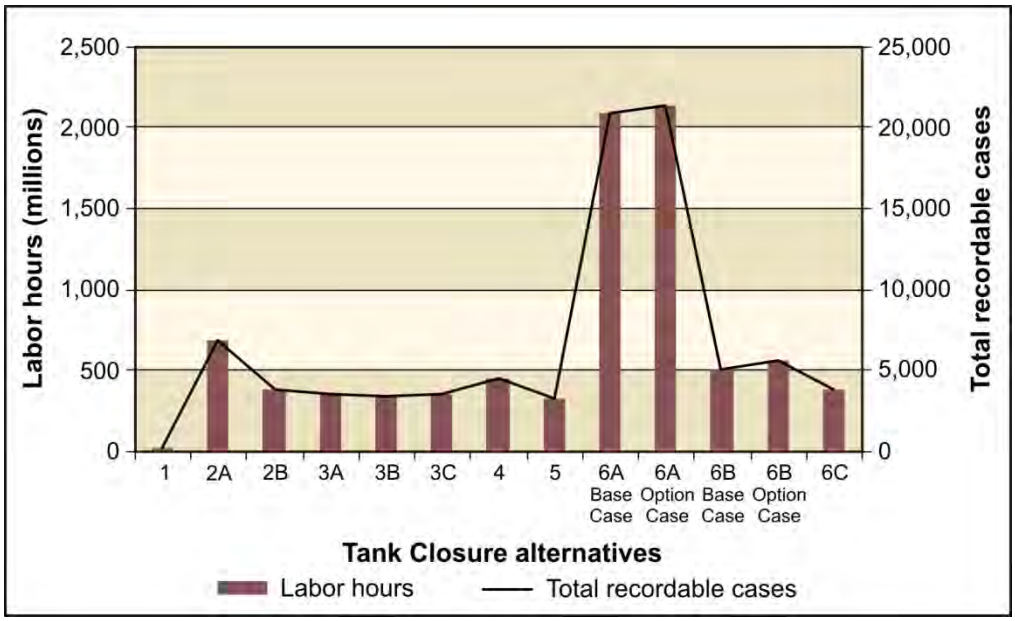


**Figure 4–25. Total Recordable Cases and Labor Hours by Alternative**

#### 4.1.15.1 Alternative 1: No Action

It is anticipated that, under this alternative, there would be less than 200 TRCs and no fatalities.

#### 4.1.15.2 Alternative 2A: Existing WTP Vitrification; No Closure

Projected impacts on worker safety under this alternative are 7,080 TRCs. A fatality as a result of an occupational accident is not anticipated. A value greater than 1 in the "Projected Fatalities" column of Table 4–98 indicates a death is anticipated. This value is based on the fatality incident rates (deaths per 200 million labor hours) recorded from 2001 through 2006. This alternative would require about 708 million labor hours, with the greater portion required during the peak periods of construction and operations.

#### 4.1.15.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

During all phases of the alternative, the projected impact is 3,880 TRCs and no fatalities. The greatest number of labor hours would be spent during the construction and operations phases.

#### 4.1.15.4 Alternative 3A: Existing WTP Vitrification with Thermal Supplemental Treatment (Bulk Vitrification); Landfill Closure

There is a total of 349 million labor hours for this alternative during all phases (construction, operations, decommissioning, and closure) of the project. Given the selected TRC rates for illness and injury, 3,490 TRCs are anticipated. No fatalities are anticipated during any phase of this alternative.

#### 4.1.15.5 Alternative 3B: Existing WTP Vitrification with Nonthermal Supplemental Treatment (Cast Stone); Landfill Closure

Under this alternative, 344 million hours of work would occur during the construction, operations, deactivation, and closure phases. Given the selected incident rates for illness and injury, it is anticipated that 3,440 TRCs would occur. No fatalities are projected.

#### 4.1.15.6 Alternative 3C: Existing WTP Vitrification with Thermal Supplemental Treatment (Steam Reforming); Landfill Closure

Given the selected incident rates for illness and injury, it is anticipated that 3,570 TRCs would occur. No fatalities are projected.

#### 4.1.15.7 Alternative 4: Existing WTP Vitrification with Supplemental Treatment Technologies; Selective Clean Closure/Landfill Closure

This alternative involves work requiring 450 million hours. It is anticipated that work under this alternative would generate approximately 4,500 TRCs. No fatalities are anticipated during any phase of the alternative.

#### 4.1.15.8 Alternative 5: Expanded WTP Vitrification with Supplemental Treatment Technologies; Landfill Closure

A total of 325 million labor hours are identified under this alternative. It is anticipated that about 3,250 TRCs would be generated by this alternative. No fatalities are expected during any phase of the alternative.

#### 4.1.15.9 Alternative 6A: All Vitrification/No Separations; Clean Closure

Alternative 6A would impact occupational safety. Factors influencing this impact include the total labor hours required and the historical incident rate. There are two variations under Alternative 6A: the Base Case and the Option Case. The estimated impacts are addressed separately.

##### 4.1.15.9.1 Base Case

Alternative 6A, Base Case, would require 2,160 million labor hours for the completion of all relevant tasks. About 21,600 TRCs and between two and three fatalities are projected to result annually.

##### 4.1.15.9.2 Option Case

Alternative 6A, Option Case, would require 2,130 million labor hours that would generate 21,300 TRCs. Three fatalities are anticipated annually.

#### 4.1.15.10 Alternative 6B: All Vitrification with Separations; Clean Closure

Alternative 6B would impact occupational safety. Factors influencing this impact include the total labor hours required and the historical incident rate. There are two variations under Alternative 6B: the Base Case and the Option Case. The estimated impacts are addressed separately.

##### 4.1.15.10.1 Base Case

A total of 515 million labor hours would be required to accomplish all tasks under Alternative 6B, Base Case. Given the incident rate and total labor hours, about 5,150 TRCs and no fatalities are projected.

#### 4.1.15.10.2 Option Case

Under Alternative 6B, Option Case, 572 million labor hours would be required to complete all relevant tasks. Given the total labor hours and incident rates for illness, injuries, and fatalities, about 5,720 TRCs and no fatalities are projected.

### 4.1.15.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Alternative 6C would require 389 million labor hours to complete all the tasks identified. Given application of the incident rate to the total labor hours, approximately 3,890 TRCs and no fatalities are projected.

## 4.2 FFTF DECOMMISSIONING ALTERNATIVES

This section describes the potential short-term environmental and human health impacts associated with implementation of alternatives considered for decommissioning of FFTF and its auxiliary facilities at Hanford; management of waste from the decommissioning process, including waste designated as remote-handled special components (RH-SCs); and disposition of the Hanford inventory of radioactively contaminated bulk sodium from FFTF, as well as other facilities on site. Three FFTF Decommissioning alternatives are considered and analyzed in this EIS: (1) FFTF Decommissioning Alternative 1: No Action, (2) FFTF Decommissioning Alternative 2: Entombment, and (3) FFTF Decommissioning Alternative 3: Removal.

Under FFTF Decommissioning Alternative 1: No Action, only certain deactivation activities at FFTF would be conducted, consistent with previous DOE National Environmental Policy Act actions. FFTF Decommissioning Alternative 2: Entombment would involve removing all aboveground structures within the 400 Area Property Protected Area (PPA), as well as minimal removal of below-grade structures, equipment, and materials as necessary to comply with regulatory standards. An RCRA-compliant barrier would be constructed over the remains of the Reactor Containment Building (RCB) and any other remaining below-grade structures (including the reactor vessel) that contain residual radioactive and treated hazardous materials. FFTF Decommissioning Alternative 3: Removal would involve removing all above-grade structures within the 400 Area PPA, as well as all contaminated below-grade structures, equipment, and materials. Associated construction, operations, deactivation, closure, and decommissioning activities were assessed, as applicable, under each alternative.

Under each action alternative (FFTF Decommissioning Alternatives 2 and 3), two options (a Hanford and an Idaho option) were evaluated for disposition of RH-SCs and processing of bulk sodium. For RH-SCs, the Hanford Option would involve treating the waste in a new Remote Treatment Project (RTP) at Hanford's T Plant, followed by disposal of the treated components and residuals along with other Hanford waste in the 200 Areas. Under the Idaho Option, RH-SCs would be shipped to an existing facility at the Idaho National Laboratory (INL) Idaho Nuclear Technology and Engineering Center (INTEC). Following treatment at INTEC, the FFTF components and residuals would be disposed of with other INL waste at the Nevada National Security Site (NNSS) (formerly the Nevada Test Site) or returned to Hanford for disposal in an IDF. For processing of bulk sodium under the Hanford Reuse Option, the bulk sodium would be stored in its current locations until it is shipped for processing to a new Sodium Reaction Facility (SRF) to be built in the 400 Area. The bulk sodium would be converted to a caustic sodium hydroxide solution for product reuse in processing tank waste at the WTP or for supporting Hanford tank corrosion controls. Under the Idaho Reuse Option, the bulk sodium would be stored in its current locations until it is shipped to the INL Materials and Fuels Complex (MFC) for processing in the existing Sodium Processing Facility (SPF). Following processing, the caustic solution would be returned to Hanford for product reuse. These alternatives and options are described further in Chapter 2, Section 2.5.3.

## 4.2.1 Land Resources

### 4.2.1.1 Alternative 1: No Action

#### 4.2.1.1.1 Land Use

##### 4.2.1.1.1.1 Facility Disposition

Under the No Action Alternative, the FFTF RCB and the rest of the buildings and structures within the 18-hectare (44.5-acre) FFTF PPA would remain in place (see Figure 4–26). Thus, the industrial nature of the 400 Area would not change and the presence of the FFTF RCB and associated facilities would preclude use of the area for other industrial purposes in the foreseeable future.

Any waste to be disposed of under this alternative would be placed in trenches 31 and 34 of LLBG 218-W-5 or in IDF-East (see Figure 4–1). As the 200 Areas have been designated Industrial-Exclusive, disposal associated with this alternative would not affect Hanford land use. Additional geologic material would not be needed under this alternative; thus, there would be no need to excavate geologic material from Borrow Area C.

##### 4.2.1.1.1.2 Disposition of Remote-Handled Special Components

Under this alternative, RH-SCs would be removed from the FFTF RCB. They would be packaged and stored within the 400 Area. Thus, there would be no change in land use within the 400 Area.

##### 4.2.1.1.1.3 Disposition of Bulk Sodium

Under the No Action Alternative, the Hanford bulk sodium inventory would remain stored untreated in its current Hanford locations; FFTF bulk sodium would remain within the Sodium Storage Facility (SSF) within the 400 Area (see Figure 4–26). As only existing facilities would be used, there would be no change in land use under this alternative.

#### 4.2.1.1.2 Visual Resources

##### 4.2.1.1.2.1 Facility Disposition

The FFTF RCB and associated buildings and structures would remain in place under the No Action Alternative. Thus, there would be no change in the appearance of the site or the current BLM Visual Resource Management Class IV rating for the 400 Area.

The minimal volume of waste to be disposed of under this alternative would be placed within trenches 31 and 34 of LLBG 218-W-5 or IDF-East. The use of either of these facilities would not change the overall visual appearance of the 200 Areas; thus, there would be no change in the BLM Visual Resource Management Class IV rating for the area.

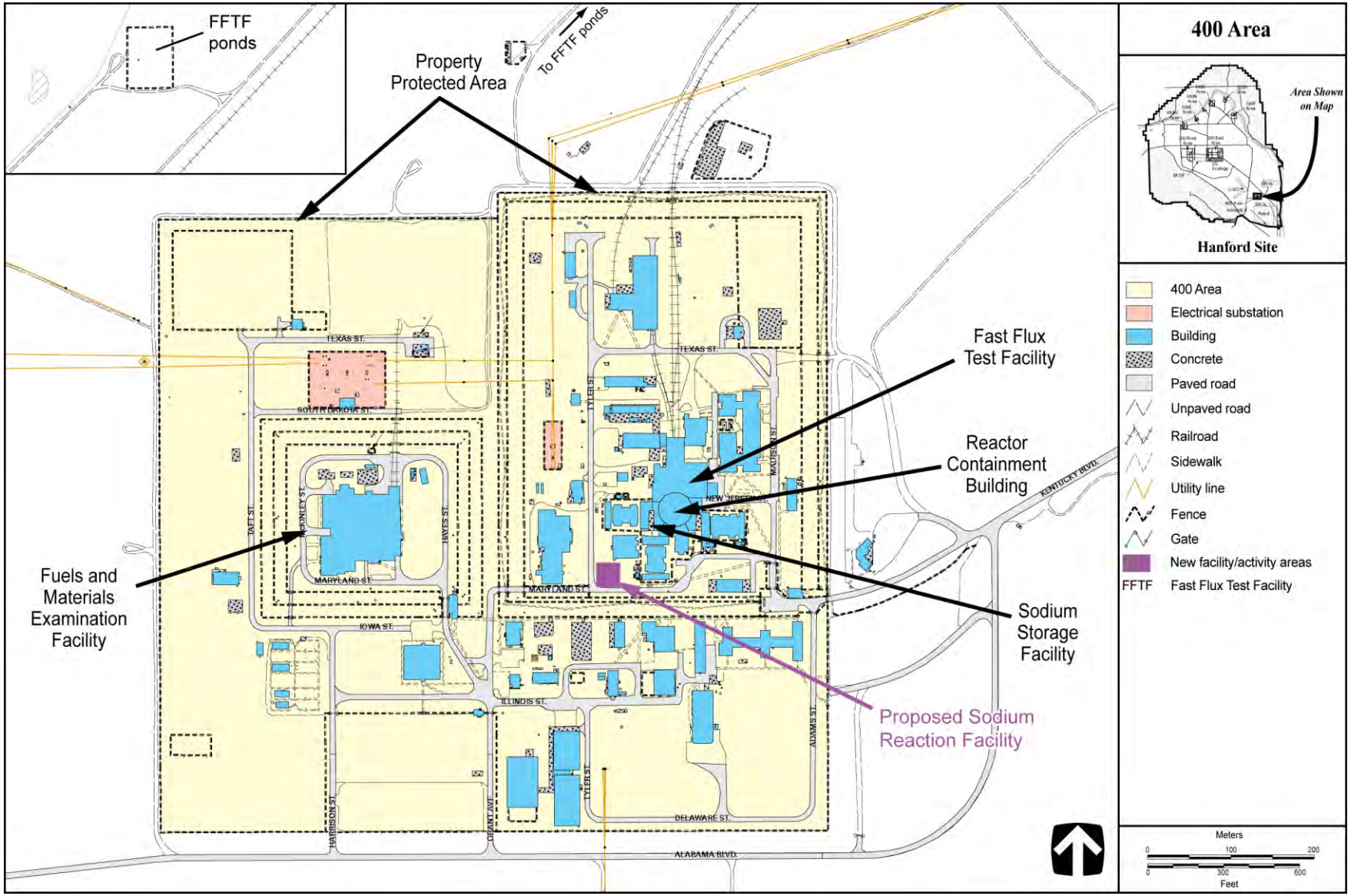


**Figure 4–26. 400 Area Facility Location**

#### 4.2.1.1.2.2 Disposition of Remote-Handled Special Components

Under the No Action Alternative, RH-SCs would be removed and packaged for storage in the 400 Area. Thus, there would be no impact on the visual environment of the 400 Area and, consequently, no change in the Visual Resource Management Class IV rating of the area.

#### 4.2.1.1.2.3 Disposition of Bulk Sodium

Under the No Action Alternative, FFTF sodium would be stored in the SSF, which is located within the 400 Area, and other bulk sodium would remain in place in the 200 Areas. Thus, there would be no impact on visual resources and no change in the Visual Resource Management Class IV rating of either area.

### 4.2.1.2 Alternative 2: Entombment

#### 4.2.1.2.1 Land Use

#### 4.2.1.2.1.1 Facility Disposition

Under Alternative 2, the FFTF RCB and immediately adjacent support facilities would be dismantled to below grade, and a 0.7-hectare (1.7-acre) modified RCRA Subtitle C barrier would be placed over the site. Other facilities within the PPA would be dismantled to grade. After appropriate preparation, 2.1 hectares (5.3 acres) of the site, including the barrier, would be revegetated. Thus, under this alternative, the PPA would be available for future development. Under this alternative, the Industrial designation of the 400 Area would not change.

Debris and other waste not placed in the RCB or used as backfill would be transported to trenches 31 and 34 of LLBG 218-W-5 or to IDF-East for disposal. Impacts on land use of constructing this IDF are addressed in Section 4.3.1.2.1.

Under this alternative, there would be a need to supply geologic material for grout and the modified RCRA Subtitle C barrier. This material would come from Borrow Area C, which is located to the south of State Route 240. The volume of material needed would necessitate the excavation of 2.8 hectares (7 acres), or 0.3 percent, of Borrow Area C. As Borrow Area C has a land use designation of Conservation (Mining), the removal of this material would be consistent with the current site land use plan.

#### 4.2.1.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, RH-SCs would be stored, treated, and disposed of at Hanford. As both storage and disposal facilities currently exist within the 200 Areas and are presently used for similar purposes, their use under this option would not affect land use. Treatment of RH-SCs would involve construction of a new RTP at the T Plant complex located in the 200-West Area. This facility would encompass 0.1 hectares (0.3 acres) of land. As the 200-West Area has been designated as Industrial-Exclusive, the new facility would be in keeping with current land use.

**IDAHO OPTION**

Under this option, RH-SCs removed from the FFTF RCB would be stored at Hanford prior to shipment to INL, where they would be treated in an existing facility at INTEC. As a treatment facility currently exists and there would be no new construction, there would be no change to the existing land use. Treated

components would be returned to Hanford or sent to NNSS for disposal, where they would be placed in existing disposal facilities. Thus, there would be no impact on land use at Hanford, INL, or NNSS from this element of the Idaho Option.

#### 4.2.1.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under the Hanford Reuse Option, sodium from FFTF would be sent to a new SRF to be built in the 400 Area. Construction of this new facility would require about 0.1 hectares (0.2 acres) of land near the SSF. As the new SRF would be constructed within the already highly developed 400 Area, which is designated as Industrial, there would be no impact on land use. The treated sodium would be stored in an existing facility within the 200 Areas; thus, there also would be no impact on land use from this element of the Hanford Reuse Option.

**IDAHO REUSE OPTION**

Under this option, sodium from FFTF and other sodium would be transported to INL for treatment in the SPF. Although the SPF is an existing facility within the MFC, its use would require a minor, external modification to accommodate a sodium offload system. However, this modification would not alter land use within the MFC. Further, there would be no change in land use in the 400 Area and 200 Areas at Hanford from implementation of this option because only existing facilities would be used.

### 4.2.1.2.2 Visual Resources

#### 4.2.1.2.2.1 Facility Disposition

Under the Entombment Alternative, a 0.7-hectare (1.7-acre) modified RCRA Subtitle C barrier would be placed over FFTF and adjacent support facilities following their dismantlement to below grade. Remaining structures within the PPA would also be dismantled, but a barrier would not be used. Disturbed areas within the PPA would be revegetated. Thus, under this alternative, there would be an initial overall improvement in the visual character of the 400 Area. However, if the site were to accommodate industrial facilities in the future, its appearance could return to one similar to today's. Regardless, the overall BLM Visual Resource Management Class IV rating of the 400 Area would remain unchanged due to other development in the immediate area.

Some debris would be placed in the RCB or used as backfill. Remaining waste would be transported to trenches 31 and 34 of LLBG 218-W-5 or to IDF-East for disposal. Impacts on visual resources of constructing this IDF are addressed in Section 4.3.1.2.2.

Although only a limited area (2.8 hectares [7 acres]) would be developed within Borrow Area C to supply geologic material under this alternative, excavation activities would impact the view from State Route 240 and nearby higher elevations. As Borrow Area C would be visible and would attract the attention of the viewer, the BLM visual resource management rating would be lowered from Class II to Class III.

#### 4.2.1.2.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, RH-SCs would be stored, treated, and disposed of at Hanford. As both storage and disposal facilities currently exist within the 200 Areas, their use under this option would not alter the visual environment. Treatment of RH-SCs would involve construction of a new RTP, which, when

complete, would require less than 0.1 hectares (0.3 acres) of land. This facility would be constructed within the T Plant complex in the 200-West Area. As this area is presently industrial, the new facility would not meaningfully alter the visual environment. Thus, under this option, the BLM Visual Resource Management Class IV rating of the 200-West Area would not change.

**IDAHO OPTION**

Under this option, RH-SCs removed from the FFTF RCB would be stored at Hanford prior to shipment to INL, where they would be treated in an existing facility at INTEC. As INTEC is currently industrial in nature and an existing facility would be used, there would be no change in the existing visual environment. Treated components would be returned to Hanford or sent to NNSS for disposal, where they would be placed in existing disposal facilities. Thus, there would be no change in the BLM Visual Resource Management Class IV rating of involved areas at Hanford, INL, or NNSS under this alternative.

#### 4.2.1.2.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under this option, sodium from FFTF would be sent to a new SRF to be built in the 400 Area. This new facility, which would occupy 0.1 hectares (0.2 acres) of land, would be constructed near the SSF. As the SRF would be constructed within the already highly developed 400 Area, there would be minimal impact on visual resources. The treated sodium would be stored within an existing facility within the 200 Areas; thus, there would be no impact on the visual environment from this element of the Hanford Reuse Option. The BLM Visual Resource Management Class IV rating for each involved area would not change under this option.

**IDAHO REUSE OPTION**

Under the Idaho Reuse Option, sodium from FFTF and other sodium would be transported to INL for treatment in the SPF. As the SPF is an existing facility within the MFC that would require only a minor external modification to accommodate a sodium offload system, its use would not change the visual environment of the MFC. There also would be no change to visual impacts in the 400 Area and 200 Areas at Hanford from implementation of this option because only existing facilities would be used. Thus, the BLM Visual Resource Management Class IV rating for each involved area would not change.

### 4.2.1.3 Alternative 3: Removal

#### 4.2.1.3.1 Land Use

#### 4.2.1.3.1.1 Facility Disposition

Under this alternative, the FFTF RCB and adjacent support facilities would be removed to 0.9 meters (3 feet) below grade; however, an engineered barrier would not be needed because the reactor vessel and other radioactively contaminated equipment would be removed. A 1-meter-thick (3.3-foot-thick) layer of soil would be placed over the site to permit the growth of vegetation. In total, 2.4 hectares (6 acres) of the 400 Area would be revegetated under this alternative. Thus, as is the case under Alternative 2, the PPA would become available for future development. Under this alternative, the Industrial designation of the 400 Area would not change.

Debris and other waste would be handled in the same manner as under Alternative 2 (see Section 4.2.1.2.1.1); thus, there would be no impact on land use at Hanford. Additionally, it would be necessary to develop 3.2 hectares (8 acres), or 0.3 percent, of Borrow Area C to supply the geologic material needed under this alternative. As Borrow Area C is designated Conservation (Mining), this action would be consistent with the current site land use plan.

#### 4.2.1.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

The steps involved in the disposition of RH-SCs under the Hanford Option of this alternative are identical to those under the Entombment Alternative. Thus, the impacts on land use from disposition-related activities would be the same as those discussed under the Hanford Option in Section 4.2.1.2.1.2.

**IDAHO OPTION**

Similar to the Hanford Option, the actions taken at INL would be the same under this alternative as those under the Entombment Alternative. Thus, the impacts on land use would be the same as those discussed under the Idaho Option in Section 4.2.1.2.1.2.

#### 4.2.1.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

The steps involved in processing bulk sodium under the Hanford Reuse Option of this alternative would be identical to those under the Entombment Alternative. Thus, the impacts on land use from processing activities would be the same as those discussed under the Hanford Reuse Option in Section 4.2.1.2.1.3.

**IDAHO REUSE OPTION**

Similar to the Hanford Reuse Option, the steps involved in the processing of bulk sodium at INL would be the same under this alternative as those under the Entombment Alternative. Thus, the impacts on land use would be the same as those discussed under the Idaho Reuse Option in Section 4.2.1.2.1.3.

### 4.2.1.3.2 Visual Resources

#### 4.2.1.3.2.1 Facility Disposition

The Removal Alternative would result in the dismantling and removal of the FFTF RCB and all associated structures within the PPA. Although an engineered barrier would not be used, the FFTF RCB site would be covered with a 1-meter-thick (3.3-foot-thick) layer of soil to permit the growth of vegetation. Overall, the visual impacts of this alternative would be similar to those under the Entombment Alternative because disturbed areas would be recontoured and revegetated. As under the Entombment Alternative, any future development would return the site to an industrial appearance. Regardless of future development, due to other industrial nature of the 400 Area, there would be no change in the BLM Visual Resource Management Class IV rating of the area.

Placement of debris and other waste resulting from removal activities in trenches 31 and 34 of LLBG 218-W-5 or in IDF-East is not expected to alter the overall appearance of either facility or the BLM Visual Resource Management Class IV rating of the 200 Areas. Although slightly more land would be affected, the visual impact of developing 3.2 hectares (8 acres) of Borrow Area C would be minimal, as described in Section 4.2.1.2.2.1.

#### 4.2.1.3.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

The steps involved in the disposition of RH-SCs under the Hanford Option of the Removal Alternative are identical to those under the Entombment Alternative. Thus, the impacts on visual resources of disposition-related activities would be the same as those discussed under the Hanford Option in Section 4.2.1.2.2.2.

**IDAHO OPTION**

Similar to the Hanford Option, the actions taken at INL would be the same under this alternative as under the Entombment Alternative. Thus, impacts on visual resources would be the same as those discussed under the Idaho Option in Section 4.2.1.2.2.2.

#### 4.2.1.3.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

The steps involved in the processing of bulk sodium under the Hanford Reuse Option of the Removal Alternative would be identical to those under the Entombment Alternative. Thus, the impacts on visual resources of processing activities would be the same as those discussed under the Hanford Reuse Option in Section 4.2.1.2.2.3.

**IDAHO REUSE OPTION**

Similar to the Hanford Reuse Option, the steps involved in the processing of bulk sodium at INL would be the same under this alternative as those under the Entombment Alternative. Thus, the impacts on visual resources would be the same as those discussed under the Idaho Reuse Option in Section 4.2.1.2.2.3.

### 4.2.2 Infrastructure

This subsection presents the potential impacts of FFTF Decommissioning alternatives and their associated options for disposition of RH-SCs and processing of bulk sodium on key utility infrastructure resources, including projected activity demands for electricity, fuel, and water. Total and peak annual utility infrastructure requirements are projected for each alternative and option, as well as for applicable component project phases (i.e., construction, operations, deactivation, closure, and decommissioning).

The key underlying assumptions used to project utility infrastructure demands under each of the FFTF Decommissioning alternatives and associated options are similar to those described in Section 4.1.2 for the Tank Closure alternatives. For example, it was assumed for analysis purposes that liquid fuels are not capacity-limiting resources because supplies would be replenished from offsite sources to support each alternative and provided at the point of use as needed.

Hanford's site utility infrastructure is described in Chapter 3, Section 3.2.2, and INL's is described in Chapter 3, Section 3.3.2. Table 4–99 summarizes the projected utility infrastructure resource requirements for the FFTF Decommissioning alternatives and associated options. Projected demands for key utility infrastructure resources and impacts on the respective utility systems from implementation of each of the alternatives and options are further discussed in the following sections.

**Table 4–99. FFTF Decommissioning Alternatives and Options – Summary of Utility Infrastructure Requirements**

| Alternatives and Options | Activity Phase | Electricity (M megawatt-hours) | Diesel Fuel[a] (M liters) | Gasoline (M liters) | Water (M liters) |
|---|---|---|---|---|---|
| Alternative 1: No Action | Deactivation | 0.60 | 0.0 | 0.11 | 795 |
| | **Total[b]** | **0.60** | **0.0** | **0.11** | **795** |
| | **Peak (Year)** | **0.006 (2008–2107)** | **N/A** | **0.0011 (2008–2107)** | **7.95 (2008–2107)** |
| Alternative 2: Facility Disposition-Entombment | Decommissioning | 0.0032 | 2.28 | 0.075 | 8.24 |
| | Closure | 0.0 | 1.74 | 0.29 | 11.4 |
| | **Total[b]** | **0.0032** | **4.02** | **0.36** | **19.6** |
| | **Peak (Year)** | **0.0032 (2017)** | **1.74 (2021)** | **0.098 (2021)** | **11.4 (2021)** |
| Alternative 3: Facility Disposition-Removal | Decommissioning | 0.0064 | 2.64 | 0.16 | 8.38 |
| | Closure | 0.0 | 1.11 | 0.22 | 10.5 |
| | **Total[b]** | **0.0064** | **3.76** | **0.37** | **18.9** |
| | **Peak (Year)** | **0.0032 (2013–2014)** | **1.11 (2021)** | **0.050 (2013–2014)** | **10.5 (2021)** |
| Alternative 2 or 3: Disposition of RH-SCs (Hanford Option for remote treatment) | Construction | 0.0 | 0.24 | 0.090 | 7.50 |
| | Operations | 0.00000071 | 0.00020 | 0.0 | 0.69 |
| | Deactivation | 0.00000036 | 0.00006 | 0.0 | 0.35 |
| | **Total[b]** | **0.00000107** | **0.24** | **0.090** | **8.53** |
| | **Peak (Year)** | **0.00000071 (2017)** | **0.12 (2015–2016)** | **0.045 (2015–2016)** | **3.75 (2015–2016)** |
| Alternative 2 or 3: Disposition of RH-SCs (Idaho Option for remote treatment) | Construction | 0.0 | 0.0 | 0.0 | 0.0 |
| | Operations | 0.00000071 | 0.0020 | 0.0 | 0.69 |
| | Deactivation | 0.00000036 | 0.00006 | 0.0 | 0.35 |
| | **Total[b]** | **0.00000107** | **0.002** | **0.0** | **1.04** |
| | **Peak (Year)** | **0.00000071 (2017)** | **0.0020 (2017)** | **N/A** | **0.693 (2017)** |
| Alternative 2 or 3: Disposition of Bulk Sodium (Hanford Reuse Option) | Construction | 0.0 | 0.95 | 0.36 | 0.17 |
| | Operations | 0.0013 | 0.011 | 0.0034 | 2.72 |
| | Deactivation | 0.0 | 0.13 | 0.051 | 0.032 |
| | **Total[b]** | **0.0013** | **1.09** | **0.42** | **2.92** |
| | **Peak (Year)** | **0.00069 (2017)** | **0.47 (2015–2016)** | **0.18 (2015–2016)** | **1.36 (2017–2018)** |
| Alternative 2 or 3: Disposition of Bulk Sodium (Idaho Reuse Option) | Construction | 0.0 | 0.015 | 0.0088 | 0.0 |
| | Operations | 0.0013 | 0.11 | 0.0034 | 2.72 |
| | Deactivation | 0.0 | 0.0 | 0.0 | 0.0 |
| | **Total[b]** | **0.0013** | **0.12** | **0.012** | **2.72** |
| | **Peak (Year)** | **0.00068 (2015)** | **0.058 (2015)** | **0.0088 (2014)** | **1.36 (2015–2016)** |

[a] Assumed to be inclusive of all No. 2 diesel fuel, including road diesel and heating fuel oil.

[b] Totals may not equal the sum of the contributions due to rounding.

**Note:** To convert liters to gallons, multiply by 0.26417. Values presented in the table have been rounded to no more than three significant digits, where appropriate.

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; M=million; N/A=not applicable; RH-SCs=remote-handled special components.

**Source:** SAIC 2010b.

#### 4.2.2.1 Alternative 1: No Action

Following the completion of deactivation activities for the FFTF complex and support buildings in the Hanford 400 Area under this alternative, utility infrastructure demands during the subsequent 100-year administrative control period would be very small and limited to usage levels necessary to maintain safety- and environmental–protection related systems, such as those for fire protection; heating, ventilating, and air conditioning; emergency lighting; and environmental monitoring, and to perform periodic facility inspections and system testing.

##### 4.2.2.1.1 Electricity

Under Alternative 1, annual electrical energy demand to support FFTF complex surveillance activities over the 100-year administrative control period would remain relatively constant and would represent a small fraction (about 3.5 percent) of the 0.17 million megawatt-hours of electricity currently used annually at Hanford. The projected peak annual electricity demand of 0.006 million megawatt-hours during the administrative control period would be comparable to the 0.0051 million megawatt-hours used in fiscal year 2006 during FFTF deactivation.

##### 4.2.2.1.2 Fuel

Annualized liquid fuel consumption (diesel fuel and gasoline) during the 100-year administrative control period for the FFTF complex would be a very small fraction (less than 0.03 percent) of the 4.3 million liters (1.1 million gallons) of liquid fuels currently used annually at Hanford.

##### 4.2.2.1.3 Water

Annualized water demands in the 400 Area over the 100-year administrative control period would be a relatively small fraction, less than 1 percent, of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford. The projected annual water demand of 7.95 million liters (2.1 million gallons) would be about 6.8 percent of the 116 million liters (30.6 million gallons) of groundwater used in the 400 Area in fiscal year 2006 during FFTF deactivation.

#### 4.2.2.2 Alternative 2: Entombment

##### 4.2.2.2.1 Electricity, Fuel, and Water

###### 4.2.2.2.1.1 Facility Disposition

Planning for the projected 8-year active decommissioning period under the Entombment Alternative calls for utility systems in the 400 Area PPA to be shut down as they are no longer needed. Deactivation of the office and maintenance buildings would be delayed until just prior to their scheduled demolition, so their utility infrastructure could be used to support overall entombment activities. As decommissioning activities proceeded, all equipment, piping, ducting, and electrical components would be removed by demolition personnel from building interiors prior to final demolition. Remaining underground utilities–electric, water, sewer, and communications–would be abandoned and capped at 3 feet (0.9 meters) below grade (BREI 2003:23, 29, 30, 31). Thus, existing utility infrastructure would be used to the extent possible and would then be supplemented or replaced by portable, temporary facilities as work progresses.

Electrical energy requirements under the Entombment Alternative would peak in 2017, driven by the demand for grout facility operations to grout the RCB and associated facilities. The peak electrical energy demand of 0.0032 million megawatt-hours (approximating an electric load of 0.37 megawatts) would be about 0.18 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load

capacity) of the Hanford electric power distribution system and about 0.54 percent of the 400 Area substation distribution capacity of 0.59 million megawatt-hours (67-megawatt load capacity).

Peak liquid fuel consumption under the Entombment Alternative would total about 1.74 million liters (0.46 million gallons) in 2021, primarily driven by surface barrier construction and related final site-closure activities.

Peak water demands would also occur in 2021, driven by water use for site regrading activities in conjunction with surface barrier construction. The projected peak water demand of 11.4 million liters (3.01 million gallons) would be about 0.06 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 9.8 percent of the 116 million liters (30.6 million gallons) of groundwater used in the 400 Area in fiscal year 2006.

#### 4.2.2.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Impacts of construction, operations, and deactivation of the RTP, which would be used to treat RH-SCs, would be minimal compared with those of the FFTF disposition efforts. The new RTP would be located adjacent to Hanford's T Plant and would utilize existing utility tie-ins to the extent possible; operationally, the RTP would have a relatively short lifespan of 1 year. For facility construction, it was assumed that electric power requirements would be minimal; any required electricity would be produced via fuel-fired generators. The peak annual electrical energy demand of 0.00000071 million megawatt-hours (approximating an electric load of about 0.00008 megawatts) in 2017, driven by facility operations, would be about 0.00004 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system and about 0.00012 percent of the 400 Area substation distribution capacity of 0.59 million megawatt-hours (67-megawatt load capacity). Total liquid fuel demands of 0.33 million liters (0.087 million gallons) in 2015–2016 would primarily be limited to the amount necessary to operate construction equipment and transport RH-SCs by truck from the 400 Area to the T Plant. Water would be required to support both facility construction and operations. Total estimated water requirements would peak in the 2015–2016 timeframe at 3.75 million liters (0.991 million gallons), driven primarily by the need for dust control during facility construction.

**IDAHO OPTION**

Construction impacts under this option would be minimal to none because this option would involve modifications to an existing facility at INL's INTEC. Utility resources under this option would be limited to operations and deactivation activities. The peak annual electrical energy demand would be the same as discussed above under the Hanford Option. Total liquid fuel (diesel only) demands of 0.0020 million liters (0.0005 million gallons) in 2017 would come mainly from operations activities and would represent about 6 percent of the 0.033 million liters (0.0087 million gallons) of diesel fuel used annually at INTEC and 0.06 percent of the 3.5 million liters (0.92 million gallons) of total liquid fuel used at INTEC. The peak water demand of 0.693 million liters (0.183 million gallons) would occur in 2017 during operations and deactivation of the facility. This water requirement would be about 0.14 percent of the 500 million liters (132 million gallons) used annually at INTEC.

#### 4.2.2.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Construction, operations, and deactivation of the SRF, which would be used to process Hanford bulk sodium and would be located in the 400 Area, would require relatively small quantities of utility resources as compared with the facility disposition efforts.

It was assumed that a fuel-fired generator would be used to supply electric power during facility construction. The peak electrical energy demand of 0.00069 million megawatt-hours (approximating an electric load of 0.080 megawatts) in 2017 during the first year of facility operations would be about 0.04 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system and about 0.12 percent of the 400 Area substation distribution capacity of 0.59 million megawatt-hours (67-megawatt load capacity).

Peak liquid fuel consumption under this option would total about 0.65 million liters (0.17 million gallons) in 2015–2016, associated with facility construction. Water requirements would peak in 2017–2018 at 1.36 million liters (0.359 million gallons) annually, driven by sodium processing operations. This water demand would be a small fraction (about 1.2 percent) of the 116 million liters (30.6 million gallons) of groundwater used in the 400 Area in fiscal year 2006.

**IDAHO REUSE OPTION**

Construction impacts on utility infrastructure under this option would be negligible as compared with those under the Hanford Reuse Option because this option would only involve modifications to an existing facility at INL's INTEC to receive and process Hanford sodium. Operational demands for utility resources would be very similar to those under the Hanford Reuse Option, except diesel fuel consumption for operations alone would be higher due to the need to transport Hanford sodium to and from INL. Total utility resource requirements would be less under this option.

### 4.2.2.3 Alternative 3: Removal

#### 4.2.2.3.1 Electricity, Fuel, and Water

#### 4.2.2.3.1.1 Facility Disposition

Similar to the situation previously described (see Section 4.2.2.2.1.1), utility systems in the closure area would be shut down as they are no longer needed and supplemented or replaced by portable, temporary facilities as site work progresses. Decommissioning activities involving the removal of major components, piping, and materials from the RCB under the Removal Alternative would drive overall utility resource demands under this alternative. Nevertheless, total utility infrastructure demands under this alternative would be similar to those projected above under the Entombment Alternative (see Table 4–99). This similarity is attributable to the fact that, while decommissioning requirements for the FFTF complex would be greater under this alternative, most utility resource needs to support final site closure would be markedly lower because, as under the Entombment Alternative, no surface barriers would need to be constructed.

Peak electrical energy requirements under the Removal Alternative would occur in 2013–2014, associated with grout facility operations as part of decommissioning. The peak electrical energy demand of 0.0032 million megawatt-hours (approximating an electric load of 0.37 megawatts) would be about 0.18 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system and about 0.54 percent of the 400 Area substation distribution capacity of 0.59 million megawatt-hours (67-megawatt load capacity).

Peak liquid fuel consumption under the Removal Alternative would total about 1.16 million liters (0.31 million gallons) in 2021, primarily driven by equipment operations in support of site regrading and revegetation activities. Similarly, peak water demands would also occur in 2021, driven by water use for final site activities including regrading and revegetation. The projected peak water demand of 10.5 million liters (2.77 million gallons) would be about 0.06 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 9.1 percent of the 116 million liters (30.6 million gallons) of the groundwater used in the 400 Area in fiscal year 2006.

#### 4.2.2.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Utility resource demands under this option would be the same as those discussed in Section 4.2.2.2.1.2 under the Hanford Option.

**IDAHO OPTION**

Utility resource demands under this option would be the same as those discussed in Section 4.2.2.2.1.2 under the Idaho Option.

#### 4.2.2.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Utility resource demands under this option would be the same as those discussed in Section 4.2.2.2.1.3 under the Hanford Reuse Option.

**IDAHO REUSE OPTION**

Utility resource demands under this option would be the same as those discussed in Section 4.2.2.2.1.3 under the Idaho Reuse Option.

### 4.2.3 Noise and Vibration

Facility construction, operations, decommissioning, deactivation, and closure activities, as applicable to each alternative, would result in minor noise impacts of employee vehicles, trucks, construction equipment, generators, and other equipment. The offsite noise levels from activities in the 200 and 400 Areas would be negligible due to the distance to the Hanford boundary. Heavy diesel equipment used for construction under most of the alternatives is expected to cause the highest noise levels. For example, if an estimated 67 items of construction equipment were operating at FFTF during the regrading closure and revegetation activities for Alternative 2 with a sound pressure level of 88 dBA at 15 meters (50 feet), the contribution to the sound level at the nearest site boundary would be 28 dBA (SAIC 2010b). During a normal daytime shift, the estimated maximum sound level at the site boundary from construction equipment operation would be well below the Washington State standard daytime maximum noise level limit of 60 dBA for industrial sources impacting residential receptors (WAC 173-60). Noise levels from decommissioning, operations, deactivation, and construction are expected to be less than those from this regrading closure activity.

Some disturbance of wildlife near the 200 and 400 Areas could occur as a result of noise from construction-type activities during decommissioning, construction, deactivation, and closure, as applicable to each alternative. Mitigation of impacts on special status species is discussed in Section 4.2.7.

The number of employee vehicles and trucks moving materials for various phases of FFTF decommissioning activities will vary over the duration of the project and by FFTF Decommissioning alternative. The increase in the number of employee vehicle and truck trips is discussed below for each FFTF Decommissioning alternative.

Activities at Hanford associated with the FFTF Decommissioning alternatives that would involve excavation, earthmoving, transport of fill material, and other vehicle traffic through Hanford could result in ground vibration that could affect LIGO operations. Most of the activities that have been identified to have impacts on this facility would be activities in which heavy vehicles or large construction equipment were used. It is expected that blasting would also have an impact on this facility if it is required for mining. Although DOE would coordinate vibration-producing activities with LIGO, the impacts of such activities are expected to result in some interference with the operations of this facility.

#### 4.2.3.1 Alternative 1: No Action

The increase in the number of employee vehicle and truck trips under FFTF Decommissioning Alternative 1 is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. Through use of the information cited in the discussion of local traffic in Section 4.2.9, the increase in employee and truck traffic was compared with the existing average traffic volume (see Chapter 3, Sections 3.2.9.4 and 3.3.9.4). For the purpose of comparing the alternatives, the increase in traffic noise level was estimated from the ratio of the projected traffic volume to the existing traffic volume (see Appendix F, Section F.3).

#### 4.2.3.2 Alternative 2: Entombment

##### 4.2.3.2.1 Facility Disposition

The increase in the number of employee vehicle and truck trips for facility disposition under Alternative 2 is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.2.3.1).

##### 4.2.3.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

The increase in the number of employee vehicle and truck trips for disposition of RH-SCs under FFTF Decommissioning Alternative 2, Hanford Option, is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.2.3.1).

**IDAHO OPTION**

The increase in the number of employee vehicle and truck trips for disposition of RH-SCs at INL under FFTF Decommissioning Alternative 2, Idaho Option, is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.2.3.1).

#### 4.2.3.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

The increase in the number of employee vehicle and truck trips for disposition of bulk sodium under FFTF Decommissioning Alternative 2, Hanford Reuse Option, is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.2.3.1).

**IDAHO REUSE OPTION**

The increase in the number of employee vehicle and truck trips for disposition of bulk sodium at INL under FFTF Decommissioning Alternative 2, Idaho Reuse Option, is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.2.3.1).

### 4.2.3.3 Alternative 3: Removal

#### 4.2.3.3.1 Facility Disposition

The increase in the number of employee vehicle and truck trips for facility disposition at Hanford under FFTF Decommissioning Alternative 3, is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.2.3.1).

#### 4.2.3.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

The impacts on traffic noise levels under this option would be the same as those discussed in Section 4.2.3.2.2 under the Hanford Option.

**IDAHO OPTION**

The impacts on traffic noise levels under this option would be the same as those discussed in Section 4.2.3.2.2 under the Idaho Option.

#### 4.2.3.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

The impacts on traffic noise levels under this option would be the same as those discussed in Section 4.2.3.2.3 under the Hanford Reuse Option.

**IDAHO REUSE OPTION**

The impacts on traffic noise levels under this option would be the same as those discussed in Section 4.2.3.2.3 under the Idaho Reuse Option.

### 4.2.4 Air Quality

Activities under the various FFTF Decommissioning alternatives would result in some air quality impacts due to air pollutant emissions from employee vehicles, trucks, and construction equipment, and, as applicable under some FFTF Decommissioning alternatives, from heating equipment, generators, and process equipment. Criteria pollutant concentrations for the activities associated with each FFTF Decommissioning alternative were modeled, and the year with peak concentrations for each alternative, pollutant, and averaging time was identified (see Appendix G). These concentrations are presented in Table 4–100 and compared with the ambient concentration standards. The maximum concentrations that would result from these activities under each FFTF Decommissioning alternative would be below the ambient concentration standards, except possibly for $PM_{2.5}$ and nitrogen dioxide under Alternatives 2 and 3. The peak period identified for each FFTF Decommissioning alternative and the primary contributing activities are discussed for each alternative below. Maximum air quality impacts are expected to occur along State Route 240 or along or near the Hanford boundary to the east, south, or west. The concentration estimates for PM are high due to the high emissions estimates. PM concentrations would be reduced by applying appropriate dust control measures (see Chapter 7, Section 7.1).

Construction activities considered in estimating PM emissions include general construction equipment activity, windblown particulates from disturbed areas, resuspension of road dust, fuel combustion in construction equipment, and grout facility operations. For the Idaho Options under Alternatives 2 and 3, the maximum concentrations would be below the ambient standards. As described in Section 4.1.4, the emissions calculations result in a substantial overestimate of $PM_{10}$ and $PM_{2.5}$ emissions. A refined analysis of emissions, based on more-detailed engineering of the construction activities and application of appropriate control technologies, is expected to result in substantially lower estimates of emissions and ambient concentrations from the major construction activities under any of the alternatives.

The sulfur dioxide emission factor used for fuel-burning sources was based on the use of equipment burning a distillate fuel with a sulfur content of about 0.0015 percent (15 ppm), which is being phased in beginning in 2007. No adjustment was made for more-restrictive emission standards for nitrogen dioxide and PM, which were scheduled to be phased in beginning in 2007. In future years pollutant emissions and impacts are expected to be smaller than estimated in this analysis, as better fuels, combustion technologies, emission controls, and alternative energy sources are developed.

Contributions to the total ambient concentrations from sources in the region and existing and reasonably anticipated sources at Hanford that are unrelated to FFTF activities are expected to change over the period of the activities evaluated in this EIS and are addressed in the cumulative impacts section. The existing contributions of Hanford sources and regional monitored concentrations are discussed in Chapter 3, Section 3.2.4. Existing contributions of INL sources and regional monitored concentrations are discussed in Chapter 3, Section 3.3.4.

**Table 4–100. FFTF Decommissioning Alternatives – Maximum Incremental Criteria Pollutant Concentrations at the Hanford Site**

| Pollutant and Averaging Period | Standard[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Alternative 2 | | | Alternative 3 | | |
| | | Alternative 1 | Facility Disposition | Disposition of Remote-Handled Special Components | Disposition of Bulk Sodium | Facility Disposition | Disposition of Remote-Handled Special Components | Disposition of Bulk Sodium |
| **Carbon Monoxide** | | | | | | | | |
| 8-hour | 10,000[b] | 4.35 | 60.6 | 5.47 | 719 | 53.0 | 5.47 | 719 |
| 1-hour | 40,000[b] | 31.3 | 435 | 39.3 | 5,160 | 381 | 39.3 | 5,160 |
| **Nitrogen Dioxide** | | | | | | | | |
| Annual | 100[b] | 0.00066 | 2.91 | (c) | (c) | 2.09 | (c) | (c) |
| 1-hour | 188 | 0.812 | **3,590** | (c) | (c) | **2,570** | (c) | (c) |
| **$PM_{10}$[d]** | | | | | | | | |
| Annual | 50[e] | 0.0000405 | 0.466 | 0.623 | 0.334 | 1.07 | 0.623 | 0.334 |
| 24-hour | 150[b] | 0.00272 | 31.3 | 41.9 | 22.5 | 72 | 41.9 | 22.5 |
| **$PM_{2.5}$[d]** | | | | | | | | |
| Annual | 15[d] | 0.0000405 | 0.466 | 0.623 | 0.334 | 1.07 | 0.623 | 0.334 |
| 24-hour | 35[d] | 0.00272 | 31.3 | **41.9** | 22.5 | 72 | 41.9 | 22.5 |
| **Sulfur Dioxide** | | | | | | | | |
| Annual | 50[e] | 0.000034 | 0.0249 | 0.0000504 | 0.00566 | 0.0409 | (c) | (c) |
| 24-hour | 260[e] | 0.00229 | 1.67 | 0.00339 | 0.381 | 2.75 | (c) | (c) |
| 3-hour | 1,300[b] | 0.014 | 10.2 | 0.0207 | 2.32 | 16.8 | (c) | (c) |
| 1-hour | 197[e] | 0.0419 | 30.6 | 0.062 | 6.97 | 50.4 | (c) | (c) |

a The more stringent of the Federal and Washington State standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The 24-hour $PM_{10}$ standard is attained when the expected number of days with a 24-hour average concentration above the standard is less than or equal to 1. The annual arithmetic mean $PM_{10}$ standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. The annual $PM_{2.5}$ standard is met when the 3-year average of the annual means is less than or equal to the standard. The 24-hour $PM_{2.5}$ standard is met when the 3-year average of the 98th percentile 24-hour averages is less than or equal to the standard. The 1-hour nitrogen dioxide standard is met when the 3-year average 98th percentile of the daily maximum 1-hour average does not exceed the standard value.

b Federal and Washington State standard.

c There is no disposition of remote-handled special components or bulk sodium in the peak year for this pollutant.

d The Federal standards for $PM_{2.5}$ are 15 micrograms per cubic meter annual average and 35 micrograms per cubic meter 24-hour average. No specific data for $PM_{2.5}$ were available, but for analysis purposes, concentrations were assumed to be the same as $PM_{10}$.

e Washington State standard.

**Note:** NAAQS also includes standards for lead and ozone. No sources of lead emissions have been identified for the alternatives evaluated. Washington State also has ambient standards for fluorides. Concentrations in **bold** text indicate potential exceedance of the standard.

**Key:** FFTF=Fast Flux Test Facility; NAAQS=National Ambient Air Quality Standards; $PM_n$=particulate matter with an aerodynamic diameter less than or equal to *n* micrometers.

**Source:** Appendix G, Section G.3.

The Clean Air Act, as amended, requires that Federal actions conform to the host state's "state implementation plan" (see Appendix G, Section G.4). The final rule, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans," requires a conformity determination for certain-size projects in nonattainment areas. Hanford and INL are within areas currently designated as in attainment for criteria air pollutants. Therefore, a conformity determination for these alternatives is not necessary to meet the requirements of the final rule (40 CFR 93, Subpart B).

Both carcinogenic and noncarcinogenic toxic pollutant concentrations were evaluated. Exposure of members of the public to airborne pollutants would be sourced from process emissions released during operations and from equipment used during construction, operations, and decommissioning. Selected air toxics were modeled because they represent toxic constituents associated with emissions from operation of gasoline- and diesel-fueled equipment. Maximum concentrations for each alternative and the Washington State acceptable source impact levels are presented in Table 4–101. These concentrations are below the acceptable source impact levels for all of the alternatives. The acceptable source impact levels are used by the state in the permitting process and represent concentrations sufficiently low to protect human health and safety from potential carcinogenic and other toxic effects (WAC 173-460).

**Table 4–101. FFTF Decommissioning Alternatives – Maximum Incremental Toxic Chemical Concentrations at the Hanford Site**

| Pollutant | Averaging Period | Acceptable Source Impact Level[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Alternative 1 | Alternative 2 | | | Alternative 3 | | |
| | | | | FD | Disposition of RH-SCs | DBS | FD | Disposition of RH-SCs | DBS |
| Ammonia | 24-hour | 70.8 | 0.000132 | 0.196 | 0.0157 | 14.0 | 0.0264 | 0.0157 | 14.0 |
| Benzene | Annual | 0.0345 | 0.00000327 | 0.0109 | (b) | (b) | 0.0109 | (b) | (b) |
| 1,3-Butadiene | Annual | 0.00588 | 0.0000000183 | 0.000229 | (b) | (b) | 0.000119 | (b) | (b) |
| Formaldehyde | Annual | 0.167 | 0.0000011 | 0.00367 | (b) | (b) | 0.00367 | (b) | (b) |
| Mercury | 24-hour | 0.09 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Toluene | 24-hour | 5,000 | 0.00338 | 11.3 | (b) | (b) | 11.3 | (b) | (b) |
| Xylene | 24-hour | (c) | 0.000954 | 3.18 | (b) | (b) | 3.18 | (b) | (b) |

[a] WAC 173-460. Acceptable source impact levels were updated in this environmental impact statement.
[b] There is no disposition of RH-SCs or bulk sodium in the peak year for this pollutant.
[c] Not listed in WAC 173-460.
**Key:** DBS=Disposition of Bulk Sodium; FD=Facility Disposition; FFTF=Fast Flux Test Facility; RH-SCs=remote-handled special components.
**Source:** Appendix G, Section G.3.

For noninvolved workers at nearby facilities, the highest annual concentration for each toxic chemical was used to estimate the Hazard Quotient for each chemical, as described in Appendix G. The Hazard Quotients were summed to provide the Hazard Index from noncarcinogenic chemicals associated with the alternative. A Hazard Index of less than 1 indicates that adverse health effects of non-cancer-causing agents are not expected. Hazard Indices for each alternative are summarized in Table 4–102. For carcinogens, the highest annual concentration was used to estimate the increased cancer risk from a chemical. Cancer risks from nonradioactive toxic pollutant emissions for each alternative are summarized in Table 4–103.

**Table 4–102. FFTF Decommissioning Alternatives – Nonradioactive Airborne Toxic Chemical Hazard Index for the Nearest Noninvolved Worker at the Hanford Site**

| Chemical | Hazard Quotient | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Alternative 2 | | | Alternative 3 | | |
| | Alternative 1 | Facility Disposition | Disposition of Remote-Handled Special Components | Disposition of Bulk Sodium | Facility Disposition | Disposition of Remote-Handled Special Components | Disposition of Bulk Sodium |
| Ammonia | $1.67\times10^{-8}$ | $1.35\times10^{-4}$ | $1.77\times10^{-3}$ | $1.78\times10^{-3}$ | $1.17\times10^{-4}$ | $1.99\times10^{-6}$ | $1.78\times10^{-3}$ |
| Mercury | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Toluene | $8.56\times10^{-9}$ | $2.94\times10^{-5}$ | $1.37\times10^{-6}$ | $1.76\times10^{-6}$ | $2.92\times10^{-5}$ | $2.34\times10^{-9}$ | $1.76\times10^{-6}$ |
| Xylene | $1.21\times10^{-7}$ | $4.17\times10^{-4}$ | $1.96\times10^{-5}$ | $2.52\times10^{-5}$ | $4.13\times10^{-4}$ | $8.16\times10^{-8}$ | $2.51\times10^{-5}$ |
| Hazard Index | $1.46\times10^{-7}$ | $5.81\times10^{-4}$ | $1.79\times10^{-3}$ | $1.81\times10^{-3}$ | $5.59\times10^{-4}$ | $2.07\times10^{-6}$ | $1.80\times10^{-3}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix G, Section G.3.

**Table 4–103. FFTF Decommissioning Alternatives – Nonradioactive Airborne Toxic Chemical Cancer Risk for the Nearest Noninvolved Worker**

| Chemical | | Alternative 2 | | | Alternative 3 | | |
|---|---|---|---|---|---|---|---|
| | Alternative 1 | Facility Disposition | Disposition of Remote-Handled Special Components | Disposition of Bulk Sodium | Facility Disposition | Disposition of Remote-Handled Special Components | Disposition of Bulk Sodium |
| Benzene | $2.17\times10^{-11}$ | $8.16\times10^{-8}$ | $4.54\times10^{-9}$ | $6.04\times10^{-9}$ | $7.91\times10^{-8}$ | $2.08\times10^{-10}$ | $5.83\times10^{-9}$ |
| 1,3-Butadiene | $4.69\times10^{-13}$ | $8.30\times10^{-9}$ | $2.51\times10^{-10}$ | $3.55\times10^{-10}$ | $5.21\times10^{-9}$ | $3.35\times10^{-11}$ | $3.22\times10^{-10}$ |
| Formaldehyde | $1.22\times10^{-11}$ | $5.43\times10^{-8}$ | $4.24\times10^{-9}$ | $5.88\times10^{-9}$ | $5.12\times10^{-8}$ | $4.39\times10^{-10}$ | $5.44\times10^{-9}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix G, Section G.3.

#### 4.2.4.1 Alternative 1: No Action

Criteria pollutant concentrations from activities under FFTF Decommissioning Alternative 1 are presented in Table 4–100. The peak concentrations of all criteria pollutants would occur from 2008 through 2107. The peak period concentration would result from administrative control activities.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–101. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–102 and 4–103. A Hazard Index of less than 1 indicates that adverse health effects of non-cancer-causing agents are not expected.

#### 4.2.4.2 Alternative 2: Entombment

Criteria pollutant concentrations from facility disposition, disposition of RH-SCs, and disposition of bulk sodium under FFTF Decommissioning Alternative 2 at Hanford are presented in Table 4–100. The peak concentrations occur in 2016 for all pollutants except nitrogen dioxide, which peaks in 2021. The peak period concentration would result primarily from Hanford SRF construction (for carbon monoxide); from Hanford SRF and RTP construction (for PM); from grout facility construction (for sulfur dioxide); and from modified RCRA Subtitle C barrier construction and site regrading (for nitrogen dioxide). Figure 4–27 shows the 24-hour $PM_{10}$ concentration over the project duration, including the Hanford

options for disposition of RH-SCs and bulk sodium, as well as the contribution of major activities to these concentrations at Hanford.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–101. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–102 and 4–103.

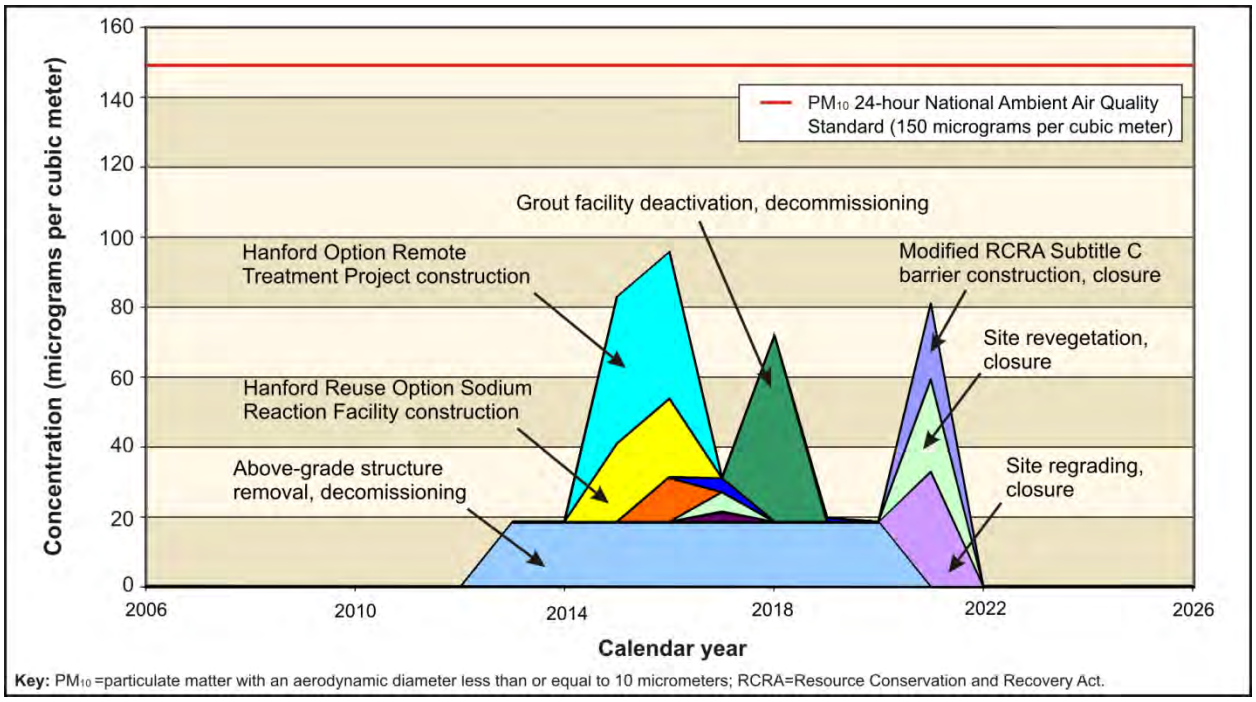


**Figure 4–27. FFTF Decommissioning Alternative 2**
**$PM_{10}$ Maximum 24-Hour Concentration at the Hanford Site**

#### 4.2.4.2.1 Facility Disposition

Decommissioning activities, especially above-grade structure and equipment removal and onsite grout facility construction and operations, would be the primary contributors to air pollutant impacts of facility disposition because of the amount of equipment used and earthmoving activity. Peak year facility disposition concentrations are shown in Tables 4–100 and 4–101.

#### 4.2.4.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Disposition of RH-SCs under the Hanford Option would result in air pollutant impacts due to construction and operations of the RTP at Hanford. Peak year concentrations from disposition of RH-SCs are shown in Tables 4–100 and 4–101.

**IDAHO OPTION**

Operation of the RTP would not produce criteria or toxic air pollutant emissions.

#### 4.2.4.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Processing bulk sodium under the Hanford Reuse Option would result in air pollutant impacts due to construction and operations of an SRF in the 400 Area. Peak year concentrations from disposition of bulk sodium are shown in Tables 4–100 and 4–101.

**IDAHO REUSE OPTION**

Processing bulk sodium under the Idaho Reuse Option would result in air pollutant impacts of modification of the existing SPF at INL. Peak year concentrations from modifying SPF are shown in Tables 4–104 and 4–105. Operation of the SPF would not produce criteria or toxic air pollutant emissions.

**Table 4–104. FFTF Decommissioning Alternatives – Maximum Incremental Criteria Pollutant Concentrations from Disposition of Bulk Sodium at Idaho National Laboratory**

| Pollutant and Averaging Period | Standard[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | |
|---|---|---|---|
| | | Alternative 2 | Alternative 3 |
| **Carbon Monoxide** | | | |
| 8-hour | 10,000[b] | 46.6 | 46.6 |
| 1-hour | 40,000[b] | 66.6 | 66.6 |
| **Nitrogen Dioxide** | | | |
| Annual | 100[b] | 0.772 | 0.772 |
| 1-hour | 188[b] | 9.64 | 9.64 |
| **$PM_{10}$[c]** | | | |
| 24-hour | 150[b] | 13.5 | 13.5 |
| **$PM_{2.5}$[c]** | | | |
| Annual | 15[c] | 2.71 | 2.71 |
| 24-hour | 35[c] | 13.5 | 13.5 |
| **Sulfur Dioxide** | | | |
| Annual | 80[b] | 0.00717 | 0.00717 |
| 24-hour | 365[b] | 0.0358 | 0.0358 |
| 3-hour | 1,300[b] | 0.0807 | 0.0807 |
| 1-hour | 197[b] | 0.0896 | 0.0896 |

a The more stringent of the Federal and Idaho State standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, are not to be exceeded more than once per year. The 24-hour $PM_{10}$ standard is attained when the expected number of days with a 24-hour average concentration above the standard is less than or equal to 1. The annual arithmetic mean $PM_{10}$ standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. The annual $PM_{2.5}$ standard is met when the 3-year average of the annual means is less than or equal to the standard. The 24-hour $PM_{2.5}$ standard is met when the 3-year average of the 98th percentile 24-hour averages is less than or equal to the standard. The 1-hour nitrogen dioxide standard is met when the 3-year average 98th percentile of the daily maximum 1-hour average does not exceed the standard value.

b Federal and Idaho State standard.

c The standards for $PM_{2.5}$ are 15 micrograms per cubic meter annual average and 35 micrograms per cubic meter 24-hour average. No specific data for $PM_{2.5}$ were available, but for analysis purposes, concentrations were assumed to be the same as $PM_{10}$.

**Note:** NAAQS also includes standards for lead and ozone. No sources of lead emissions have been identified for the alternatives evaluated.

**Key:** FFTF=Fast Flux Test Facility; NAAQS=National Ambient Air Quality Standards; PMn=particulate matter with an aerodynamic diameter less than or equal to *n* micrometers.

**Source:** Appendix G, Section G.3.

**Table 4–105. FFTF Decommissioning Alternatives – Maximum Incremental Toxic Chemical Concentrations from Disposition of Bulk Sodium at Idaho National Laboratory**

| Pollutant | Averaging Period | Acceptable Ambient Concentration[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | |
|---|---|---|---|---|
| | | | Alternative 2 | Alternative 3 |
| Ammonia | 24-hour | 0.3 | 0.007 | 0.007 |
| Benzene | Annual | 0.12 | 0.000805 | 0.000805 |
| 1,3-Butadiene | Annual | 0.0036 | 0.00000936 | 0.00000936 |
| Formaldehyde | Annual | 0.077 | 0.000395 | 0.000395 |
| Mercury | 24-hour | 2.5 | 0 | 0 |
| Toluene | 24-hour | 18,800 | 0.0517 | 0.0517 |
| Xylene | 24-hour | 21,800 | 0.0147 | 0.0147 |

[a] IDAPA 58.01.01.585 and 58.01.01.586.
**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix G, Section G.3.

#### 4.2.4.3 Alternative 3: Removal

Criteria pollutant concentrations from facility disposition, disposition of RH-SCs, and disposition of bulk sodium activities under FFTF Decommissioning Alternative 3 are presented in Table 4–100. Peak concentrations of carbon monoxide, PM, and nitrogen dioxide would occur in 2015. The peak concentration of sulfur dioxide would occur in 2012. These peak period concentrations would result primarily from Hanford SRF construction and above-grade structure and equipment removal (for carbon monoxide); site regrading (for nitrogen dioxide); grout facility deactivation and Hanford RTP construction (for PM); and grout facility construction (for sulfur dioxide). Figure 4–28 shows the 24-hour $PM_{10}$ concentration over the project duration, including the Hanford options for disposition of RH-SCs and bulk sodium, as well as the contribution of major activities to these concentrations at Hanford.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–101. No impacts on the public due to projected nonradioactive toxic pollutant emissions are anticipated. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–102 and 4–103.

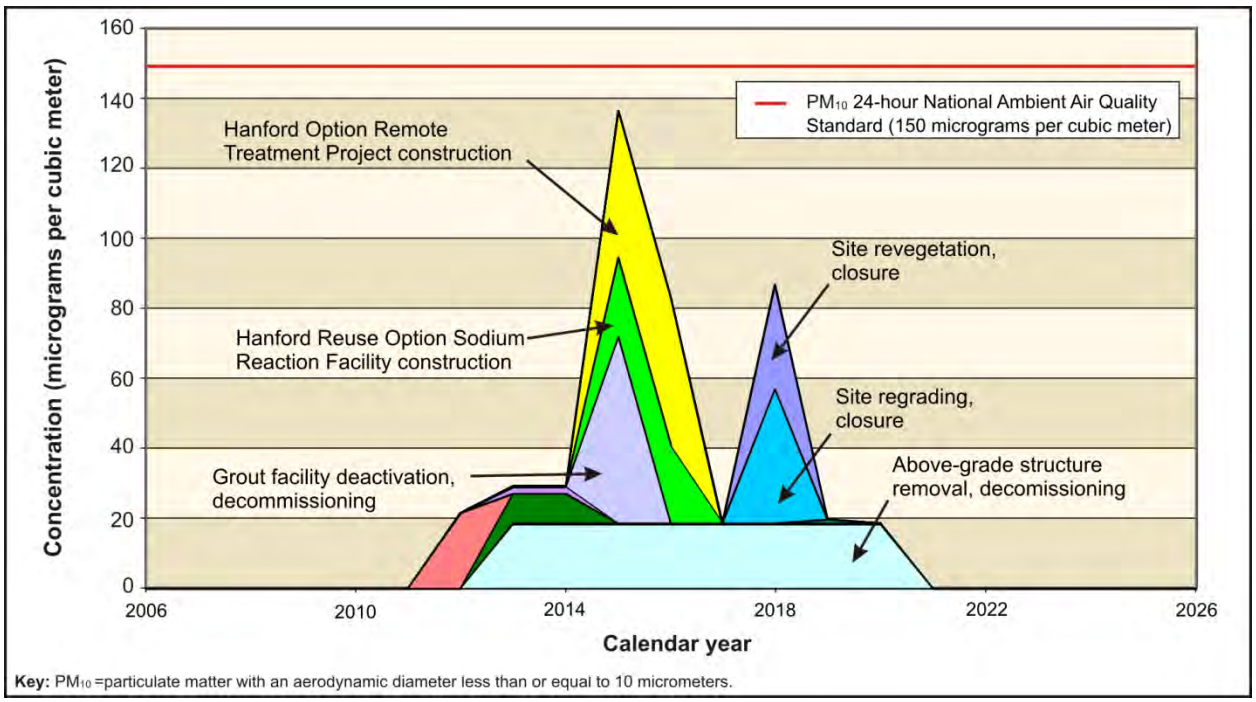


**Figure 4–28. FFTF Decommissioning Alternative 3**
**$PM_{10}$ Maximum 24-Hour Concentration at the Hanford Site**

#### 4.2.4.3.1 Facility Disposition

Decommissioning activities, especially above-grade structure and equipment removal and onsite grout facility construction and deactivation, would be the primary contributors to the air pollutant impacts of facility disposition because of the amount of equipment used and earthmoving activity. Peak year facility disposition concentrations are shown in Tables 4–100 and 4–101.

#### 4.2.4.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Disposition of RH-SCs under the Hanford Option would result in air pollutant impacts due to construction and operations of the RTP at Hanford. Peak year concentrations from disposition of RH-SCs are shown in Tables 4–100 and 4–101.

**IDAHO OPTION**

Operation of the RTP would not produce criteria or toxic air pollutant emissions.

#### 4.2.4.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Processing bulk sodium under the Hanford Reuse Option would result in air pollutant impacts due to construction and operations of an SRF in the 400 Area. Peak year concentrations from constructing and operating SRF are shown in Tables 4–100 and 4–101.

**IDAHO REUSE OPTION**

Processing bulk sodium under the Idaho Reuse Option would result in air pollutant impacts due to modification of the existing SPF at INL. Peak year concentrations from modifying SPF are shown in Tables 4–104 and 4–105. Operation of the SPF would not produce criteria or toxic pollutant emissions.

## 4.2.5 Geology and Soils

Impacts on geology and soils would generally be directly proportional to the total area of land disturbed by facility decommissioning and demolition, site grading, excavation work, and construction of facilities to support facility disposition and related waste treatment options under the FFTF Decommissioning alternatives and options. Consumption of geologic resources, including rock, mineral, and soil resources, would constitute the major indirect impact on geologic and soil resources, as summarized in Table 4–106 for each of the alternatives and options. The key underlying assumptions used to analyze the potential environmental impacts on geology and soils and the acquisition and use of geologic resources in support of the FFTF Decommissioning alternatives and options were similar to those described in Section 4.1.5 for the Tank Closure alternatives.

### 4.2.5.1 Alternative 1: No Action

#### 4.2.5.1.1 Facility Disposition

No facility demolition or related ground-disturbing activities would be conducted during the 100-year administrative control period under the No Action Alternative. In addition, no geologic resources would be consumed as part of related surveillance and monitoring activities at FFTF. Therefore, there would be no incremental impact on geologic and soil resources in the 400 Area of Hanford under the No Action Alternative because the FFTF RCB and other structures within the FFTF PPA would remain in place.

Hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect Hanford facilities are summarized in Chapter 3, Section 3.2.5.1.4. Maximum considered earthquake ground motions for Hanford encompass those that may cause substantial structural damage to buildings (equivalent to an MMI of VII and up), thus presenting safety concerns for occupants. Ground shaking of MMI VII associated with postulated earthquakes is possible and is supported by the historical record for the region. However, this level of ground motion is primarily expected to affect the integrity of inadequately designed or nonreinforced structures (see Appendix F, Table F–7). Little or no damage is expected in reinforced structures such as the FFTF RCB. DOE Order 420.1B requires nuclear and nonnuclear facilities to be designed, constructed, and operated so that the public, workers, and environment are protected from adverse impacts of natural phenomena hazards, including earthquakes. The order stipulates natural phenomena hazards mitigation for DOE facilities and specifically provides for reevaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components, as well as the evaluation, modification, and upgrade of existing structures, systems, and components, so that DOE facilities can safely withstand the effects of natural phenomena hazards, such as earthquakes. Analyses of the potential effects of a beyond-design-basis earthquake on human health and the environment are provided in Section 4.2.11.1.1.

**Table 4–106. FFTF Decommissioning Alternatives – Summary of Major Geologic and Soil Resource Impact Indicators and Requirements**

| Parameter/Resource | Alternatives and Options | | | | | | |
|---|---|---|---|---|---|---|---|
| | Alternative 1: No Action | Alternative 2: Facility Disposition-Entombment | Alternative 3: Facility Disposition-Removal | Disposition of RH-SCs (Hanford Option for Remote Treatment) | Disposition of RH-SCs (Idaho Option for Remote Treatment) | Disposition of Bulk Sodium (Hanford Reuse Option) | Disposition of Bulk Sodium (Idaho Reuse Option) |
| New, permanent land disturbance[a] | 0.0 | 3.5 | 3.2 | 0.1 | 0.0 | 0.1 | <0.1 |
| **Construction Materials** | | | | | | | |
| Concrete | 0.0 | 0.0 | 0.0 | 2,900 | 0.0 | 79.9 | 31.7 |
| Cement[b] | 0.0 | 0.0 | 0.0 | 719 | 0.0 | 16.3 | 6.46 |
| Sand[b] | 0.0 | 0.0 | 0.0 | 1,410 | 0.0 | 38.8 | 15.4 |
| Gravel[b] | 0.0 | 0.0 | 0.0 | 1,840 | 0.0 | 50.6 | 20.1 |
| **Other Borrow Materials[c]** | | | | | | | |
| Rock/basalt | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Sand | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Gravel | 0.0 | 0.0 | 0.0 | 1,390 | 0.0 | 112 | 0.0 |
| Soil (specification backfill) | 0.0 | 80,400 | 121,000 | 37.8 | 0.0 | 0.0 | 0.0 |
| **Decommissioning and Closure-Specific Materials** | | | | | | | |
| Grout[d] | 0.0 | 24,900 | 24,900 | 0.0 | 0.0 | 0.0 | 0.0 |
| Cement | 0.0 | 188 | 188 | 0.0 | 0.0 | 0.0 | 0.0 |
| Sand[e] | 0.0 | 22,600 | 22,600 | 0.0 | 0.0 | 0.0 | 0.0 |
| Barrier materials[f] | 0.0 | 19,300 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Total[g]** | **0.0** | **122,000** | **143,000** | **4,670** | **0.0** | **202** | **35.5** |

[a] Reflects land area assumed to be permanently disturbed for new facilities. The value also includes land area excavated from Borrow Area C or elsewhere to supply geologic materials listed in the table.
[b] Components of concrete.
[c] Resources for miscellaneous uses not exclusively tied to facility construction, operations, or closure, such as site grading and backfill for excavations.
[d] Grout comprises cement, sand, fly ash, and other materials.
[e] Principal component of grout that would be obtained from onsite deposits.
[f] Volume includes soil, sand, gravel, rock, and asphalt for construction of a modified Resource Conservation and Recovery Act Subtitle C barrier.
[g] Excludes concrete, cement, and grout. Totals may not equal the sum of the contributions due to rounding.

**Note:** All values are expressed in cubic meters except land disturbance, which is in hectares. Values presented in the table have been rounded to no more than three significant digits, where appropriate. To convert cubic meters to cubic yards, multiply by 1.308; hectares to acres, multiply by 2.471.

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; RH-SCs=remote-handled special components.

**Source:** SAIC 2010b.

#### 4.2.5.1.2 Disposition of Remote-Handled Special Components

Storage of removed RH-SCs within the 400 Area would have no incremental impact on geology and soils and would not entail any demand for geologic resources.

#### 4.2.5.1.3 Disposition of Bulk Sodium

Storage of FFTF bulk sodium in the 400 Area SSF, as well as ongoing storage of the Hallam Reactor and Sodium Reactor Experiment (SRE) sodium in existing facilities within the 200-West Area, would have no incremental impact on geology and soils.

### 4.2.5.2 Alternative 2: Entombment

#### 4.2.5.2.1 Facility Disposition

Under the Entombment Alternative, all above-grade (ground-level) structures associated with the FFTF RCB, two adjacent service buildings, and five other immediately adjacent facilities composing the FFTF complex would be dismantled and removed. Floors and walls, along with other demolition debris, would be collapsed into below-grade spaces to the extent possible, except that wood and large steel components would be removed. Waste not suitable for consolidation into below-grade spaces would be categorized and removed for proper disposal. While contaminated structures, systems, and components would remain below grade in the RCB and two adjacent service buildings, hazardous and radioactive material would be removed from all other buildings. Except for the RCB and two adjacent service buildings, the building demolition sites and remaining below-grade void spaces would then be backfilled with soil. For the RCB and adjacent service buildings, an onsite grout facility would be constructed and operated to fill the below-grade spaces with grout to prevent subsidence and to immobilize remaining hazardous and radioactive constituents. Subsequently, a modified RCRA Subtitle C barrier would be emplaced over the RCB and adjacent service buildings to entomb them and any residual hazardous and radioactive constituents. The 2.7-meter-thick (9-foot-thick) engineered barrier would be composed of layers of topsoil in the upper part, which would support a mixed perennial grass ground cover, and underlain by layers of sand, gravel, asphalt, and/or riprap in the lower part, as previously described in Section 4.1.5 for the Tank Closure alternatives. In total, the entombment barrier would encompass an approximately 0.7-hectare (1.7-acre) area of the FFTF complex. In addition to the area encompassed by this barrier, an additional 2.8 hectares (7 acres) would also be excavated from Borrow Area C, making a total of 3.5 hectares (8.7 acres) of new, permanent land disturbance.

All other ancillary buildings within the 400 Area PPA would be demolished to grade as described above, with the exception that all demolition debris and soils would first be excavated to a depth of 1 meter (3 feet) and removed for disposal prior to backfilling. Upon completion of all building demolition and barrier construction, the land surface of the entire 2.1-hectare (5.3-acre) site would be regraded with topsoil, recontoured, and revegetated, including the modified RCRA Subtitle C barrier.

Because excavation work would be minimal and the 400 Area PPA is already disturbed, the direct impact of facility decommissioning activities on geology and soils would be minimal. As with any ground-disturbing activity, denuded surface soils and unconsolidated sediments in excavations and graded areas would be subject to wind and water erosion if left exposed over an extended period of time. Adherence to standard best management practices for soil erosion and sediment control during construction would minimize soil erosion and loss. During the 8-year facility decommissioning and demolition phase, prior to final regrading and revegetation of the site, temporary seeding, mulching, and the use of geotextile covers and similar best management practices would be employed to minimize soil erosion in disturbed areas.

FFTF decommissioning and closure activities would not preclude the use of rare or otherwise valuable geologic or soil resources. Geologic resources would be required to produce grout to stabilize below-grade structures, to backfill demolished facility sites, and to construct engineered barriers as part of final site closure. Total geologic resource requirements under Alternative 2 are projected to be 122,000 cubic meters (160,000 cubic yards), with little or no geologic resources expected to be required during the 100-year postclosure care period (see Table 4–106). It is expected that this volume would be supplied by Borrow Area C, as further described in Section 4.1.5.

#### 4.2.5.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Direct impacts on site geology and soils under this option would be limited to the construction of a new RTP to treat RH-SCs at a location adjacent to the existing T Plant in the 200-West Area (see Figure 4–2). Construction activities would permanently disturb about 0.1 hectares (0.3 acres) of land for the new facility. The proposed RTP would have a below-grade service level that would require excavation to a depth of approximately 6 meters (20 feet) (ANL-W 2004:27). The uppermost Hanford formation sediments across the 400 Area attain a thickness of up to 55 meters (180 feet), so the lateral and vertical extent of this unit would not be greatly impacted by facility construction and sublevel excavation.

Although the area has been previously disturbed and native soils may have been altered by fill placement, denuded surface soils and unconsolidated sediments in excavations would be subject to wind and water erosion if left exposed over an extended period of time. Adherence to standard best management practices for soil erosion and sediment control during construction would minimize soil erosion and loss. To reduce the risk of exposing contaminated soils, areas in which new facilities would be constructed under this alternative would be surveyed prior to any ground disturbance. Any contamination would be remediated as necessary. After construction, the previously disturbed areas would not be subject to long-term soil erosion.

Geologic resources would be required for new facility construction under this option, including aggregate (sand and gravel), cement, and soil for engineered backfill. Total geologic resource requirements under this option are projected to be 4,670 cubic meters (6,100 cubic yards) (see Table 4–106). It is expected that this volume would be supplied by Borrow Area C, as further described in Section 4.1.5.

As referenced and described in Section 4.2.5.1.1, hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect Hanford facilities have been evaluated. As stated in DOE Order 420.1B, DOE requires nuclear and nonnuclear facilities to be designed, constructed, and operated so that the public, workers, and environment are protected from adverse impacts of natural phenomena hazards, including earthquakes. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components, as well as the evaluation, modification, and upgrade of existing structures, systems, and components, so that DOE facilities can safely withstand the effects of natural phenomena hazards, such as earthquakes. As the RTP would be a Performance Category 3 facility (ANL-W 2004:39), a probabilistic seismic hazard assessment would be required to determine the seismic design basis for RTP structures, systems, and components.

**IDAHO OPTION**

Under the Idaho Option, direct or indirect geologic and soils impacts would not occur. RH-SCs removed from the FFTF RCB would be stored at Hanford prior to shipment to INL, where these materials would be treated in an existing facility at INTEC. As a treatment facility currently exists, there would be no new construction, no geologic resources would be required, and no new facilities would be subject to potential

seismically induced ground shaking. Treated components would be returned to Hanford or sent to NNSS for disposal, where these materials would be placed in existing disposal facilities.

#### 4.2.5.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under the Hanford Reuse Option, direct impacts on site geology and soils would be limited to ground disturbance associated with construction of the new SRF in the Hanford 400 Area. Specifically, the facility would be constructed in a previously disturbed area near the existing SSF. The new SRF would permanently occupy about 0.1 hectares (0.2 acres) of land when completed. As the SRF would be constructed with a reinforced concrete slab floor and without a basement (ANL-W and Fluor Hanford 2002:19, 57), excavation work would be minimal, and the lateral and vertical extent of the Hanford Formation sediments underlying the 400 Area would not be greatly impacted.

Although the area has been previously disturbed and native soils may have been altered by fill placement, denuded surface soils and unconsolidated sediments in excavations would be subject to wind and water erosion if left exposed over an extended period of time. Adherence to standard best management practices for soil erosion and sediment control during construction would minimize soil erosion and loss. To reduce the risk of exposing contaminated soils, areas in which new facilities would be constructed under this alternative would be surveyed prior to any ground disturbance. Any contamination would be remediated as necessary. After construction, the previously disturbed areas would not be subject to long-term soil erosion.

Geologic resources required for new facility construction under this option would be relatively small and limited to aggregate (sand and gravel) and cement for concrete and gravel for slab foundation construction. Total geologic resource requirements under this option are projected to be 202 cubic meters (264 cubic yards) (see Table 4–106). It is expected that this volume would be supplied by Borrow Area C, as further described in Section 4.1.5.

As referenced and described in Section 4.2.5.1.1, hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect Hanford facilities have been evaluated. As stated in DOE Order 420.1B, DOE requires nuclear and nonnuclear facilities to be designed, constructed, and operated so that the public, workers, and environment are protected from the adverse impacts of natural phenomena hazards, including earthquakes. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components, as well as the evaluation, modification, and upgrade of existing structures, systems, and components, so that DOE facilities can safely withstand the effects of natural phenomena hazards, such as earthquakes. As the SRF presumably would be a Performance Category 3 facility, a probabilistic seismic hazard assessment would be required to determine the seismic design basis for SRF structures, systems, and components.

**IDAHO REUSE OPTION**

The type and intensity of anticipated direct impacts on geology and soils under this option would be somewhat less than those described above under the Hanford Reuse Option. Under this option, ground-disturbing activity would be limited to modifications to the existing SPF at INL's MFC to enable it to receive and process Hanford sodium. Facility modifications that could impact geologic strata would mainly be limited to constructing an enclosed concrete pad adjacent to the existing SPF (ANL-W and Fluor Hanford 2002:37).

Geologic resources required for SPF modifications at INL under this option would be relatively small and limited to aggregate (sand and gravel) and cement for concrete. Total geologic resource requirements under this option are projected to be about 36 cubic meters (47 cubic yards) (see Table 4–106). This volume would be supplied by one of a number of quarries at INL (see Chapter 3, Section 3.3.5.1.3).

As described in Chapter 3, Section 3.3.5.1.4, hazards from large-scale geologic conditions (such as earthquakes and volcanic activity) and site-specific geologic conditions with the potential to affect INL facilities have been extensively studied and evaluated. Design consideration of hazards to the modified SPF at INL from large-scale geologic conditions would be substantially the same as those described above under the Hanford Reuse Option.

### 4.2.5.3 Alternative 3: Removal

#### 4.2.5.3.1 Facility Disposition

Decommissioning activities and associated impacts on geology and soils under the Removal Alternative would be somewhat greater than those described in Section 4.2.5.2.1 for the Entombment Alternative. All above-grade (ground-level) structures associated with the FFTF RCB, two adjacent service buildings, and five other immediately adjacent facilities would be dismantled and removed. In addition, all other ancillary buildings within the 400 Area PPA would be demolished and removed to a depth of 1 meter (3 feet) below grade prior to backfilling the removed facilities with soil and restoring the site, as further described under the Entombment Alternative. However, under the Removal Alternative, instead of being left in place, the RCB reactor vessel and its internal piping and equipment would be filled with grout, removed, and packaged for transport to an IDF for onsite disposal. As under the Entombment Alternative, an onsite grout facility would be constructed and operated to grout and stabilize the reactor vessel prior to its removal and to fill the below-grade spaces associated with the RCB and adjacent service buildings before backfilling them with soil. While no engineered barrier would be constructed under this alternative, due to decommissioning activities, the demand for backfill soil would be higher than under the Entombment Alternative. To support these activities, about 3.2 hectares (8 acres) would be excavated from Borrow Area C. Upon completion of all building demolition, the entire 2.4-hectare (6.0-acre) site would be regraded with topsoil, recontoured, and revegetated.

As described in Section 4.2.5.2.1, adherence to standard best management practices for soil erosion and sediment control during construction would minimize soil erosion and loss during facility decommissioning and final site closure.

Total geologic resource requirements under Alternative 3 are projected to be 143,000 cubic meters (187,000 cubic yards), with little or no geologic resources expected to be required during the 100-year site institutional control period (see Table 4–106). It is expected that this volume would be supplied by Borrow Area C, as stated above and as further described in Section 4.1.5.

#### 4.2.5.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Direct impacts on geology and soils and geologic resource demands under this option would be the same as those discussed in Section 4.2.5.2.2 under the Hanford Option.

**IDAHO OPTION**

Direct impacts on geology and soils and geologic resource demands under this option would be the same as those discussed in Section 4.2.5.2.2 under the Idaho Option.

#### 4.2.5.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Direct impacts on geology and soils and geologic resource demands under this option would be the same as those discussed in Section 4.2.5.2.3 under the Hanford Reuse Option.

**IDAHO REUSE OPTION**

Direct impacts on geology and soils and geologic resource demands under this option would be the same as those discussed in Section 4.2.5.2.3 under the Idaho Reuse Option.

## 4.2.6 Water Resources

### 4.2.6.1 Alternative 1: No Action

#### 4.2.6.1.1 Surface Water

No facility demolition would be conducted during the 100-year administrative control period under the No Action Alternative, so there would be no construction-related impacts on surface-water resources, including stormwater quality.

Utility systems necessary to maintain safety-related functions across the FFTF complex would be left operational following the completion of deactivation activities in the 400 Area. Water use and wastewater generation would likely be limited to levels necessary to maintain and test critical systems, such as fire protection, as part of surveillance and monitoring. Projected water use under FFTF Decommissioning Alternative 1 and the impact on site utility infrastructure are discussed in Section 4.2.2.1.3. There would be no process wastewater discharges from the 400 Area following deactivation, and any sanitary wastewater generation would be a small fraction of the amount generated during standby operations and would be discharged to the existing treatment system that serves the 400 Area (see Chapter 3, Section 3.2.6.1.3).

#### 4.2.6.1.2 Vadose Zone and Groundwater

Under FFTF Decommissioning Alternative 1, residual sodium would continue to be stored in the 400 Area SSF. Periodic facility inspections and necessary maintenance activities would be conducted to ensure the structural integrity of storage facilities. Adherence to appropriate spill prevention and emergency response plans and procedures would help ensure that any spills, should they occur, do not reach soils or surfaces where they could be conveyed to surface water or groundwater.

Maintenance of the FFTF reactor vessel, related piping and equipment, RH-SCs, and tanks under an inert gas blanket through the 100-year administrative control period would ensure there would be no direct impact on the vadose zone and groundwater in the short term. Emergency mitigative actions would be undertaken to address the failure of a system or component that could pose a threat to public health and safety or the environment. Following the administrative control period, remaining hazardous and radioactive materials, including residual sodium, would be available for potential release to the environment. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.2.1.1.

#### 4.2.6.2 Alternative 2: Entombment

##### 4.2.6.2.1 Surface Water, Vadose Zone, and Groundwater

###### 4.2.6.2.1.1 Facility Disposition

Facility decommissioning activities associated with the Entombment Alternative would have little or no direct impact on surface-water features or surface-water quality because there are no natural, perennial, surface-water drainages in the 400 Area.

Demolition-related land disturbance, as well as barrier construction and site regrading work, would expose soils and sediments to possible erosion by infrequent heavy rainfall or wind. Stormwater runoff from exposed areas could convey soil, sediments, and other pollutants (e.g., contaminated demolition debris; spilled materials, such as petroleum, oils, and lubricants from heavy equipment) from demolition and other work sites and staging areas. Any potential for this runoff to impact runoff quality beyond the confines of the 400 Area is low, and the Columbia River is located approximately 6.3 kilometers (3.9 miles) away. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, staked haybales, mulch), as well as spill prevention and waste management practices, would be employed to minimize suspended sediment and other deleterious material transport and any potential water-quality impacts. Further, all demolition and ground-disturbing activities would be conducted in accordance with current NPDES and appropriate state waste discharge general permits for stormwater discharges associated with construction and industrial activities, both of which are issued by Ecology. The NPDES permit specifically requires the development and implementation of a stormwater pollution prevention plan.

Nonhazardous sanitary wastewater (sewage) would be minimal during facility decommissioning and final site closure and would be managed via existing sanitary wastewater collection and treatment systems early on and via portable sanitary facilities as existing utility infrastructure is decommissioned and closed (see Section 4.2.2.2.1.1). Waste generation and management activities under this alternative are further discussed in Section 4.2.14.2.

Potable and raw water demand to support decommissioning and closure activities would primarily be driven by the need to provide dust control and mix concrete and grout during construction of the modified RCRA Subtitle C barrier. Potable and raw water would possibly be needed to aid soil compaction in backfilled areas and equipment washdown. Water to support demolition activities would be trucked to the point of use, but could also be supplied via temporary utility service connections until the 400 Area's three water supply wells are closed and the support buildings demolished. Portable sanitary facilities would be provided to meet the workday potable and sanitary needs of decommissioning personnel, which would constitute a relatively small percentage of the total water demand. Projected water use under FFTF Decommissioning Alternative 2 and its impact on site utility infrastructure are discussed in Section 4.2.2.2.1.1.

Hazardous and radioactive material would be removed from many buildings within the 400 Area PPA under the Entombment Alternative, as described above. Contaminated structures, systems, and components in the RCB and two adjacent service buildings would remain below grade, but would be grouted. A modified RCRA Subtitle C barrier would be emplaced over the RCB and adjacent service buildings. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. Nevertheless, this barrier would degrade over time, allowing infiltration and contaminant migration from the 400 Area. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.2.1.2.

#### 4.2.6.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Construction of an RTP to treat RH-SCs would likely have little direct impact on surface-water features or surface-water quality because the facility would be constructed in a previously disturbed and developed part of the 200-West Area, where no surface-water features or surface-water drainages are located (see Figure 4–2). Any effects on stormwater runoff quality would likely be highly localized and of short duration. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, staked haybales, mulch), as well as spill prevention and waste management practices, would be employed to minimize suspended sediment and other deleterious material transport from the construction site and any potential water-quality impacts. Further, ground-disturbing activities would be conducted in accordance with current NPDES and state waste discharge general permits for stormwater discharges associated with construction activities, both of which are issued by Ecology. The NPDES permit specifically requires the development and implementation of a stormwater pollution prevention plan. The completed facility would incorporate appropriate stormwater management controls to collect, detain, and convey stormwater from the building and other impervious surfaces to minimize water-quality impacts during operations.

During RTP operations, there would be no direct discharge of effluents to either surface water or groundwater. Process wastewater generated from operation of the new facility, including any radioactive liquid effluents, would be discharged to existing treatment facilities that already service the 200 Areas, as described in Section 4.1.6.2.1. Nonhazardous sanitary wastewater (sewage) would be managed via appropriate sanitary wastewater collection and treatment systems.

Water would be required during construction for soil compaction, dust control, and other uses, including concrete production. Standard construction practices dictate that, at least initially, construction water would be trucked to construction locations on an as-needed basis for these uses until water supply and wastewater treatment utilities are in place. During operations, water would be required to support process makeup requirements and facility cooling, as well as the potable and sanitary needs of the operations workforce, among other uses. Some water would also be required during deactivation for use in activities such as facility decontamination. Projected water use under the Hanford Option and its impact on site utility infrastructure are further discussed in Section 4.2.2.2.1.2.

No impact on the Hanford vadose zone or groundwater is expected from operation of the RTP in the Hanford 200-West Area. There would be no direct discharge of effluents to either surface water or the groundwater, as described above. Following completion of the facility's mission, the facility would be deactivated and all residual waste and any hazardous or radioactive materials would be removed for disposal. Waste generation and management activities under this alternative and option case are further discussed in Section 4.2.14.2.

**IDAHO OPTION**

Under the Idaho Option, construction-related impacts on water resources would not occur. RH-SCs removed from the FFTF RCB would be stored at Hanford prior to shipment to INL, where these materials would be treated in an existing facility at INTEC. As a treatment facility currently exists, there would be no new construction and associated water-quality impacts. Treated components would be returned to Hanford or sent to NNSS for disposal, where these materials would be placed in existing disposal facilities.

During treatment at the existing INTEC facility, there would be no direct discharge of effluents to either surface water or groundwater at INL. Process wastewater generated from operation of the treatment facility, including any radioactive liquid effluents, would be discharged to existing treatment facilities.

Radioactive liquid waste would be conveyed to the Radioactive Liquid Waste Treatment Facility, while nonhazardous process wastewater would flow to an industrial waste pond. Nonhazardous sanitary wastewater (sewage) would be managed via the existing site sanitary sewer system. All liquid waste would be managed similar to the method described in the *Idaho National Laboratory, Conceptual Design Report for the Remote Treatment Project, Annex to the Hot Fuel Examination Facility* (ANL-W 2004).

Groundwater is the source of water at the existing INTEC facility and across INL. Water would be required during operations and deactivation of the facility. Projected water use under the Idaho Option and its impact on INL's utility infrastructure are further discussed in Section 4.2.2.2.1.2.

No impact on the INL vadose zone or groundwater is expected from operation of the INTEC facility. There would be no direct discharge of effluents to either surface water or groundwater, as previously described. Following completion of the facility's mission, the facility would be deactivated and all residual waste and any hazardous or radioactive materials would be removed for disposal. Waste generation and management activities under this alternative and option case would be completed in accordance with the *Final Environmental Assessment for the Remote-Handled Waste Disposition Project* (DOE 2009) and as further discussed in Section 4.2.14.2.

#### 4.2.6.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

There would be little direct impact on surface water from construction of the SRF adjacent to the SSF in the Hanford 400 Area because no surface-water features would be impacted and stormwater generation from the construction site would be minimal. Any effect on stormwater runoff quality would likely be highly localized and of short duration. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, staked haybales, mulch), as well as spill prevention and waste management practices, would be employed to minimize suspended sediment and other deleterious material transport from the construction site and any potential water-quality impacts. Further, ground-disturbing activities would be conducted in accordance with current NPDES and state waste discharge general permits for stormwater discharges associated with construction activities, both of which are issued by Ecology. The NPDES permit specifically requires the development and implementation of a stormwater pollution prevention plan. The completed facility would incorporate appropriate stormwater management controls to collect, detain, and convey stormwater from the building and other impervious surfaces so as to minimize water-quality impacts during operations.

During RTP operations, there would be no direct discharge of effluents to surface water or groundwater. Process wastewater generation would be minimal, with any waste collected and transported for storage or disposal at appropriate onsite facilities. Nonhazardous sanitary wastewater (sewage) would be managed via the existing sanitary wastewater collection and treatment system that serves the 400 Area.

Water would be required during construction for soil compaction, dust control, and other uses, including concrete production. Construction water would be trucked to the point of use or supplied via temporary connection to existing nearby utilities. Most water use would occur during the operations period to process the bulk sodium into caustic solution for product reuse at Hanford. Some water would also be required during deactivation for activities such as facility decontamination. Projected water use under the Hanford Reuse Option and its impact on site utility infrastructure are further discussed in Section 4.2.2.2.1.3.

No impact on the Hanford vadose zone or groundwater is expected from operation of the SRF in the Hanford 400 Area. There would be no direct discharge of effluents to either surface water or groundwater, as described above. Following completion of the facility's mission, the facility would be deactivated and all residual waste and any hazardous or radioactive materials would be removed for

disposal. Waste generation and management activities under this alternative and option case are further discussed in Section 4.2.14.2.

**IDAHO REUSE OPTION**

No direct impact on surface-water resources is expected from constructing modifications to the existing SPF at INL's MFC. Due to the relatively minor nature and duration of construction, the potential for stormwater runoff from construction areas to impact downstream surface-water quality is low. Surface-water drainages in the vicinity of the MFC are poorly defined and ephemeral, while infiltration to the subsurface is relatively rapid on unconsolidated sediment. Further, the closest major surface-water drainage is more than 20 kilometers (12 miles) west of the MFC. Any effect on runoff quality would likely be highly localized and of short duration. Regardless, appropriate soil erosion and sediment control measures (e.g., sediment fences, staked haybales, mulch), as well as spill prevention and waste management practices would be employed as previously discussed under the Hanford Reuse Option. Specifically, in accordance with INL's General Permit for Storm Water Discharges from Construction Sites, the INL Storm Water Pollution Prevention Plan for Construction Activities establishes measures and controls to prevent pollution of stormwater from construction activities at INL (see Chapter 3, Section 3.3.6.1.1).

Operation of the modified Idaho SPF to process Hanford bulk sodium would result in no direct discharge of effluents to surface water or groundwater. Any wastewater generated from operation of the new facility would be discharged to existing treatment facilities that already service the MFC. Nonhazardous sanitary wastewater (sewage) would be managed via the existing site sanitary sewer system (ANL-W 2004:66, 67). Waste generation and management activities under this alternative and option case are further discussed in Section 4.2.14.2.

Overall water demands required to implement this option would be less than those described for the Hanford Reuse Option. Projected water use under the Idaho Reuse Option and its impact on site utility infrastructure are further discussed in Section 4.2.2.2.1.3.

No impact on the INL vadose zone or groundwater is expected from operation of the modified SPF in the INL MFC. There would be no direct discharge of untreated effluents to surface water or groundwater as previously described. Waste generation and management activities under this alternative and option case are further discussed in Section 4.2.14.2.

### 4.2.6.3 Alternative 3: Removal

#### 4.2.6.3.1 Surface Water, Vadose Zone, and Groundwater

##### 4.2.6.3.1.1 Facility Disposition

Facility decommissioning activities under the Removal Alternative would have little or no impacts on surface-water features or surface-water quality for the same reasons as previously described under the Entombment Alternative (see Section 4.2.6.2.1.1). Stormwater runoff and the potential for water-quality impacts would be somewhat greater under this alternative due to the greater area disturbed. Demolition-related land disturbance and stormwater runoff would also be similar to that described under the Entombment Alternative, except the reactor vessel and other contaminated equipment would be removed for disposal at an IDF under this alternative rather than being left in place. While no engineered barrier would be constructed under this alternative, a slightly larger area (2.4 hectares [6.0 acres]) of the 400 Area would be regraded with topsoil, recontoured, and revegetated. Nevertheless, application of the same soil erosion and sediment control measures and other practices described under the Entombment Alternative would apply under this alternative.

Any effluents generated during facility decommissioning would be managed as described under the Entombment Alternative (see Section 4.2.6.2.1.1). Waste generation and management activities under this alternative are further discussed in Section 4.2.14.3.

Potable and raw water demands to support decommissioning and closure activities would be very similar to those previously described under the Entombment Alternative. Projected water use under Alternative 3 and its impact on site utility infrastructure are discussed in Section 4.2.2.3.1.1.

Removal of the FFTF reactor vessel and other contaminated equipment and debris from the RCB is expected to have both short-term and long-term positive impacts on groundwater quality in the 400 Area because the major sources of residual contamination would not be available for release to the vadose zone and groundwater. Long-term impacts on water resources of this alternative, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.2.1.3.

#### 4.2.6.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Impacts of this option on water resources would be the same as those discussed in Section 4.2.6.2.1.2 under the Hanford Option.

**IDAHO OPTION**

Impacts of this option on water resources would be the same as those discussed in Section 4.2.6.2.1.2 under the Idaho Option.

#### 4.2.6.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Impacts of this option on water resources would be the same as those discussed in Section 4.2.6.2.1.3 under the Hanford Reuse Option.

**IDAHO REUSE OPTION**

Impacts of this option on water resources would be the same as those discussed in Section 4.2.6.2.1.3 under the Idaho Reuse Option.

## 4.2.7 Ecological Resources

### 4.2.7.1 Alternative 1: No Action

Under the No Action Alternative, the FFTF RCB (including RH-SCs), along with the rest of the buildings and structures within the 400 Area PPA, would remain in place. Sodium would be drained from FFTF and stored in the SSF within the 400 Area; other sodium would continue to be stored at current locations. As FFTF would remain in place and existing facilities would be used for sodium storage, there would be no additional impact on terrestrial resources, wetlands, aquatic resources, or threatened and endangered species under this alternative.

Any waste disposed of under this alternative would be placed in trenches 31 and 34 of LLBG 218-W-5 or in IDF-East. As there would be no need to excavate geologic material from Borrow Area C under this alternative, there would be no impacts on ecological resources within Borrow Area C.

#### 4.2.7.2 Alternative 2: Entombment

##### 4.2.7.2.1 Terrestrial Resources

###### 4.2.7.2.1.1 Facility Disposition

Under the Entombment Alternative, FFTF and adjacent support facilities would be dismantled to below grade, and a 0.7-hectare (1.7-acre) engineered barrier would be placed over the site. Other facilities within the PPA would be dismantled to grade. After appropriate preparation, disturbed areas (including the barrier) would be revegetated. Vegetation placed over the barrier would include shallow-rooted species to prevent root penetration. The ultimate future use of the remaining portions of the PPA would determine how those areas would be revegetated. As the site is located within an area designated Industrial, future development is a possibility. Thus, revegetation efforts under this alternative would likely seek to stabilize soil rather than recreate natural conditions. This stabilization approach would, in turn, limit wildlife use of the area. However, if future development is not planned, native plantings could be used, which would increase the ecological diversity of the area.

Debris and other waste not placed in the RCB or used as backfill would be transported to trenches 31 and 34 of LLBG 218-W-5 or to IDF-East. Similar to the No Action Alternative, impacts associated with construction and use of this IDF are addressed in Section 4.3.7.

The Entombment Alternative would require excavation of a limited amount of geologic material from Borrow Area C. The amount of material required would necessitate the development of 2.8 hectares (7 acres) of Borrow Area C, which would have a minimal impact on terrestrial resources. Limited development should avoid the ecologically important needle-and-thread grass/Indian ricegrass community.

###### 4.2.7.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, RH-SCs would be stored, treated, and disposed of at Hanford. As storage facilities currently exist within the 200 Areas and are used for similar purposes, their use under this option would not affect terrestrial resources. Treatment of RH-SCs would involve construction of a new RTP. This facility, which would be constructed in a disturbed portion of the 200-West Area at the T Plant complex, would occupy 0.1 hectares (0.3 acres) of land and would not impact terrestrial resources at Hanford. Treated components would be disposed of in IDF-East.

**IDAHO OPTION**

RH-SCs removed from the FFTF RCB would be stored at Hanford prior to shipment to INL, where they would be treated in an existing facility at INTEC. As this area is currently industrial in nature and an existing facility would be used, there would be no impacts on terrestrial resources at INTEC or INL. Treated components would be returned to Hanford or sent to NNSS for disposal. As an existing waste site would be used at NNSS, there would be no impacts on terrestrial resources at the site. If returned to Hanford, waste would be placed in IDF-East.

###### 4.2.7.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under the Hanford Reuse Option, sodium from FFTF would be sent to a new SRF to be built in the 400 Area. This facility would be constructed on less than 0.4 hectares (1 acre) of land within the already

highly developed 400 Area near the SSF. Thus, there would be no impacts on terrestrial resources within the 400 Area or at Hanford. As treated sodium would be stored in an existing facility within the 200 Areas, again there would be no impacts on terrestrial resources from this element of the Hanford Reuse Option.

**IDAHO REUSE OPTION**

Under this option, sodium from FFTF would be transported to INL for treatment in the SPF. The SPF is an existing facility within the MFC. Use of this facility would not alter existing terrestrial resources at the MFC or INL. There would also be no change in terrestrial resources at the 400 Area and 200 Areas at Hanford from implementation of this option because only existing facilities would be used.

#### 4.2.7.2.2 Wetlands

##### 4.2.7.2.2.1 Facility Disposition

Although the Entombment Alternative would involve removing aboveground portions of FFTF and dismantling associated buildings and structures, this alternative would not affect wetlands because these resources do not occur within either the 400 Area or 200 Areas. Neither disposal of waste at IDF-East nor excavation of 2.8 hectares (7 acres) of Borrow Area C would impact wetlands because none are present within these areas.

##### 4.2.7.2.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

Actions involving the storage, treatment, and disposal of RH-SCs carried out under both options would not impact wetlands at either Hanford or INL because wetlands are not located within any of the areas affected by disposition activities.

##### 4.2.7.2.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

Wetlands would not be affected by actions taken under either the Hanford or Idaho Reuse Options because none are located within any of the areas potentially impacted.

#### 4.2.7.2.3 Aquatic Resources

##### 4.2.7.2.3.1 Facility Disposition

Although the Entombment Alternative would involve removing aboveground portions of FFTF and dismantling associated buildings and structures, this alternative would not affect aquatic resources because these resources do not occur within either the 400 Area or 200 Areas. Neither disposal of waste at IDF-East nor excavation of 2.8 hectares (7 acres) of Borrow Area C would impact aquatic resources because none are present within these areas.

##### 4.2.7.2.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

Actions involving the storage, treatment, and disposal of RH-SCs carried out under both options would not impact aquatic resources at Hanford or INL because aquatic resources are not located within any of the areas affected by disposition activities.

#### 4.2.7.2.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

Aquatic resources would not be affected by actions taken under either the Hanford or Idaho Reuse Options because none are located within any of the areas potentially impacted.

#### 4.2.7.2.4 Threatened and Endangered Species

#### 4.2.7.2.4.1 Facility Disposition

Although the Entombment Alternative would involve removing aboveground portions of the FFTF RCB and dismantling associated buildings and structures, this alternative would not affect any special status species, including threatened and endangered species, as none have been recorded within the 400 Area. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Debris and other waste not placed in the RCB or used as backfill would be disposed of in IDF-East. Impacts associated with construction and operation of this IDF are addressed in Section 4.3.7.2.3.

As noted in Chapter 3, Section 3.2.7.4, surveys have identified Piper's daisy (state sensitive), stalked-pod milkvetch (state watch), crouching milkvetch (state watch), and the long-billed curlew (state monitor) within the boundaries of Borrow Area C. Although mitigation would not be required for the state watch or state monitor species, they should be considered during project planning. Impacts on state sensitive species, which are considered Level III resources under the *Hanford Site Biological Resources Management Plan*, would require mitigation. When avoidance and minimization are not possible or are insufficient, mitigation via rectification or compensation is recommended (DOE 2001b:4.9, 8.11). However, due to the limited land requirement under this alternative (i.e., 2.8 hectares [7 acres]), it is likely that impacts on listed species could be avoided. If impacts were likely to occur, a comprehensive mitigation action plan would be developed prior to construction (DOE 2003f:43).

#### 4.2.7.2.4.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, RH-SCs would be stored, treated, and disposed of at Hanford. As storage facilities currently exist within the 200 Areas and are used for similar purposes, their use under this option would not affect special status species. Treatment of RH-SCs would involve construction of a new RTP. As this facility would be constructed in a disturbed portion of the 200-West Area at the T Plant complex, it would not impact any listed species. Treated components would be disposed of in IDF-East.

**IDAHO OPTION**

RH-SCs removed from the FFTF RCB would be stored at Hanford prior to shipment to INL, where they would be treated in an existing facility at INTEC. Thus, there would be no impacts on threatened or endangered species. Treated components would be returned to Hanford or sent to NNSS for disposal. As an existing waste site would be used at NNSS, there would be no impacts on threatened or endangered species at the site. If returned to Hanford, waste would be placed in IDF-East.

#### 4.2.7.2.4.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under the Hanford Reuse Option, sodium from FFTF would be sent to a new SRF to be built in the 400 Area, and treated sodium would be stored in an existing facility within the 200 Areas. As there are no special status species within either of these areas, there would be no impact under this option.

**IDAHO REUSE OPTION**

Under this option, sodium from FFTF would be transported to the MFC for treatment in the existing SPF. Use of this facility would not impact threatened and endangered species because none are found within the MFC. There also would be no impacts on these species at Hanford because only existing facilities would be used.

### 4.2.7.3 Alternative 3: Removal

#### 4.2.7.3.1 Terrestrial Resources

#### 4.2.7.3.1.1 Facility Disposition

The Removal Alternative would result in the dismantlement and removal of the FFTF RCB and all associated buildings and structures within the PPA to or below grade. As all contaminated equipment would be removed from the RCB, an engineered barrier would not be needed; instead, the area would be covered with soil, recontoured, and revegetated using native species. Overall, impacts on terrestrial resources from this alternative would be similar to those described under the Entombment Alternative (see Section 4.2.7.2.1.1); however, revegetation of the FFTF site would not be limited to shallow-rooted species because the facility would no longer be contaminated. Future industrial development would be the determining factor in regard to long-term restoration of the site.

Under this alternative, debris and other waste would be handled in the same manner as under the Entombment Alternative (see Section 4.2.7.2.1.1). Impacts of the construction and use of IDF-East are addressed in Section 4.3.7.

The Removal Alternative would require a limited amount of geologic material to be excavated from Borrow Area C. The amount of material required would necessitate the development of 3.2 hectares (8 acres) of the area, which would have a minimal impact on terrestrial resources. Limited development should avoid the ecologically important needle-and-thread grass/Indian ricegrass community.

#### 4.2.7.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

The steps involved in the disposition of RH-SCs under both the Hanford and Idaho Options would be identical to those under the Entombment Alternative. Thus, the impacts on terrestrial resources from disposition-related activities would be the same as those discussed under that alternative (see Section 4.2.7.2.1.2).

#### 4.2.7.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

The steps involved in the processing of bulk sodium under both the Hanford Reuse and Idaho Reuse Options under the Removal Alternative would be identical to those under the Entombment Alternative.

Thus, the impacts on terrestrial resources from processing activities would be the same as those discussed under that alternative (see Section 4.2.7.2.1.3).

#### 4.2.7.3.2 Wetlands

The steps involved in facility disposition, disposition of RH-SCs, and processing of bulk sodium under the Removal Alternative would be identical to those under the Entombment Alternative. Further, there are no wetlands within any of the areas affected by these actions; thus, similar to the Entombment Alternative, there would be no impacts on wetlands under this alternative or the option cases.

#### 4.2.7.3.3 Aquatic Resources

The steps involved in facility disposition, disposition of RH-SCs, and the processing of bulk sodium under this alternative would be identical to those under the Entombment Alternative. Further, there are no aquatic resources within any of the areas affected by these actions; thus, similar to the Entombment Alternative, there would be no impacts on aquatic resources under this alternative or the option cases.

#### 4.2.7.3.4 Threatened and Endangered Species

##### 4.2.7.3.4.1 Facility Disposition

This alternative would involve removing aboveground portions of the FFTF RCB and dismantling associated buildings and structures. As no special status species, including threatened and endangered species, are found within the 400 Area, actions associated with facility disposition would not impact this group of organisms. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, including development of Borrow Area C, designated critical habitat would not be adversely affected.

Debris and other waste not placed in the RCB or used as backfill would be disposed of in IDF-East. Impacts associated with construction and operation of this IDF are addressed in Section 4.3.7.2.3.

Potential impacts on sensitive species resulting from the removal of geologic material from Borrow Area C would be similar to those described in Section 4.2.7.2.4.1 because nearly the same land area would be affected.

##### 4.2.7.3.4.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

The steps involved in the disposition of RH-SCs under both the Hanford and Idaho Options would be identical to those under the Entombment Alternative. Further, because there are no threatened or endangered species within affected areas, there would be no impacts on this group of organisms from disposition-related activities (see Section 4.2.7.2.4.2).

##### 4.2.7.3.4.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

The steps involved in processing bulk sodium under both the Hanford and Idaho Reuse Options would be identical to those of the Entombment Alternative. Further, because there are no threatened or endangered species within affected areas, there would be no impacts on this group of organisms from the sodium processing activities (see Section 4.2.7.2.4.3).

## 4.2.8 Cultural and Paleontological Resources

### 4.2.8.1 Alternative 1: No Action

Under the No Action Alternative, the FFTF RCB and the other buildings in the FFTF PPA would remain in place. There would be no change in the appearance of the site from Rattlesnake Mountain, Gable Mountain, or Gable Butte, all of which are important to American Indians for religious and other cultural purposes. No geologic material would be excavated from Borrow Area C. Minimal volumes of waste requiring disposal would be placed within trenches 31 and 34 of LLBG 218-W-5 or in IDF-East. The use of these facilities would not change the overall visual appearance of the 200 Areas, as further described in Section 4.2.1.1.2.1.

#### 4.2.8.1.1 Prehistoric Resources

As there would be no construction in areas not already in use, there would be no impact on prehistoric resources within this area.

##### 4.2.8.1.1.1 Disposition of Remote-Handled Special Components

There are no known prehistoric resources in the 400 Area, which is considered an area of low archaeological sensitivity. Under the No Action Alternative, RH-SCs would remain in place within the FFTF RCB. Therefore, there would be no impacts on prehistoric resources.

##### 4.2.8.1.1.2 Disposition of Bulk Sodium

Under the No Action Alternative, FFTF sodium would be stored in the SSF, which is located in the 400 Area, and other bulk sodium would remain in place in the 200 Areas. There would be no impacts on prehistoric resources.

#### 4.2.8.1.2 Historic Resources

The FFTF RCB, along with the other buildings in the FFTF PPA, would remain in place. As there would be no construction in areas not already in use, there would be no impacts on historic resources within this area.

##### 4.2.8.1.2.1 Disposition of Remote-Handled Special Components

Under the No Action Alternative, RH-SCs would remain in place within the FFTF RCB. Therefore, there would be no impacts on historic resources located in this area.

##### 4.2.8.1.2.2 Disposition of Bulk Sodium

Under the No Action Alternative, FFTF sodium would be stored in the SSF, which is located in the 400 Area, and other bulk sodium would remain in place in the 200 Areas. There would be no impacts on historic resources.

#### 4.2.8.1.3 American Indian Interests

As there would be no construction in areas not already in use, and the overall visual appearance would not change, there would be no impacts on American Indian interests within this area.

#### 4.2.8.1.3.1 Disposition of Remote-Handled Special Components

The 400 Area is not known to contain any American Indian areas of interest. Under the No Action Alternative, RH-SCs would remain in place within the FFTF RCB. Therefore, there would be no impacts on resources.

#### 4.2.8.1.3.2 Disposition of Bulk Sodium

Under the No Action Alternative, FFTF sodium would be stored in the SSF, which is located in the 400 Area, and other bulk sodium would remain in place in the 200 Areas. There would be no impacts on American Indian interests.

#### 4.2.8.1.4 Paleontological Resources

As there would be no construction in areas not already in use, there would be no impacts on paleontological resources within this area.

#### 4.2.8.1.4.1 Disposition of Remote-Handled Special Components

No known paleontological resources have been reported in the 400 Area. Under the No Action Alternative, RH-SCs would remain in place within the FFTF RCB. Therefore, there would be no impacts on paleontological resources.

#### 4.2.8.1.4.2 Disposition of Bulk Sodium

Under the No Action Alternative, FFTF sodium would be stored in the SSF, which is located in the 400 Area, and other bulk sodium would remain in place in the 200 Areas. There would be no impacts on paleontological resources.

### 4.2.8.2 Alternative 2: Entombment

#### 4.2.8.2.1 Prehistoric Resources

#### 4.2.8.2.1.1 Facility Disposition

Under this alternative, the FFTF RCB and adjacent support facilities would be dismantled, and a modified RCRA Subtitle C barrier would be placed over the site. The barrier would be revegetated, and the PPA would become available for future development. The Industrial designation of the 400 Area would not change. There are no known prehistoric resources in the 400 Area, which is considered an area of low archaeological sensitivity. Therefore, facility disposition activities would not impact known prehistoric resources.

An estimated 2.8 hectares (7 acres) of Borrow Area C would be excavated to supply geologic material to support this alternative. Removal of this material would be consistent with the current site land use plan. If prehistoric resources were discovered during facility disposition in the 400 Area or excavation of geologic material from Borrow Area C, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

#### 4.2.8.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Treatment of RH-SCs would involve construction of a new RTP adjacent to the T Plant complex in the 200-West Area. This facility would encompass 0.1 hectares (0.3 acres) of land. Known prehistoric

resources would not be disturbed by these activities. If prehistoric resources were discovered during construction of a new RTP, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

**IDAHO OPTION**

Under this option, RH-SCs would be stored at Hanford prior to shipment to INL, where they would be treated in an existing facility at INTEC. As an existing facility would be used and this area is industrial, there would be no impact on prehistoric resources at INTEC. Treated components would be returned to Hanford or sent to NNSS for disposal, where they would be placed in existing facilities. An existing waste site would be used at NNSS. If returned to Hanford, waste would be placed in IDF-East. Therefore, there would be no impacts on prehistoric resources at NNSS or Hanford.

#### 4.2.8.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under this option, sodium from FFTF would be sent to a new SRF to be built in the already highly developed 400 Area, which is considered an area of low archaeological sensitivity. The treated sodium would be stored in an existing facility within the 200 Areas. There would be no impacts on known prehistoric resources under this option. If prehistoric resources were discovered during construction of a new SRF, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

**IDAHO REUSE OPTION**

Under this option, sodium from FFTF would be transported to INL for treatment in the SPF, an existing facility within the MFC. There would be no impacts on prehistoric resources under this option.

### 4.2.8.2.2 Historic Resources

#### 4.2.8.2.2.1 Facility Disposition

Under this alternative, the FFTF RCB and adjacent support facilities would be dismantled, and a modified RCRA Subtitle C barrier would be placed over the site. Disturbed areas within the PPA would be revegetated, providing an overall improvement in the appearance of the 400 Area. Some of the buildings to be dismantled are eligible for listing in the National Register as contributing properties within the Hanford Site Manhattan Project and Cold War Era Historic District. As required by the programmatic agreement with the Advisory Council on Historic Preservation and the Washington State Historic Preservation Office, DOE prepared written and photographic documentation and assessed the contents of the historic buildings and structures within FFTF. DOE also identified and tagged artifacts with interpretive and/or educational value and prepared a curation management plan (DOE 1996; Harvey 2002) (see Section 3.2.8.2.3).

An estimated 2.8 hectares (7 acres) of Borrow Area C would be excavated for geologic material to support this alternative. If historic resources were discovered during facility disposition in the 400 Area or excavation of geologic material from Borrow Area C, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

#### 4.2.8.2.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, both storage and disposal facilities exist within the 200 Areas. A new RTP would be constructed, requiring 0.1 hectares (0.3 acres) in a presently industrial area. Known historic resources would not be disturbed by these activities. If historic resources were discovered during construction, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

**IDAHO OPTION**

Under this option, RH-SCs would be stored at Hanford prior to shipment to INL, where they would be treated in an existing facility at INTEC. As an existing facility would be used and this area is industrial, there would be no impact on historic resources at INTEC. Treated components would be returned to Hanford or sent to NNSS for disposal, where they would be placed in existing facilities. An existing waste site would be used at NNSS. If returned to Hanford, waste would be placed in IDF-East. Therefore, there would be no impacts on historic resources at NNSS or Hanford.

#### 4.2.8.2.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under this option, sodium from FFTF would be sent to a new SRF to be built in the already highly developed 400 Area, which is considered an area of low archaeological sensitivity. Sodium would be stored in an existing facility within the 200 Areas. Known historic resources would not be disturbed by these activities. If historic resources were uncovered during construction, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

**IDAHO REUSE OPTION**

Under this option, bulk sodium from FFTF and other sodium would be transported to INL for treatment in the existing SPF. There would be no impacts on historic resources.

#### 4.2.8.2.3 American Indian Interests

#### 4.2.8.2.3.1 Facility Disposition

Under this alternative, the FFTF RCB and adjacent support facilities would be dismantled, and a modified RCRA Subtitle C barrier would be placed over the site. The barrier would be revegetated, and the PPA would become available for future development. As described in Section 4.2.1.2.2.1, there would be an initial overall improvement in the visual character of the 400 Area, although it may return to a similar industrial view in the future. Therefore, the view from nearby higher elevations like Rattlesnake Mountain, Gable Mountain, and Gable Butte, all of which are important to American Indians for religious and other cultural purposes, would be largely unchanged from its current industrial nature.

Under the Entombment Alternative, a limited area of 2.8 hectares (7 acres) would be excavated from Borrow Area C. Excavation activities would impact the view from State Route 240 and higher elevations, including Rattlesnake Mountain, an area of cultural significance to American Indians. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

#### 4.2.8.2.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, a new RTP in the 200-West Area would not affect American Indian interests. If artifacts of importance to American Indians were discovered during construction, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented.

**IDAHO OPTION**

Under this option, RH-SCs would be stored at Hanford prior to shipment to INL, where they would be treated in an existing facility at INTEC. Treated components would be returned to Hanford or sent to NNSS for disposal, where they would be placed in existing facilities. An existing waste site would be used at NNSS. If returned to Hanford, waste would be placed in IDF-East. As there would be no new construction, there would be no impact on American Indian interests.

#### 4.2.8.2.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under this option, a new SRF would be built in an already highly developed part of the 400 Area; therefore, its construction would have no visual impact. If artifacts of importance to American Indians were discovered during construction of the facility, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

**IDAHO REUSE OPTION**

As there would be no new construction in areas not already in use, there would be no impacts on American Indian interests.

### 4.2.8.2.4 Paleontological Resources

#### 4.2.8.2.4.1 Facility Disposition

There would be no impact on paleontological resources under this alternative or options because no such resources have been discovered within the affected areas. As is the case with cultural resources, if any paleontological resources were discovered, procedures in place to properly manage the discovery site would be implemented.

#### 4.2.8.2.4.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

There would be no impacts on paleontological resources under this alternative or options because no such resources have been discovered within the affected areas. As is the case with cultural resources, if any paleontological resources were discovered, procedures in place to properly manage the discovery site would be implemented.

**IDAHO OPTION**

There would be no impacts on paleontological resources under this alternative or options because no such resources have been discovered within the affected areas. As is the case with cultural resources, if any

paleontological resources were discovered, procedures in place to properly manage the discovery site would be implemented.

#### 4.2.8.2.4.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

There would be no impacts on paleontological resources under this alternative or options because no such resources have been discovered within the affected areas. As is the case with cultural resources, if any paleontological resources were discovered, procedures in place to properly manage the discovery site would be implemented.

**IDAHO REUSE OPTION**

There would be no impacts on paleontological resources under this alternative or options because no such resources have been discovered within the affected areas. As is the case with cultural resources, if any paleontological resources were discovered, procedures in place to properly manage the discovery site would be implemented.

### 4.2.8.3 Alternative 3: Removal

#### 4.2.8.3.1 Prehistoric Resources

#### 4.2.8.3.1.1 Facility Disposition

The Removal Alternative would result in the dismantlement and removal of the FFTF RCB and all associated buildings and structures within the PPA to or below grade. The area would be covered with soil, recontoured, and revegetated. The PPA would become available for future development. The Industrial designation of the 400 Area would not change. There are no known prehistoric resources in the 400 Area, which is considered an area of low archaeological sensitivity. Therefore, facility disposition activities would not impact known prehistoric resources.

An area of about 3.2 hectares (8 acres) would also be excavated from Borrow Area C to support activities under this alternative. Removal of this material would be consistent with the current site land use plan. If prehistoric resources were discovered during facility disposition in the 400 Area or excavation in Borrow Area C, appropriate guidance set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g) would be implemented.

#### 4.2.8.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

Activities under these options would be identical to those under the Entombment Alternative. Therefore, there would be no impacts on prehistoric resources.

#### 4.2.8.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

Activities under these options would be identical to those under the Entombment Alternative. Therefore, there would be no impacts on prehistoric resources.

#### 4.2.8.3.2 Historic Resources

##### 4.2.8.3.2.1 Facility Disposition

Activities and potential impacts on historic resources would be similar to those described in Section 4.2.8.2.2.1 under the Entombment Alternative.

##### 4.2.8.3.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

Disposition of RH-SCs under this option would not impact historic resources.

##### 4.2.8.3.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

There are no known historic resources located within the areas that would be impacted by these options.

#### 4.2.8.3.3 American Indian Interests

##### 4.2.8.3.3.1 Facility Disposition

Activities and potential impacts on American Indian interests would be similar to those described in Section 4.2.8.2.3.1 under the Entombment Alternative.

##### 4.2.8.3.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

There would be no impacts on American Indian interests under these options for the same reasons described in Section 4.2.8.2.3.2.

##### 4.2.8.3.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

There would be no impacts on American Indian interests under these options for the same reasons described in Section 4.2.8.2.3.3.

#### 4.2.8.3.4 Paleontological Resources

There would be no impacts on known paleontological resources under this alternative or options, as described in Section 4.2.8.2.4. No such resources have been discovered within the affected areas. As is the case with cultural resources, if any paleontological resources were discovered, procedures in place to properly manage the discovery site would be implemented.

### 4.2.9 Socioeconomics

The primary or direct impacts of FFTF decommissioning and disposition on employment, regional demographics, housing and community services, and local transportation in both the Hanford and Idaho regions were analyzed for this section of the EIS. The potential primary impacts were set forth by analyzing projected changes in employment (in terms of FTEs) and truck activity related to the activities in each alternative (see Appendix I). The projected changes in employment and truck activity have the potential to generate economic impacts that may affect the need for housing units and public services and local transportation in both regions.

The key underlying assumptions used to project changes in employment under each of the FFTF Decommissioning alternatives and associated options were similar to those described in Section 4.1.9 for the Tank Closure alternatives. Impacts of onsite truck trips, i.e., trips conducted solely on site, are included in the onsite analysis. Impacts of the onsite portion of truck trips to or from the site are included in the offsite analysis. Impacts on local commuter traffic were determined by calculating the daily number of vehicles driving to and from work. The conservative assumption used for employees commuting to work in the Idaho region was that employees would commute in single-occupancy vehicles. As in the socioeconomics analysis for tank closure activities (see Section 4.1.9), it was assumed that Hanford employees would commute with an average of 1.25 passengers in each vehicle (Malley 2007). FFTF Decommissioning alternatives consist of three distinct activities: FFTF disposition, disposition of RH-SCs, and disposition of bulk sodium. Table 4–107 summarizes the indicators used to analyze the socioeconomic impacts under each activity.

**Table 4–107. FFTF Decommissioning Alternatives and Options – Summary of Peak Estimated Socioeconomic Indicators**

| Alternatives and Options | Peak Annual Workforce[a] (Peak Year) | Peak Daily Commuter Traffic | Peak Daily Truck Loads (Peak Year) | |
|---|---|---|---|---|
| | | | Off Site | On Site |
| Alternative 1: No Action | 1 (2008–2107) | 1 | Less than 1 (2008–2107) | 0 |
| Alternative 2: Facility Disposition–Entombment | 50 (2021) | 40 | 3 (2017) | 52 (2021) |
| Alternative 3: Facility Disposition–Removal | 85 (2013–2014) | 68 | 2 (2013–2014) | 63 (2021) |
| Disposition of RH-SCs (Hanford Option for remote treatment) | 53 (2015–2016) | 43 | 1 (2015–2016) | 2 (2015–2016) |
| Disposition of RH-SCs (Idaho Option for remote treatment) | 40 (2017) | 40 | Less than 1 (2017) | 0 |
| Disposition of Bulk Sodium (Hanford Reuse Option) | 65 (2017) | 52 | Less than 1 (2015–2016) | Less than 1 (2015–2016) |
| Disposition of Bulk Sodium (Idaho Reuse Option) | 55 (2015) | 55 | Less than 1 (2015) | Less than 1 (2014) |

[a] Workforce is rounded into full-time-equivalent quantities.

**Note:** Values presented in the table have been rounded to no more than two significant digits, where appropriate.

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; RH-SCs=remote-handled special components.

**Source:** Appendix I; SAIC 2010b.

#### 4.2.9.1 Alternative 1: No Action

Under Alternative 1, No Action, the total onsite employment of one FTE per year from 2008 through 2107 for the surveillance and maintenance period would have little or no impacts on regional economic

characteristics, the demographic characteristics, or housing and community services. In addition, one truck trip per year along with a single commuter vehicle would have little or no impact on local transportation in the Hanford ROI.

#### 4.2.9.2 Alternative 2: Entombment

Under Alternative 2, employment activity for all three activities shown in Table 4–107 would be limited to the period from 2013 through 2021. No workforce estimate would be above 65 workers per year during the active years, followed by a single FTE needed for institutional controls through 2121. In addition to these direct employees associated with the closure and cleanup of FFTF, indirect positions would likely be created in the ROI. The impact on the region of both sources of jobs together would be small. The heaviest truckload activity would result from FFTF site regrading activities at Hanford.

##### 4.2.9.2.1 Regional Economic Characteristics

###### 4.2.9.2.1.1 Facility Disposition

The decommissioning and closure activities pertaining to facility disposition would require a peak workforce of 50 FTEs in 2021. By comparison, the labor force in the Hanford ROI is projected to be about 150,000 in 2021 (BEA 2007).

###### 4.2.9.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Disposition of RH-SCs at Hanford under this option would require a peak workforce of 53 FTEs from 2015 through 2016. By comparison, the labor force in the Hanford ROI is projected to be about 138,000 in 2015 (BEA 2007).

**IDAHO OPTION**

Disposition of RH-SCs at INL under this option would require a peak workforce of 40 FTEs in 2017. By comparison, the labor force in the Idaho ROI is projected to be about 182,000 in 2017 (BEA 2007).

###### 4.2.9.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Processing bulk sodium at Hanford under this option would require a peak workforce of 65 FTEs in 2017. By comparison, the labor force in the Hanford ROI is projected to be about 142,000 in 2017 (BEA 2007).

**IDAHO REUSE OPTION**

Processing bulk sodium at INL under this option would require a peak workforce of 55 FTEs in 2015. By comparison, the labor force in the Idaho ROI is projected to be about 178,000 in 2015 (BEA 2007).

##### 4.2.9.2.2 Demographic Characteristics

The majority of the peak decommissioning workforce would likely be drawn from the local labor force for each of the three activities, facility disposition, disposition of RH-SCs, and disposition of bulk sodium. There would likely be little in-migration of new workers and their families; thus, the demographic characteristics of the Hanford ROI and Idaho ROI would not be altered.

#### 4.2.9.2.3 Housing and Community Services

For FFTF disposition, disposition of RH-SCs, and disposition of bulk sodium, the peak workforce required under this alternative would have little or no impacts on demands for housing, schools, and other community services within the Hanford ROI or Idaho ROI.

#### 4.2.9.2.4 Local Transportation

##### 4.2.9.2.4.1 Facility Disposition

Under Alternative 2, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to 40 passenger vehicles per day are expected to commute to the site during the peak year of 2021. Based on predicted truck activity off site—up to 853 offsite truck trips per year (3 trips per day) in 2017—and predicted commuter traffic, the LOS on offsite roads in the Hanford area is not expected to change (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak in 2021, with up to 13,500 trips per year (52 trips per day) as a result of FFTF closure activities.

##### 4.2.9.2.4.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under Alternative 2, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to 43 passenger vehicles per day are expected to commute to the site during the peak years of 2015 and 2016. Based on predicted truck activity off site—up to 272 offsite truck trips (1 truck trip per day) in 2015 and 2016—and predicted commuter traffic, the LOS on offsite roads in the Hanford area is not expected to change (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak in 2015 and 2016 with up to 545 trips per year (2 trips per day) as a result of the construction of the RTP.

**IDAHO OPTION**

Under Alternative 2, assuming an average of 1 person per passenger vehicle, up to 40 passenger vehicles per day are expected to commute to the site during 2017. Based on predicted truck activity off site—up to 4 offsite truck trips (less than 1 truck trip per day) in 2017—and predicted commuter traffic, the LOS on U.S. Highway 20 in the INL area is not expected to change (see Chapter 3, Section 3.3.9.4). There would be no onsite truck trips for this option.

##### 4.2.9.2.4.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under Alternative 2, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to 52 passenger vehicles per day are expected to commute to the site during the peak year of 2017. Based on predicted truck activity off site—up to 35 offsite truck trips per year in 2015 and 2016—and predicted commuter traffic, the LOS on offsite roads in the Hanford area is not expected to change (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak in 2015 and 2016, with up to 23 trips per year as a result of the construction of the Hanford SRF.

**IDAHO REUSE OPTION**

Under Alternative 2, assuming an average of 1 person per passenger vehicle, up to 55 passenger vehicles per day are expected to commute to the site during the peak year of 2015. Based on predicted truck activity off site—up to 13 offsite truck trips per year in 2015—and predicted commuter traffic, the LOS on U.S. Highway 20 in the INL area is not expected to change (see Chapter 3, Section 3.3.9.4). Onsite

truck trips would peak in 2014, with up to 13 trips per year as a result of the construction and operations of the INL SPF.

#### 4.2.9.3 Alternative 3: Removal

Under Alternative 3, employment activity for all three activities shown in Table 4–107 would be limited to the period from 2012 through 2021. No workforce estimate would be above 85 workers per year during the active years, followed by a single FTE needed for institutional controls through 2121. In addition to these direct employees associated with the closure and cleanup of FFTF, indirect positions would likely be created in the ROI. The impact on the region of both sources of jobs together would be small. The heaviest truckload activity would result from FFTF site regrading activities at Hanford.

##### 4.2.9.3.1 Regional Economic Characteristics

###### 4.2.9.3.1.1 Facility Disposition

The decommissioning and closure activities pertaining to facility disposition would require a peak workforce of 85 FTEs from 2013 through 2014. By comparison, the labor force in the Hanford ROI is projected to be about 134,000 in 2013 (BEA 2007).

###### 4.2.9.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Similar to the impacts under Alternative 2, disposition of RH-SCs at Hanford under this option would require a peak workforce of 53 FTEs from 2015 through 2016. By comparison, the labor force in the Hanford ROI is projected to be about 138,000 in 2015 (BEA 2007).

**IDAHO OPTION**

Similar to the impacts under Alternative 2, disposition of RH-SCs at INL under this option would require a peak workforce of 40 FTEs in 2017. By comparison, the labor force in the Idaho ROI is projected to be about 182,000 in 2017 (BEA 2007).

###### 4.2.9.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Similar to the impacts under Alternative 2, processing bulk sodium at Hanford under this option would require a peak workforce of 65 FTEs in 2017. By comparison, the labor force in the Hanford ROI is projected to be about 142,000 in 2017 (BEA 2007).

**IDAHO REUSE OPTION**

Similar to the impacts under Alternative 2, processing bulk sodium at INL under this option would require a peak workforce of 55 FTEs in 2015. By comparison, the labor force in the Idaho ROI is projected to be about 178,000 in 2015 (BEA 2007).

##### 4.2.9.3.2 Demographic Characteristics

Similar to Alternative 2, this alternative would likely draw the majority of its peak workforce for each of the three activities, FFTF disposition, disposition of RH-SCs, and disposition of bulk sodium, from the local labor force. There would likely be little in-migration of new workers and their families; thus, the demographic characteristics of the Hanford ROI and Idaho ROI would not be altered.

#### 4.2.9.3.3 Housing and Community Services

For each of the three activities, FFTF disposition, disposition of RH-SCs, and disposition of bulk sodium, the peak workforce required under this alternative would have little or no impacts on demands for housing, schools, and other community services within the Hanford ROI or Idaho ROI.

#### 4.2.9.3.4 Local Transportation

##### 4.2.9.3.4.1 Facility Disposition

Under Alternative 3, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to 68 passenger vehicles per day are expected to commute to the site during the peak years of 2013 and 2014. Based on predicted truck activity off site—up to 448 offsite truck trips per year (2 trips per day)—and predicted commuter traffic, the LOS on offsite roads in the Hanford area is not expected to change (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak in 2021, with up to 16,400 trips per year (63 trips per day) as a result of FFTF closure activities.

##### 4.2.9.3.4.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Similar to Alternative 2, assuming an average of 1.25 persons per passenger vehicle, up to 43 passenger vehicles per day are expected to commute to the site during the peak years of 2015 and 2016. Based on predicted truck activity off site—up to 272 offsite truck trips per year (1 truck trip per day) in 2015 and 2016—and predicted commuter traffic, the LOS on offsite roads in the Hanford area is not expected to change (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak in 2015 and 2016, with up to 545 trips per year (2 trips per day) as a result of the construction of the RTP.

**IDAHO OPTION**

Similar to Alternative 2, assuming an average of 1 person per passenger vehicle, up to 40 passenger vehicles per day are expected to commute to the site in 2017. Based on predicted truck activity off site—up to 4 offsite truck trips per year (less than 1 truck trip per day) in 2017—and predicted commuter traffic, the LOS on U.S. Highway 20 in the INL area is not expected to change (see Chapter 3, Section 3.3.9.4). There would be no onsite truck trips for this option.

##### 4.2.9.3.4.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Similar to Alternative 2, assuming an average of 1.25 persons per passenger vehicle, up to 52 passenger vehicles per day are expected to commute to the site during the peak year of 2017. Based on predicted truck activity off site—up to 35 offsite truck trips per year in 2015 and 2016—and predicted commuter traffic, the LOS on offsite roads in the Hanford area is not expected to change (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak in 2015 and 2016, with up to 23 trips per year as a result of the construction of the Hanford SRF.

**IDAHO REUSE OPTION**

Similar to Alternative 2, assuming an average of 1 person per passenger vehicle, up to 55 passenger vehicles per day are expected to commute to the site during the peak year of 2015. Based on predicted truck activity off site—up to 13 offsite truck trips per year in 2015—and predicted commuter traffic, the LOS on U.S. Highway 20 in the INL area is not expected to change (see Chapter 3, Section 3.3.9.4).

Onsite truck trips would peak in 2014, with up to 13 trips per year as a result of the construction and operations of the INL SPF.

## 4.2.10 Public and Occupational Health and Safety—Normal Operations

Details of the assessment methodology for determining radiological exposure to workers and members of the public are presented in Appendix K. Radiological impacts are presented for three public receptors: the general population living within 80 kilometers (50 miles) of the site (either Hanford or INL), an MEI living near the site boundary, and an onsite MEI. Impacts on the general population are evaluated for a residential scenario whereby people are exposed to radioactive materials emitted from project facilities. Radiological exposure occurs through inhalation, direct exposure to the radioactive plume and material deposited on the ground, and ingestion of contaminated food products from animals raised locally and fruits and vegetables grown in a family garden (DOE 1995:A-7). Impacts on the MEI are evaluated for a scenario that includes the same exposure pathways assumed for the general population, but with an increased amount of time spent outdoors and a higher rate of contaminated food consumption. Impacts on the onsite MEI, a worker at the Columbia Generating Station or LIGO, are evaluated for inhalation and exposure to the radioactive plume and material deposited on the ground. Doses are presented as total effective doses.

In addition to members of the public, workers directly involved in the activities associated with each alternative and nearby noninvolved workers may receive radiation doses. Doses to an involved worker are calculated based on an FTE employee. It was assumed for purposes of this dose evaluation that an FTE worker has a 2,080-hour work year. In practice, the number of workers who receive a radiation dose may be larger than the number assumed in this analysis, resulting in a smaller average dose per worker. A noninvolved worker is a person working at the site who is incidentally exposed due to the radioactive air emissions associated with the alternatives considered. The noninvolved worker was assumed to be about 100 meters (110 yards) away or at a nearby facility and was assumed to be there only during workdays.

Impacts of FFTF deactivation were previously evaluated in the *Environmental Assessment, Sodium Residuals Reaction/Removal and Other Deactivation Work Activities, Fast Flux Test Facility (FFTF) Project, Hanford Site, Richland, Washington (FFTF Deactivation EA)* (DOE 2006b). Those impacts included negligible doses to the public and conservatively estimated (overestimated) worker doses from the removal and treatment of sodium-contaminated equipment from the facility. The impacts of FFTF deactivation were assumed to occur independent of the actions evaluated in this EIS and are not included among the impacts of the FFTF Decommissioning alternatives. However, deactivation impacts are discussed in the following section for perspective.

Very small radiological impacts on the public are expected from any of the FFTF Decommissioning alternatives. The options for disposition of RH-SCs and bulk sodium at Hanford would have slightly higher offsite impacts than the options for these activities at INL. Implementing either the Entombment Alternative or the Removal Alternative would result in relatively small incremental worker doses over those estimated for deactivation activities, with the Removal Alternative having the higher dose. Worker doses from RH-SC and bulk sodium processing at Hanford vary only slightly from those at INL.

### 4.2.10.1 Alternative 1: No Action

#### 4.2.10.1.1 Radiological Impacts on the Public

As discussed in Section 4.2.10, the *FFTF Deactivation EA* evaluated impacts of removing equipment and piping and processing the residual sodium. The document conservatively assumed that all of the tritium contamination in the sodium was released to the environment, and the resulting dose to an MEI was estimated to be about 0.00026 millirem per year (DOE 2006b). Based on the extremely low dose to the

MEI, doses to the offsite population would be very small and insubstantial. Completion of the FFTF deactivation activities is the assumed starting point of the alternatives evaluated in this EIS.

Under the No Action Alternative, radioactive emissions from FFTF were assumed to continue at a rate comparable to those in recent years (see Appendix K, Section K.2.2.1.3.3). The resulting annual dose would be 0.00027 person-rem to the population and 0.000017 millirem to an MEI. Over the 100 years of administrative control, the population dose would be 0.027 person-rem; no LCFs (a calculated risk of 0.00002) are expected as a result of this dose. An MEI exposed for 70 years would receive a dose of 0.0012 millirem; the increased risk of an LCF from this dose would be negligible (less than 1 in 1 billion).

#### 4.2.10.1.2 Radiological Impacts on Workers

Worker doses would occur during the administrative control period. The worker population dose from deactivation activities was conservatively estimated to be about 576 person-rem (DOE 2006b). No additional LCFs are expected in the worker population as a result of the deactivation activities.

Table 4–108 presents dose and risk estimates for a worker involved in the 100 years of administrative control. The average annual FTE radiation worker dose would be 50 millirem, less than the Administrative Control Level of 500 millirem. A radiation worker who received the average annual dose over his or her career (assumed to be 40 years) would receive a dose of 2,000 millirem, corresponding to a risk of $1 \times 10^{-3}$ (1 chance in 1,000) of developing an LCF.

**Table 4–108. FFTF Decommissioning Alternative 1 Radiological Impacts on Workers**

| | Life-of-Project Worker Population | | Average Annual Involved Full-Time-Equivalent Worker | | Annual Noninvolved Worker | |
|---|---|---|---|---|---|---|
| **Activity** | **Dose (person-rem)** | **LCF[a]** | **Dose (millirem per year)** | **LCF Risk[b]** | **Dose (millirem per year)** | **LCF Risk[b]** |
| Administrative control | 1 | 0 ($6\times10^{-4}$) | 50 | $3\times10^{-5}$ | 0.00064 | $4\times10^{-10}$ |

a The reported value is the projected number of LCFs in the worker population and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

b The lifetime risk that the worker would develop an LCF based on the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** FFTF=Fast Flux Test Facility; LCF=latent cancer fatality.

**Source:** Appendix K, Section K.2.2.

Table 4–108 also shows the estimated collective worker dose for the 100-year administrative control period. The dose to the worker population would be about 1 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, no LCFs are expected as a result of the dose associated with this activity.

The *FFTF Deactivation EA* estimated the dose to a noninvolved worker assumed to be 100 meters (110 yards) away during deactivation activities to be 0.16 millirem per year (DOE 2006b); a noninvolved worker beyond the vicinity of FFTF (for example, at the 300 Area) would receive a dose closer to that of the MEI—0.00026 millirem per year. The annual dose from administrative control activities at FFTF to a noninvolved worker, assumed to be in the Hanford 300 Area, would be 0.0000064 millirem. There would be essentially no risk of an LCF from this exposure.

### 4.2.10.2 Alternative 2: Entombment

#### 4.2.10.2.1 Radiological Impacts on the Public

The radiological impacts of deactivation activities, as discussed in Section 4.2.10.1, would occur independent of the FFTF Decommissioning alternatives. Those activities were estimated to result in an MEI dose of 0.00026 millirem per year and no measurable increase in the collective offsite population dose. The following sections address the radiological doses and risks of the activities associated with this alternative. Table 4–109 presents public dose and risk estimates from disposition of FFTF, RH-SCs, and bulk sodium. The population doses shown in the table are for the entire duration of the activity, whereas the MEI doses are for the year of maximum impact.

**Table 4–109. FFTF Decommissioning Alternative 2 Radiological Impacts on the Public**

| | Offsite Population | | Maximally Exposed Individual | |
|---|---|---|---|---|
| **Activity** | **Life-of-Project Dose (person-rem)** | **LCF[a]** | **Maximum Annual Dose (millirem per year)** | **LCF Risk[b]** |
| **Facility Disposition** | 0.00000067 | 0 ($4\times10^{-10}$) | 0.000000058 | $3\times10^{-14}$ |
| **Disposition of Remote-Handled Special Components** | | | | |
| Hanford Option | 0.00019 | 0 ($1\times10^{-7}$) | 0.0000078 | $5\times10^{-12}$ |
| Idaho Option | 0.000048 | 0 ($3\times10^{-8}$) | 0.0000044 | $3\times10^{-12}$ |
| **Disposition of Bulk Sodium** | | | | |
| Hanford Reuse Option | 0.022 | 0 ($1\times10^{-5}$) | 0.00046 | $3\times10^{-10}$ |
| Idaho Reuse Option | 0.0021 | 0 ($1\times10^{-6}$) | 0.00037 | $2\times10^{-10}$ |

[a] The reported value is the projected number of LCFs among the population and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

[b] The lifetime risk that the maximally exposed individual would develop an LCF based on the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; LCF=latent cancer fatality.

**Source:** Appendix K, Section K.2.2.

##### 4.2.10.2.1.1 Facility Disposition

Grouting of belowground structures while preparing FFTF for entombment would result in small amounts of radioactive air emissions. The population dose as a result of these emissions would be extremely small (0.00000067 person-rem). No excess LCFs are expected to occur in the offsite population as a result of this small dose. The maximum annual MEI dose from facility disposition activities would be about 0.000000058 millirem, which would result in essentially no additional risk of an LCF (a risk of much less than 1 chance in 1 million). The dose and risk to an onsite MEI would be less than those estimated for the MEI; this is because the onsite MEI would be exposed for a shorter time (only during the workday) and through fewer pathways (e.g., no ingestion pathway).

#### 4.2.10.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Processing of RH-SCs to remove the sodium and prepare them for disposal would result in radioactive air emissions and a potential dose to the public, primarily from sodium-22 and cesium-137. Under the option of performing this work in a new RTP located in the Hanford 200-West Area, the offsite population would receive a collective dose of 0.00019 person-rem. This dose would be received over the 2-year period in which the RTP is operated and decommissioned. No additional LCFs are expected in the offsite population as a result of this activity. The maximum annual dose to an MEI of 0.0000078 millirem would occur during the year in which the RH-SCs would be processed. There would be essentially no risk of developing an LCF from this dose (a risk of much less than 1 chance in 1 million). The dose to an onsite MEI at US Ecology in the year of maximum impact would be 0.000018 millirem. There would be essentially no risk of developing an LCF from this dose (a risk of much less than 1 chance in 1 million).

**IDAHO OPTION**

Under the option of processing the RH-SCs at the INL's INTEC, the projected offsite population dose would be 0.000048 person-rem. The lower projected dose is due to a smaller exposed population and differences in population distribution and meteorology between Hanford and INL. No LCFs are expected among the population as a result of this dose. The maximum annual dose to an MEI would be 0.0000044 millirem, which would result in essentially no additional risk of an LCF (a risk of much less than 1 chance in 1 million).

#### 4.2.10.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Processing the bulk sodium at a new SRF near FFTF would result in airborne releases of tritium, sodium-22, cesium-137, and uranium isotopes that occur as contaminants in the sodium. Under this option, the offsite population would receive a collective dose of 0.022 person-rem over the 3 years of processing the sodium and decommissioning the facility. No additional LCFs are expected in the offsite population as a result of this activity. The maximum annual dose to an MEI of 0.00046 millirem would occur during the years in which the sodium is processed. There would be essentially no risk of developing an LCF from this dose (a risk of much less than 1 chance in 1 million). The dose and risk to an onsite MEI would be less than those estimated for the MEI.

**IDAHO REUSE OPTION**

Under the option of processing bulk sodium at the INL MFC, the offsite population and MEI doses would be lower than those under the Hanford Reuse Option. The lower population dose is due to differences in total population, population distribution, and meteorology. The dose to the population received over the 3-year course of the activity would be 0.0021 person-rem. No additional LCFs are expected in the offsite population as a result of this activity. The maximum annual MEI dose would be 0.00037 millirem; there would be essentially no risk of developing an LCF from this dose (a risk of much less than 1 chance in 1 million).

#### 4.2.10.2.2 Radiological Impacts on Workers

Radiological impacts on workers from facility deactivation (activities that would occur prior to implementing an FFTF Decommissioning alternative) would be the same as discussed in Section 4.2.10.1.2. The worker population dose from deactivation would be about 576 person-rem. No additional LCFs are expected in the worker population as a result of this dose (DOE 2006b). Radiological

doses and risks under Alternative 2 are presented in Table 4–110. Worker population impacts presented in Table 4–110 are for the duration of the project; average worker impacts are for the year of maximum impact.

**Table 4–110. FFTF Decommissioning Alternative 2 Radiological Impacts on Workers**

| Activity | Life-of-Project Worker Population | | Average Annual Involved Full-Time-Equivalent Worker | | Annual Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (person-rem) | LCF[a] | Dose (millirem per year) | LCF Risk[b] | Dose (millirem per year) | LCF Risk[b] |
| **Facility Disposition** | 0.37 | 0 ($2\times10^{-4}$) | 100 | $6\times10^{-5}$ | 0.0000000059 | $4\times10^{-15}$ |
| **Disposition of Remote-Handled Special Components** | | | | | | |
| Hanford Option | 1.2 | 0 ($7\times10^{-4}$) | 20 | $1\times10^{-5}$ | 0.011 | $6\times10^{-9}$ |
| Idaho Option | 1.2 | 0 ($7\times10^{-4}$) | 20 | $1\times10^{-5}$ | 0.00000029 | $1\times10^{-14}$ |
| **Disposition of Bulk Sodium** | | | | | | |
| Hanford Reuse Option | 3.7 | 0 ($2\times10^{-3}$) | 39 | $2\times10^{-5}$ | 0.00025 | $2\times10^{-10}$ |
| Idaho Reuse Option | 3.6 | 0 ($2\times10^{-3}$) | 39 | $2\times10^{-5}$ | 0.069 | $4\times10^{-8}$ |

a The reported value is the projected number of LCFs in the worker population and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

b The lifetime risk that the worker would develop an LCF based on the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; LCF=latent cancer fatality.

**Source:** Appendix K, Section K.2.2.

#### 4.2.10.2.2.1 Facility Disposition

Worker doses would result from facility disposition activities associated with stabilizing FFTF in preparation for entombment. The worker population would receive a dose of 0.37 person-rem during the preparation activities. No additional LCFs are expected in the worker population as a result of this dose. The average annual worker dose would be 100 millirem; this dose corresponds to an increased risk of an LCF of $6 \times 10^{-5}$, or about 1 chance in 17,000.

The annual dose from this activity to a noninvolved worker assumed to be in the Hanford 300 Area would be 0.0000000059 millirem. There would be essentially no risk of an LCF from this exposure.

#### 4.2.10.2.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Processing of RH-SCs to remove the sodium and prepare them for disposal would result in a worker dose, primarily from sodium-22 and cesium-137 contaminants. Under the Hanford Option, the worker population would receive a collective dose of 1.2 person-rem. This dose would be received over the 2-year period in which the RTP is operated and decommissioned. No additional LCFs are expected in the worker population as a result of this activity. The maximum annual worker dose would occur during the

year in which the RH-SCs are processed. The average worker dose in that year would be 20 millirem; this dose corresponds to an increased risk of an LCF of $1 \times 10^{-5}$, or less than 1 chance in 100,000.

The annual dose from this activity to a noninvolved worker assumed to be 100 meters (110 yards) away in the 200-West Area would be 0.011 millirem. There would be essentially no risk of an LCF from this exposure.

**IDAHO OPTION**

Under the Idaho Option, in which RH-SCs would be processed at the INL RTP, the involved worker doses and risks would be the same as those estimated for Hanford.

The annual dose from this activity to a noninvolved worker assumed to be about 100 meters (110 yards) away from the RTP at another INTEC facility would be 0.00000029 millirem. There would be essentially no risk of an LCF from this exposure.

#### 4.2.10.2.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Processing of bulk sodium would result in a worker dose from contaminants in the sodium, primarily tritium, sodium-22, cesium-137, and uranium isotopes. Under the option of processing the sodium at a new SRF near FFTF, the worker population would receive a collective dose of 3.7 person-rem. This dose would be received over the 3-year period in which the SRF is operated and decommissioned. No additional LCFs are expected in the worker population as a result of this activity. The maximum annual worker dose would occur during each of the 2 years in which the sodium is processed. The average annual worker dose in those years would be 39 millirem; this dose corresponds to an increased risk of an LCF of $2 \times 10^{-5}$, or less than 1 chance in 50,000.

The annual dose from this activity to a noninvolved worker assumed to be in the Hanford 300 Area would be 0.00025 millirem. There would be essentially no risk of an LCF from this exposure.

**IDAHO REUSE OPTION**

Under the option of processing the sodium at the INL SPF, the projected collective worker doses would be slightly less than that estimated for Hanford because the SPF would not be decommissioned under this project, but rather would remain available for processing sodium from other sources. The worker population would receive a collective dose of 3.6 person-rem over the 3-year duration of the activity, and the average worker would receive a maximum annual dose of 39 millirem. No additional LCFs are expected among the workers as a result of the dose, and the risk of an LCF in the average worker would be $2 \times 10^{-5}$ (1 chance in 50,000).

The annual dose from this activity to a noninvolved worker assumed to be about 100 meters (110 yards) away at another facility in the MFC would be 0.069 millirem. There would be essentially no risk of an LCF from this exposure.

### 4.2.10.3 Alternative 3: Removal

#### 4.2.10.3.1 Radiological Impacts on the Public

Radiological impacts of deactivation activities, as discussed in Section 4.2.10.1, would occur independent of all FFTF Decommissioning alternatives. Those activities were estimated to result in an MEI dose of 0.00026 millirem per year and no measurable increase in the collective offsite population dose. The

following sections address the radiological doses and risks for the activities associated with this alternative. Table 4–111 presents the public dose and risk estimates for this alternative. The population dose in the table is for the entire duration of the activity, whereas the MEI dose is for the year of maximum impact.

**Table 4–111. FFTF Decommissioning Alternative 3 Radiological Impacts on the Public**

| Activity | Offsite Population | | Maximally Exposed Individual | |
|---|---|---|---|---|
| | Life-of-Project Dose (person-rem) | LCF[a] | Maximum Annual Dose (millirem per year) | LCF Risk[b] |
| **Facility Disposition** | Negligible | 0 | Negligible | 0 |
| **Disposition of Remote-Handled Special Components** | | | | |
| Hanford Option | 0.00019 | 0 ($1\times10^{-7}$) | 0.0000078 | $5\times10^{-12}$ |
| Idaho Option | 0.000048 | 0 ($3\times10^{-8}$) | 0.0000044 | $3\times10^{-12}$ |
| **Disposition of Bulk Sodium** | | | | |
| Hanford Reuse Option | 0.022 | 0 ($1\times10^{-5}$) | 0.00046 | $3\times10^{-10}$ |
| Idaho Reuse Option | 0.0021 | 0 ($1\times10^{-6}$) | 0.00037 | $2\times10^{-10}$ |

[a] The reported value is the projected number of LCFs among the population and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

[b] The lifetime risk that the maximally exposed individual would develop an LCF based on the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; LCF=latent cancer fatality.

**Source:** Appendix K, Section K.2.2.

#### 4.2.10.3.1.1 Facility Disposition

Facility disposition would result in minimal releases of radioactivity; therefore, doses to the offsite public and the MEI would be negligible. No substantive increase in exposure beyond that from other site activities is expected.

#### 4.2.10.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Doses and risks to members of the public from disposition of the RH-SCs at Hanford would be the same under this alternative as those under Alternative 2, Entombment.

**IDAHO OPTION**

Doses and risks to members of the public from disposition of the RH-SCs at INL would be the same under this alternative as those under Alternative 2, Entombment.

#### 4.2.10.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Doses and risks to members of the public from processing the bulk sodium at Hanford would be the same under this alternative as those under Alternative 2, Entombment.

**IDAHO REUSE OPTION**

Doses and risks to members of the public from processing the bulk sodium at INL would be the same under this alternative as those under Alternative 2, Entombment.

### 4.2.10.3.2 Radiological Impacts on Workers

Radiological doses and risks under Alternative 3 are presented in Table 4–112. Worker population impacts presented in Table 4–112 are for the duration of the project; average worker impacts are for the year of maximum impact.

**Table 4–112. FFTF Decommissioning Alternative 3 Radiological Impacts on Workers**

| | Life-of-Project Worker Population | | Average Annual Involved Full-Time-Equivalent Worker | | Annual Noninvolved Worker | |
|---|---|---|---|---|---|---|
| **Activity** | **Dose (person-rem)** | **LCF[a]** | **Dose (millirem per year)** | **LCF Risk[b]** | **Dose (millirem per year)** | **LCF Risk[b]** |
| **Facility Disposition** | 6.3 | 0 ($4\times10^{-3}$) | 100 | $6\times10^{-5}$ | – | – |
| **Disposition of Remote-Handled Special Components** | | | | | | |
| Hanford Option | 1.2 | 0 ($7\times10^{-4}$) | 20 | $1\times10^{-5}$ | 0.011 | $6\times10^{-9}$ |
| Idaho Option | 1.2 | 0 ($7\times10^{-4}$) | 20 | $1\times10^{-5}$ | 0.00000029 | $1\times10^{-14}$ |
| **Disposition of Bulk Sodium** | | | | | | |
| Hanford Reuse Option | 3.7 | 0 ($2\times10^{-3}$) | 39 | $2\times10^{-5}$ | 0.00025 | $2\times10^{-10}$ |
| Idaho Reuse Option | 3.6 | 0 ($2\times10^{-3}$) | 39 | $2\times10^{-5}$ | 0.069 | $4\times10^{-8}$ |

[a] The reported value is the projected number of LCFs in the worker population and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

[b] The lifetime risk that the worker would develop an LCF based on the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; LCF=latent cancer fatality.

**Source:** Appendix K, Section K.2.2.

#### 4.2.10.3.2.1 Facility Disposition

Dismantling FFTF would result in a collective worker dose of 6.3 person-rem. No additional LCFs are expected in the worker population as a result of this dose. The average annual dose to an individual worker would be about 100 millirem per year; this dose correlates to a risk of $6 \times 10^{-5}$, or about 1 chance in 17,000 of an LCF.

#### 4.2.10.3.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Worker doses and risks associated with disposition of the RH-SCs at Hanford would be the same under this alternative as those under Alternative 2, Entombment.

**IDAHO OPTION**

Worker doses and risks associated with disposition of the RH-SCs at INL would be the same under this alternative as those under Alternative 2, Entombment.

#### 4.2.10.3.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Worker doses and risks associated with processing the bulk sodium at Hanford would be the same under this alternative as those under Alternative 2, Entombment.

**IDAHO REUSE OPTION**

Worker doses and risks associated with processing the bulk sodium at INL would be the same under this alternative as those under Alternative 2, Entombment.

### 4.2.11 Public and Occupational Health and Safety—Facility Accidents

This section addresses potential impacts on workers and the public associated with potential accidents under the FFTF Decommissioning alternatives and associated options for the disposition of RH-SCs and the processing of Hanford bulk sodium. For each FFTF Decommissioning alternative and applicable option, radiological impacts of postulated accident scenarios were quantified for an MEI living near Hanford, the offsite population as a whole, and a noninvolved worker. Hazardous chemical impacts were also evaluated. For an involved worker, accident consequences were not quantified because the number and location of personnel relative to a postulated accident are unknown. In the event of an accident involving chemicals or radioactive materials, workers near an accident could be at risk of serious injury or fatality. Safety procedures, safety equipment, and protective barriers are typical features that would prevent or minimize worker impacts. Additionally, following initiation of accident/site emergency alarms, workers in adjacent areas of the facility would evacuate in accordance with the technical area and facility emergency operating procedures and training. Therefore, involved worker impacts are not discussed further relative to the FFTF Decommissioning alternatives. The impacts of selected intentional destructive act scenarios are addressed in Appendix K, Section K.3.11.

There would be no radiological accidents associated with facility construction in support of decommissioning and closure activities under any action alternative. Further, any hazardous chemical accidents associated with facility construction would be typical of those normally associated with industrial construction materials, hazards, and practices. Projected accident consequences of each FFTF Decommissioning alternative and its options for treating RH-SCs and processing bulk sodium are presented in the following sections. Details of the methodology for assessing the potential impacts on workers and the public associated with postulated accidents are presented in Appendix K, Section K.3.

### 4.2.11.1 Alternative 1: No Action

#### 4.2.11.1.1 Radiological Impacts of Airborne Releases

Under FFTF Decommissioning Alternative 1, reasonably foreseeable accidents that could occur include a fire in the FFTF SSF, failure of the SSF tanks, and fires involving the Hallam Reactor and SRE sodium stored in the 200-West Area. These accidents would all involve sodium that is stored at Hanford and could occur under any of the FFTF Decommissioning alternatives.

Table 4–113 shows the consequences of the postulated set of accidents for the public (offsite MEI and the general population living within 80 kilometers [50 miles] of the facility) and a noninvolved worker 100 meters (110 yards) from the facility. The accident that would have the highest consequences if it were to occur is the Hanford sodium storage tank failure (accident HSTF1). Table 4–114 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur. The accidents listed in these tables were selected from a spectrum of accidents described in Appendix K, Section K.3. The selection process ensures that the accidents chosen for evaluation in this EIS represent the full range of impacts of reasonably foreseeable accidents that could occur at the facilities. The scenarios are attributed to a variety of initiating events, including aircraft crash, material defect, human error, and high winds. Each one might also be initiated by a seismic event of sufficient magnitude to cause severe damage to structures in which the sodium is stored. Thus, if any other accident not evaluated in this EIS were to occur, its impacts on workers and the public should be within the range of the impacts evaluated.

**Table 4–113. FFTF Decommissioning Alternatives – Radiological Consequences of Accidents**

| | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| Accident[a] | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Sodium Storage Facility fire (SSF1) | 0.0000010 | $6\times10^{-10}$ | 0.0063 | 0 ($4\times10^{-6}$) | 0.00000034 | $2\times10^{-10}$ |
| Hanford sodium storage tank failure (HSTF1) | 0.0000011 | $6\times10^{-10}$ | 0.0064 | 0 ($4\times10^{-6}$) | 0.00000087 | $5\times10^{-10}$ |
| Hallam Reactor sodium fire (HSF1) | 0.00000000046 | $3\times10^{-13}$ | 0.0000077 | 0 ($5\times10^{-9}$) | 0.00000000025 | $2\times10^{-13}$ |
| Sodium Reactor Experiment sodium fire (SRE1) | 0.000000045 | $3\times10^{-11}$ | 0.00076 | 0 ($5\times10^{-7}$) | 0.00000011 | $7\times10^{-11}$ |

[a] The alphanumeric code following the accident's title (e.g., SSF1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.

[b] Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.

[c] Based on populations of 445,002 persons residing within 80 kilometers (50 miles) of the 400 Area (SSF1 and HSTF1) and 589,668 persons residing within 80 kilometers (50 miles) of the 200-West Area (HSF1 and SRE1).

[d] The reported value is the projected number of LCFs among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; LCF=latent cancer fatality.

**Source:** Appendix K, Section K.3.7.2.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–114) is the SRE sodium fire (accident SRE1). For this accident, no LCFs are expected among the population; the risk to the offsite population would be an increase of about $5 \times 10^{-9}$ per year in the likelihood of an LCF (1 chance in 220 million per year of a single LCF occurring among the population). For the offsite MEI, the increase in the likelihood of an LCF would be about $3 \times 10^{-13}$ per year (i.e., 1 chance in 4 trillion per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be $7 \times 10^{-13}$ per year (i.e., about 1 chance in 1.5 trillion per year). For any involved or noninvolved worker closer than 100 meters (110 yards) to the accident's location, the risk of exposure to radioactivity resulting in eventual development of an LCF would depend on the distance and other factors, but would generally be higher.

**Table 4–114. FFTF Decommissioning Alternatives – Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of LCF | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Sodium Storage Facility fire (SSF1) | $1\times10^{-6}$ | $6\times10^{-16}$ | 0 ($4\times10^{-12}$) | $2\times10^{-16}$ |
| Hanford sodium storage tank failure (HSTF1) | $1\times10^{-5}$ | $6\times10^{-15}$ | 0 ($4\times10^{-11}$) | $5\times10^{-15}$ |
| Hallam Reactor sodium fire (HSF1) | $2\times10^{-5}$ | $5\times10^{-18}$ | 0 ($9\times10^{-14}$) | $3\times10^{-18}$ |
| Sodium Reactor Experiment sodium fire (SRE1) | $1\times10^{-2}$ | $3\times10^{-13}$ | 0 ($5\times10^{-9}$) | $7\times10^{-13}$ |

[a] The alphanumeric code following the accident's title (e.g., SSF1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.
[b] Increased risk of a latent cancer fatality to the individual.
[c] Based on populations of 445,002 persons residing within 80 kilometers (50 miles) of the 400 Area (SSF1 and HSTF1) and 589,668 persons residing within 80 kilometers (50 miles) of the 200-West Area (HSF1 and SRE1).
[d] The reported value is the projected number of LCFs among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; LCF=latent cancer fatality.
**Source:** Appendix K, Section K.3.7.2.

Under FFTF Decommissioning Alternative 1, the possibility of an accident involving the stored sodium inventory would exist for the entire 100-year period of analysis. For the accident with the largest consequence (accident HSTF1), over the life of the project the risk of a single LCF occurring in the offsite population would be $4 \times 10^{-9}$, the risk of an LCF to the MEI would be $6 \times 10^{-13}$, and the risk of an LCF to the noninvolved worker would be $5 \times 10^{-13}$.

#### 4.2.11.1.2 Hazardous Chemical Impacts

During FFTF decommissioning activities, including activities under FFTF Decommissioning Alternative 1: No Action, the only chemical capable of creating a substantial airborne hazard resulting from an accidental release is sodium formerly used as a reactor coolant. Three inventories of bulk sodium are addressed. These inventories include FFTF bulk sodium stored in the SSF, Hallam Reactor sodium stored in the 2727-W Building, and SRE sodium stored in the South Alkali Metal Storage Modules in the 200-West Area. Under FFTF Decommissioning Alternative 1, bulk sodium inventories would be stored for the foreseeable future. Accidents involving the stored sodium could occur under any of the FFTF Decommissioning alternatives.

Bulk sodium in its solid or molten form does not represent a substantial airborne hazard. However, metallic sodium reacts violently with a broad range of materials, including water. On contact with water it will ignite and produce hydrogen. Metallic sodium is highly flammable and may ignite spontaneously on exposure to moisture in the air. If sodium is burned in air, the resulting combustion byproducts are

mostly sodium oxide, with a small percentage of sodium carbonate and a very small percentage of sodium hydroxide. Because of the ability of sodium oxide to react with water in the air (or in the human respiratory tract) to form sodium hydroxide, all of the sodium released from a fire was assumed to be in the form of sodium hydroxide.

Because the sodium metal is contaminated with radioactive material, any airborne release caused by a fire would cause radiological as well as chemical impacts. For each sodium fire scenario analyzed as part of the radiological impacts of facility accidents, there is also a chemical impact. Therefore, the accident scenarios analyzed in this section of the EIS are the same as those analyzed and described in Section 4.2.11.1.1.

A sodium fire produces an opaque, white plume. Contact with the plume in high concentrations near the source of release is immediately irritating and can cause burns to the upper respiratory tract, exposed skin, and surface of the eyes. The recognizable and characteristic dense white plume, coupled with the immediate and severe health effects, create a self-evacuation effect for personnel in proximity to a release.

Table 4–115 shows the estimated concentrations of particulate sodium hydroxide for each accident scenario analyzed. As AEGL values have not been developed for sodium hydroxide, the American Industrial Hygiene Association Emergency Response Planning Guideline (ERPG) levels 2 and 3 will be compared with the concentrations at specific distances as an indicator of human health impact. The guideline levels for sodium hydroxide are 5 milligrams per cubic meter for ERPG-2 and 50 milligrams per cubic meter for ERPG-3 (Fluor Hanford 2006). The results indicate that for the Hanford sodium storage tank failure scenario, the ERPG-2 value would be slightly exceeded beyond the site boundary. For the remaining scenarios, the ERPG-2 and ERPG-3 thresholds would not be exceeded beyond the nearest site boundary. For the noninvolved worker 100 meters (110 yards) from an accident, both the ERPG-2 and ERPG-3 thresholds would be exceeded for all scenarios analyzed.

**Table 4–115. Chemical Impacts of Fast Flux Test Facility Accidents at Hanford**

| Accident | Distance to Site Boundary (meters) | Release Rate (kg/hr) | ERPG-2[a] | | ERPG-3[b] | | Concentration ($mg/m^3$) | |
|---|---|---|---|---|---|---|---|---|
| | | | Limit ($mg/m^3$) | Distance to Limit (meters) | Limit ($mg/m^3$) | Distance to Limit (meters) | Noninvolved Worker at 100 meters | Site Boundary |
| Sodium Storage Facility fire (SSF1) | 6,800 | 5,320 | 5 | 3,700 | 50 | 850 | 2,400 | 2.2 |
| Hanford sodium storage tank failure (HSTF1) | 6,800 | 13,800 | 5 | 7,350 | 50 | 1,520 | 6,200 | 5.6 |
| Hallam Reactor sodium fire (HSF1) | 4,300 | 531 | 5 | 855 | 50 | 233 | 240 | 0.41 |
| Sodium Reactor Experiment sodium fire (SRE1) | 3,500 | 139 | 5 | 395 | 50 | 113 | 63 | 0.14 |

[a] ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their ability to take protective action.

[b] ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

**Note:** To convert meters to yards, multiply by 1.0936; kilograms to pounds, by 2.2046.

**Key:** ERPG=Emergency Response Planning Guideline; Hanford=Hanford Site; kg/hr=kilograms per hour; $mg/m^3$=milligrams per cubic meter.

**Source:** Appendix K, Section K.3.9.2.

### 4.2.11.2 Alternative 2: Entombment

#### 4.2.11.2.1 Radiological Impacts of Airborne Releases

##### 4.2.11.2.1.1 Facility Disposition

The accidents associated with facility disposition under FFTF Decommissioning Alternative 2 are the same as those addressed in Section 4.2.11.1 under Alternative 1. All scenarios would involve sodium stored at Hanford and could occur under any of the FFTF Decommissioning alternatives.

##### 4.2.11.2.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

A postulated breach and fire involving RH-SCs could occur at Hanford during the removal, transport, or treatment of the component for disposal. For purposes of this analysis, the accident was assumed to involve the RH-SC containing the largest inventory of radioactivity, and the location of the accident is the 400 Area. Table 4–116 shows the consequences of the postulated accident for the public (offsite MEI and the general population living within 80 kilometers [50 miles] of the 400 Area) and a noninvolved worker 100 meters (110 yards) from the accident. Table 4–117 shows the accident risks, which were obtained by multiplying the accident's consequences by the likelihood (frequency per year) that the accident would occur.

**Table 4–116. Radiological Consequences of Accidents Under the Hanford Option for Disposition of Remote-Handled Special Components**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[c] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[b] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Remote-handled special component fire (RHSC1) at Hanford | 0.00012 | $7\times10^{-8}$ | 4.3 | 0 ($3\times10^{-3}$) | 0.00073 | $4\times10^{-7}$ |

[a] The alphanumeric code following the accident's title (i.e., RHSC1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.
[b] Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.
[c] Based on a population of 445,002 persons residing within 80 kilometers (50 miles) of the 400 Area.
[d] The reported value is the projected number of LCFs among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** Hanford=Hanford Site; LCF=latent cancer fatality.
**Source:** Appendix K, Section K.3.7.2.

**Table 4–117. Annual Cancer Risks from Accidents Under the Hanford Option for Disposition of Remote-Handled Special Components**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Remote-handled special component fire (RHSC1) at Hanford | $1\times10^{-2}$ | $7\times10^{-10}$ | 0 ($3\times10^{-5}$) | $4\times10^{-9}$ |

[a] The alphanumeric code following the accident's title (i.e., RHSC1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.
[b] Increased risk of a latent cancer fatality to the individual.
[c] Based on a population of 445,002 persons residing within 80 kilometers (50 miles) of the 400 Area.
[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** Hanford=Hanford Site.
**Source:** Appendix K, Section K.3.7.2.

For this accident, no LCFs are expected among the population; the risk to the offsite population would be an increase of about $3 \times 10^{-5}$ per year in the likelihood of an LCF (1 chance in 39,000 per year of a single LCF occurring among the population). For the offsite MEI, the increase in the likelihood of an LCF would be about $7 \times 10^{-10}$ per year (1 chance in 1.5 billion per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be about $4 \times 10^{-9}$ per year (1 chance in 228 million per year). For any involved or noninvolved worker closer than 100 meters (110 yards) from the accident's location, the risk of exposure to radioactivity resulting in eventual development of an LCF would depend on the distance and other factors, but would generally be higher. The removal of the RH-SCs would be accomplished in less than 1 year; however, the components might be stored on site for several additional years pending construction of a treatment facility. The public would be at risk of exposure to radioactivity from an accident during that time. If the period of time from removal to completion of the treatment is assumed to be 5 years, the risk to the offsite population and onsite workers during the project period would be no increase ($1 \times 10^{-4}$) in the number of LCFs occurring in the offsite population, a $4 \times 10^{-9}$ increase in the likelihood of an LCF for the MEI, and a $2 \times 10^{-8}$ increase in the likelihood of an LCF for the noninvolved worker.

### IDAHO OPTION

A postulated breach and fire involving RH-SCs could occur at INL during the transport or treatment of the component. For purposes of this EIS analysis, the accident was assumed to involve the RH-SC containing the largest inventory of radioactivity, and the location of the accident is the INTEC at INL. Table 4–118 shows the consequences of the postulated accident for the public (offsite MEI and the general population living within 80 kilometers [50 miles] of the MFC) and a noninvolved worker 100 meters (110 yards) from the accident. Table 4–119 shows the accident risks, which were obtained by multiplying the accident's consequences by the likelihood (frequency per year) that the accident would occur.

**Table 4–118. Radiological Consequences of Accidents Under the Idaho Option for Disposition of Remote-Handled Special Components**

| | Maximally Exposed Individual | | Offsite Population[b] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| Accident[a] | Dose (rem) | LCF[c] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[c] |
| Remote-handled special component fire (RHSC1) at Idaho National Laboratory | 0.00025 | $2\times10^{-7}$ | 0.30 | 0 ($2\times10^{-4}$) | 0.00018 | $1\times10^{-7}$ |

a The alphanumeric code following the accident's title (i.e., RHSC1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.

b Based on a population of 152,493 persons residing within 80 kilometers (50 miles) of the Idaho Nuclear Technology and Engineering Center.

c Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.

d The reported value is the projected number of LCFs among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** LCF=latent cancer fatality.

**Source:** Appendix K, Section K.3.7.2.

**Table 4–119. Annual Cancer Risks from Accidents Under the Idaho Option for Disposition of Remote-Handled Special Components**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Remote-handled special component fire (RHSC1) at Idaho National Laboratory | $1\times10^{-2}$ | $2\times10^{-9}$ | 0 ($2\times10^{-6}$) | $1\times10^{-9}$ |

[a] The alphanumeric code following the accident's title (i.e., RHSC1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.
[b] Increased risk of a latent cancer fatality to the individual.
[c] Based on a population of 152,493 persons residing within 80 kilometers (50 miles) of the Idaho Nuclear Technology and Engineering Center.
[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Source:** Appendix K, Section K.3.7.2.

For this accident, no LCFs are expected among the population; the risk to the offsite population would be an increase of about $2 \times 10^{-6}$ per year in the likelihood of an LCF (1 chance in 580,000 per year of a single LCF occurring among the population). For the offsite MEI, the increase in the likelihood of an LCF would be about $2 \times 10^{-9}$ per year (1 chance in 660 million per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be about $1 \times 10^{-9}$ per year (1 chance in 900 million per year). For any involved or noninvolved worker closer than 100 meters (110 yards) from the accident's location, the risk of exposure to radioactivity resulting in eventual development of an LCF would depend on the distance and other factors, but would generally be higher. The removal of the RH-SCs would be accomplished in less than 1 year; however, the components might be stored on site at INL for several additional years pending construction of a treatment facility. The public would be at risk of exposure to radioactivity from an accident throughout that time. If the period of time from arrival of the component at INL to completion of the treatment is assumed to be 5 years, the risk to the offsite population and onsite workers during the project period would be an increase of $9 \times 10^{-6}$ in the likelihood of a single LCF occurring in the offsite population, an increase of $8 \times 10^{-9}$ in the likelihood of an LCF for the MEI, and an increase of $6 \times 10^{-9}$ in the likelihood of an LCF for the noninvolved worker.

#### 4.2.11.2.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Processing the FFTF bulk sodium and the Hallam Reactor and SRE sodium in the 400 Area could result in accidents involving spills and fires comparable to those discussed under FFTF Decommissioning Alternative 1. Table 4–113 shows the consequences of the postulated set of accidents for the MEI, the general population (the offsite population within 80 kilometers [50 miles]), and a noninvolved worker 100 meters (110 yards) from the facility. Table 4–114 shows the accident risks, which were obtained by multiplying each accident's consequences by the likelihood (frequency per year) that the accident would occur.

Under this option, the possibility of an accident involving the stored sodium inventory would exist for 13 years until the sodium is processed. For the accident with the highest consequences (accident HSTF1), over the life of the project, the risk of a single LCF occurring in the offsite population would be $5 \times 10^{-10}$, the risk of an LCF to the MEI would be $8 \times 10^{-14}$, and the risk of an LCF to the noninvolved worker would be $7 \times 10^{-14}$.

**IDAHO REUSE OPTION**

A spill from the INL SPF storage tank was analyzed to represent a severe potential accident arising from the Idaho Reuse Option. Table 4–120 shows the consequences of the postulated accident for the MEI, the general population (the offsite population within 80 kilometers [50 miles]), and a noninvolved worker 100 meters (110 yards) from the facility. Table 4–121 shows the accident risks, which were obtained by multiplying its consequences by the likelihood (frequency per year) that the accident would occur.

**Table 4–120. Radiological Consequences of Accidents Under the Idaho Reuse Option for Disposition of Bulk Sodium**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[b] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[c] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| INL Sodium Processing Facility storage tank failure (INLSPF1) | 0.000000030 | $2\times10^{-11}$ | 0.000058 | 0 ($3\times10^{-8}$) | 0.0000000039 | $2\times10^{-12}$ |

[a] The alphanumeric code following the accident's title (i.e., INLSPF1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.
[b] Based on a population of 250,838 persons residing within 80 kilometers (50 miles) of the Materials and Fuels Complex.
[c] Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.
[d] The reported value is the projected number of LCFs among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** INL=Idaho National Laboratory; LCF=latent cancer fatality.
**Source:** Appendix K, Section K.3.7.2.

**Table 4–121. Annual Cancer Risks from Accidents Under the Idaho Reuse Option for Disposition of Bulk Sodium**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| INL Sodium Processing Facility storage tank failure (INLSPF1) | $1\times10^{-5}$ | $2\times10^{-16}$ | 0 ($3\times10^{-13}$) | $2\times10^{-17}$ |

[a] The alphanumeric code following the accident's title (i.e., INLSPF1) corresponds with the code in the accident's description in Appendix K, Section K.3.5.
[b] Increased risk of a latent cancer fatality to the individual.
[c] Based on a population of 250,838 persons residing within 80 kilometers (50 miles) of the Materials and Fuels Complex.
[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** INL=Idaho National Laboratory.
**Source:** Appendix K, Section K.3.7.2.

For this accident no LCFs are expected among the population; the risk to the offsite population would be an increase of about $3 \times 10^{-13}$ per year in the likelihood of an LCF (1 chance in 3 trillion per year of a single LCF occurring among the population). For the offsite MEI, the increase in the likelihood of an LCF would be about $2 \times 10^{-16}$ per year (1 chance in 6,000 trillion per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be about $2 \times 10^{-17}$ per year (1 chance in 40,000 trillion per year). For any involved or noninvolved worker closer than 100 meters (110 yards) from the accident's location, the risk of exposure to radioactivity resulting in eventual development of an LCF would depend on the distance and other factors, but would generally be higher.

Under Alternative 2, Idaho Reuse Option, the possibility of an accident involving the stored sodium inventory would exist for 9 years while the sodium is stored at Hanford and for 2 years while the sodium is being processed at INL. For the accident with the largest consequence (accident HSTF1), for the duration of time that the sodium was stored at Hanford, the risk of a single LCF occurring in the offsite population would be $3 \times 10^{-10}$, the risk of an LCF to the MEI would be $6 \times 10^{-14}$, and the risk of an LCF to the noninvolved worker would be $5 \times 10^{-14}$. Once the material was transferred to INL, over the 2 years of processing, the risk of a single LCF occurring in the offsite population would be $7 \times 10^{-13}$, the risk of an LCF to the MEI would be $4 \times 10^{-16}$, and the risk of an LCF to the noninvolved worker would be $5 \times 10^{-17}$.

#### 4.2.11.2.2 Hazardous Chemical Impacts

##### 4.2.11.2.2.1 Facility Disposition

As described in Section 4.2.11.1.2, accidents involving the three inventories of bulk sodium could occur under any of the FFTF Decommissioning alternatives. Chemical impacts of the analyzed accident scenarios are presented in Table 4–115.

##### 4.2.11.2.2.2 Disposition of Remote-Handled Special Components

Potential hazardous chemical impacts associated with disposition of RH-SCs under the Hanford Option and Idaho Option would be encompassed by those analyzed in Section 4.2.11.1.2 for facility disposition.

##### 4.2.11.2.2.3 Disposition of Bulk Sodium

Potential hazardous chemical impacts associated with disposition of bulk sodium under the Hanford Reuse Option would be encompassed by those analyzed in Section 4.2.11.1.2. Chemical impacts associated with disposition of bulk sodium under the Idaho Reuse Option are shown in Table 4–122.

**Table 4–122. Chemical Impacts of Accidents Under the Idaho Reuse Option for Disposition of Bulk Sodium**

| Accident | Distance to Site Boundary (meters) | Release Rate (kg/hr) | ERPG-2[a] | | ERPG-3[b] | | Concentration ($mg/m^3$) | |
|---|---|---|---|---|---|---|---|---|
| | | | Limit ($mg/m^3$) | Distance to Limit (meters) | Limit ($mg/m^3$) | Distance to Limit (meters) | Noninvolved Worker at 100 Meters | Site Boundary |
| INL Sodium Processing Facility storage tank failure (INLSPF1) | 5,500 | 1,380 | 5 | 1,530 | 50 | 390 | 620 | 0.75 |

[a] ERPG-2 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

[b] ERPG-3 is the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

**Note:** To convert meters to yards, multiply by 1.0936; kilograms to pounds, by 2.2046.

**Key:** ERPG=Emergency Response Planning Guideline; INL=Idaho National Laboratory; kg/hr=kilograms per hour; $mg/m^3$=milligrams per cubic meter.

**Source:** Appendix K, Section K.3.9.2.

#### 4.2.11.3 Alternative 3: Removal

##### 4.2.11.3.1 Radiological Impacts of Airborne Releases

###### 4.2.11.3.1.1 Facility Disposition

The accidents associated with facility disposition under FFTF Decommissioning Alternative 3 are the same as those addressed in Section 4.2.11.1 under Alternative 1. All scenarios would involve sodium stored at Hanford and could occur under any of the FFTF Decommissioning alternatives.

###### 4.2.11.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Potential human health impacts of postulated radiological accidents would be the same as those discussed in Section 4.2.11.2.1.2 under the Hanford Option of FFTF Decommissioning Alternative 2.

**IDAHO OPTION**

Potential human health impacts of postulated radiological accidents would be the same as those discussed in Section 4.2.11.2.1.2 under the Idaho Option of FFTF Decommissioning Alternative 2.

###### 4.2.11.3.1.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Potential human health impacts of postulated radiological accidents would be the same as those discussed in Section 4.2.11.2.1.3 under the Hanford Reuse Option of FFTF Decommissioning Alternative 2.

**IDAHO REUSE OPTION**

Potential human health impacts of postulated radiological accidents would be the same as those discussed in Section 4.2.11.2.1.3 under the Idaho Reuse Option of FFTF Decommissioning Alternative 2.

##### 4.2.11.3.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios under FFTF Decommissioning Alternative 3, Removal, are expected to be the same as those described under the No Action Alternative in Section 4.2.11.1.2.

###### 4.2.11.3.2.1 Disposition of Remote-Handled Special Components

**HANFORD OPTION AND IDAHO OPTION**

Potential hazardous chemical impacts associated with disposition of the RH-SCs under the Hanford Option and Idaho Option would be encompassed by those analyzed in Section 4.2.11.1.2 for facility disposition.

#### 4.2.11.3.2.2 Disposition of Bulk Sodium

**HANFORD REUSE OPTION AND IDAHO REUSE OPTION**

Potential hazardous chemical impacts associated with disposition of bulk sodium under the Hanford Reuse Option and Idaho Reuse Option would be encompassed by those analyzed in Section 4.2.11.2.2.3 for FFTF Decommissioning Alternative 2.

### 4.2.11.4 Intentional Destructive Acts

This section addresses potential impacts of intentional destructive acts during FFTF decommissioning. Release scenarios and impacts resulting from intentional destructive acts may be similar to a number of the accident scenarios analyzed in this EIS. An additional intentional destructive act scenario was also considered. This scenario would apply to Alternatives 2 and 3, which include removal of RH-SCs.

**Explosion in FFTF Primary Cold Trap.** An intentional destructive act was postulated whereby the FFTF primary cold trap, containing 2,700 liters (710 gallons) of sodium, 470 curies of cesium-137, and 70 curies of cobalt-60, is destroyed by an explosive or incendiary device during removal or handling. All of the radioactive material was assumed to aerosolize and be released to the atmosphere. Analysis results indicate that the radiological impacts would be about three times those calculated for the accident scenario that would involve the same inventory of radioactive material (RHSC1, remote-handled special component fire). The resulting offsite population dose was estimated to be 11 person-rem, with no ($7 \times 10^{-3}$) additional LCFs. The MEI dose would be 0.00033 rem, corresponding to an increased risk of an LCF of $2 \times 10^{-7}$. The noninvolved worker dose would be 0.0073 rem, corresponding to an increased risk of an LCF of $4 \times 10^{-6}$.

Impacts and mitigation of intentional destructive acts are discussed in more detail in Appendix K, Section K.3.11.

## 4.2.12 Public and Occupational Health and Safety—Transportation

Impacts of transporting radioactive materials are predominantly categorized as radiological impacts or nonradiological impacts. Radiological impacts are those associated with the accidental release of radioactive materials and the effects of low levels of radiation emitted during incident-free transportation. Nonradiological impacts are those associated with transportation, regardless of the nature of the cargo, such as accidents resulting in death or injury when there is no release of radioactive material.

Transportation impacts include the impacts of incident-free transportation, as well as transportation accidents. The impacts of both incident-free transportation and transportation accidents can be radiological and nonradiological. Incident-free transportation impacts include radiological impacts on the public and workers from the radiation field surrounding the transportation package. Nonradiological impacts of potential transportation accidents include traffic accident fatalities. The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing the individual risks from all accident severities, irrespective of their likelihood of occurrence. The analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents of low severity (e.g., fender bender) to hypothetical high-severity accidents that have a low probability of occurrence. Additional information is provided in Section 4.1.12, and further details on modeling and parameter selections are provided in Appendix H.

Table 4–123 provides the estimated number of shipments of various wastes under each alternative by waste type. A shipment is defined as the amount of waste transported on a single truck or a single railcar. The values presented for offsite shipments in Table 4–123 are the estimated truck transports for the Idaho Option of treating RH-SCs at INL and the Idaho Reuse Option of treating bulk sodium at INL. If the Idaho options are selected for disposition of RH-SCs and bulk sodium, the treated RH-SCs would either be shipped to NNSS or transported back to Hanford for disposal, and the treated sodium in the form of 50 percent caustic solution would be transported back to Hanford.

**Table 4–123. FFTF Decommissioning Alternatives – Estimated Number of Shipments**

| Alternative | Number of Shipments | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Offsite Shipments[a] | | | Onsite Shipments | | | | |
| | Sodium Metal | Caustic Solution | RH-SCs | Sodium Metal | Caustic Solution | RH-SCs | Reactor Vessel | Other Wastes[b] |
| Alternative 1: No Action | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA |
| Alternative 2: Entombment | 80 | 190 | 9 | 10 | 190 | 5 | 0 | 6,300 |
| Alternative 3: Removal | 80 | 190 | 9 | 10 | 190 | 5 | 1 | 6,300 |

[a] These are estimates for truck transports. Rail transports would be one-half of the values given.

[b] Other wastes include components and decommissioning waste transported to an Integrated Disposal Facility and to sanitary and hazardous landfills.

**Note:** The number of shipments is rounded to the nearest ten between 10 and 1,000 shipments, and nearest hundred between 1,000 and 100,000 shipments.

**Key:** FFTF=Fast Flux Test Facility; NA=not analyzed; RH-SCs=remote-handled special components.

**Source:** Appendix H, Section H.7.2.

The FFTF Decommissioning action alternatives consist of three distinct activities: facility disposition, disposition of RH-SCs, and disposition of bulk sodium. Table 4–124 summarizes the risks of transportation under each type of disposition. The health impacts associated with the shipment of radioactive materials were calculated assuming that all offsite shipments would be transported using either truck or rail. The impacts of each alternative would include those of activities in facility disposition and the range of options for treatment and disposition of RH-SCs and sodium. The discussions for each alternative would include a range of impacts of treating these materials at either Hanford or INL.

Table 4–124 shows that, under all alternatives, the dose to the population along the routes (see column 6 of Table 4–124: INL rows) is expected to be between the lowest expected dose of 0.08 person-rem, which is associated with the transport of RH-SCs to INL for treatment and disposal at NNSS[4] using rail transport, and the highest expected dose of about 0.96 person-rem, which is associated with the transport of sodium metals to INL for treatment and return transport of caustic solutions to Hanford using trucks. The additional LCFs that are expected from such exposures to the general population would be very small for all activities, ranging from $4.8 \times 10^{-5}$ to $5.7 \times 10^{-4}$. Similarly, the range of expected doses to the workers (see column 4 of Table 4–124: INL rows) would be 0.16 person-rem to 3.52 person-rem. Overall, the risks of transporting various radioactive materials under all alternatives are expected to result in zero fatalities.

The risks to different receptors under incident-free transportation conditions were estimated on a per-trip or per-event basis. This basis was used because it is unlikely that the same person would be exposed to multiple events; for those that could have multiple exposures, the dose over the duration of transportation activities could be calculated by multiplying by the number of events or trips. The maximum annual dose to a transportation worker would be administratively controlled to 100 millirem per year unless the individual is a trained radiation worker, in which case the administrative limit would be 2 rem per year

[4] These materials could also be returned to Hanford. Use of NNSS would maximize the impact.

(DOE Standard 1098-2008). The dose to a person stuck in traffic next to a shipment of RH-SCs for 30 minutes was calculated to be 19 millirem. For a receptor who is a member of the public residing along a transportation route, the dose over the duration of transportation activities would depend on the number of truck or rail shipments passing a particular point and would be independent of the actual route being considered. The maximum dose to this resident, if all the materials are shipped along this route, would be less than 0.2 millirem for all action alternatives. Refer to Appendix H, Table H–13, for additional results.

**Table 4–124. FFTF Decommissioning Alternatives – Risks of Transporting Radioactive Waste**

| Disposition Activity | Location (transport mode) | Number of Shipments | Incident-Free | | | | Accident | | One-Way Offsite Travel ($10^5$ km) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Crew | | Population | | | | |
| | | | Dose (person-rem) | Risk[a] | Dose (person-rem) | Risk[a] | Rad. Risk[a, b] | Nonrad. Risk[a] | |
| Facility disposition | Hanford (Alt 2) | 6,300 | (c) | (c) | (c) | (c) | (c) | 0.004 | N/A |
| | Hanford (Alt 3) | 6,300 | 0.03 | $2.0\times10^{-5}$ | 0.003 | $1.5\times10^{-6}$ | $4.0\times10^{-13}$ | 0.004 | N/A |
| Disposition of RH-SCs | INL (T) | 9 | 0.84 | $5.0\times10^{-4}$ | 0.33 | $2.0\times10^{-4}$ | $5.3\times10^{-10}$ | 0.0003 | 0.10 |
| | INL (R) | 5 | 0.17 | $1.0\times10^{-4}$ | 0.08 | $4.8\times10^{-5}$ | $5.3\times10^{-10}$ | 0.0004 | 0.060 |
| | Hanford | 5 | 0.03 | $1.9\times10^{-5}$ | 0.005 | $2.9\times10^{-6}$ | $6.8\times10^{-13}$ | 0.000005 | N/A |
| Disposition of bulk sodium | INL (T) | 270 | 3.5 | $2.1\times10^{-3}$ | 0.96 | $5.7\times10^{-4}$ | $3.9\times10^{-10}$ | 0.008 | 2.6 |
| | INL (R) | 140 | 0.16 | $9.4\times10^{-5}$ | 0.20 | $1.2\times10^{-4}$ | $2.2\times10^{-10}$ | 0.02 | 1.4 |
| | Hanford | 200 | 0.12 | $6.9\times10^{-5}$ | 0.01 | $6.7\times10^{-6}$ | $7.1\times10^{-14}$ | 0.0001 | N/A |

[a] Risk is expressed in terms of latent cancer fatalities, except for the nonradiological, where it refers to the number of accident fatalities.
[b] To calculate accident population dose (person-rem), divide the values in this column by 0.0006. For additional insight on how this dose is calculated, see the text in Section 4.1.12.
[c] Not analyzed because all waste is sanitary or hazardous (not radioactive).
**Note:** To convert kilometers to miles, multiply by 0.6214.
**Key:** Alt 2=Alternative 2; Alt 3=Alternative 3; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; INL=Idaho National Laboratory; km=kilometers; N/A=not applicable; nonrad.=nonradiological; R=rail transport; rad.=radiological; RH-SCs=remote-handled special components; T=truck transport.
**Source:** Appendix H, Section H.7.2.

Table 4–125 summarizes the impacts of transporting nonradioactive support materials required to construct new facilities, as well as materials required to treat RH-SCs and sodium and to transport decommissioned equipment to storage or burial locations. The construction materials considered include concrete, cement, sand/gravel/dirt, asphalt, steel, and piping, among others. The table shows the impacts in terms of total number of kilometers, accidents, and fatalities for all alternatives. The results in Table 4–125 indicate that for the FFTF Decommissioning alternatives, the potential for traffic fatalities is largest under Alternative 3. The absolute risk, however, is very small considering that the duration of the alternative is about 10 years.

#### 4.2.12.1 Alternative 1: No Action

Under Alternative 1, the transportation impacts would be limited to the transport of materials between Hanford and local or regional locations in support of administrative and deactivation activities. The transportation impacts of these activities would be 31,000 kilometers (about 20,000 miles) traveled, 0 (0.006) traffic accidents, and 0 (0.0004) traffic fatalities (see Table 4–125).

**Table 4–125. FFTF Decommissioning Alternatives – Estimated Impacts of Construction and Operational Material Transport**

| Alternatives/Options | Total Distance Traveled (million kilometers) | Number of Accidents | Number of Fatalities |
|---|---|---|---|
| **Alternative 1: No Action** | 0.03 | 0.006 | 0.0004 |
| **Alternative 2: Entombment** | | | |
| Facility disposition | 1.9 | 0.38 | 0.03 |
| Options at Hanford[a] | 0.42 | 0.09 | 0.006 |
| Disposition of bulk sodium | 0.04 | 0.008 | 0.0005 |
| Disposition of RH-SCs | 0.38 | 0.08 | 0.005 |
| Options at INL[b] | 0.02 | 0.005 | 0.0003 |
| Disposition of bulk sodium | 0.02 | 0.004 | 0.0002 |
| Disposition of RH-SCs[c] | 0.004 | 0.0008 | 0.00005 |
| **Alternative 3: Removal** | | | |
| Facility disposition | 2.1 | 0.42 | 0.03 |
| Options at Hanford[a] | 0.35 | 0.07 | 0.005 |
| Disposition of bulk sodium | 0.04 | 0.008 | 0.0005 |
| Disposition of RH-SCs | 0.31 | 0.06 | 0.004 |
| Options at INL[b] | 0.02 | 0.005 | 0.0003 |
| Disposition of bulk sodium | 0.02 | 0.004 | 0.0002 |
| Disposition of RH-SCs[c] | 0.004 | 0.0008 | 0.00005 |

[a] Options include disposition of bulk sodium and RH-SCs at Hanford. These activities are common to Alternatives 2 and 3.
[b] Options include disposition of bulk sodium and RH-SCs at INL. These activities are common to Alternatives 2 and 3.
[c] An environmental assessment has been prepared at INL to evaluate construction of a Remote Treatment Project at INL (DOE 2009); therefore, these construction impacts are not included.
**Note:** To convert kilometers to miles, multiply by 0.6214.
**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; INL=Idaho National Laboratory; RH-SCs=remote-handled special components.
**Source:** Appendix H, Section H.8.

### 4.2.12.2 Alternative 2: Entombment

Under this alternative, if the treatment of RH-SCs and bulk sodium were performed at INL, about 145 offsite rail shipments would occur (see Table 4–124, INL (R) rows 4 and 7). If these materials were transported using trucks, about 279 offsite shipments would be made (see Table 4–124, INL (T) rows). In addition, 6,300 truck shipments would be made to transport decommissioning waste to onsite storage and burial grounds. The total distance traveled on rail or public roads carrying radioactive materials would range from 150,000 kilometers (93,200 miles) by rail to 270,000 kilometers (168,000 miles) by truck.

No offsite shipments are expected under the Hanford Option of treating RH-SCs or the Hanford Reuse Option of treating bulk sodium at Hanford. The number of onsite transports would be about 6,500 truck shipments (see Table 4–124: Hanford, rows 1, 5, and 8).

#### 4.2.12.2.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities under this alternative (both offsite and onsite shipments if the treatment of RH-SCs and bulk sodium occurs at INL, and onsite shipments only if treatment occurs at Hanford) was estimated to range from 0.33 to 4.34 person-rem for treatment at INL and to be 0.15 person-rem for treatment at Hanford (see column 4 of Table 4–124). The total dose to the exposed population would range from 0.28 to 1.29 person-rem if this waste were treated at INL

or would be 0.015 person-rem if this waste were treated at Hanford. Accordingly, incident-free transportation of radioactive material would result in maximums of 0 (0.0026) LCFs among transportation workers and 0 (0.00077) LCFs in the total affected population over the duration of the alternative.

#### 4.2.12.2.1.1 Facility Disposition

Under this alternative, the irradiated components, such as reactor vessels, test assemblies and hardware, and Interim Examination and Maintenance cells, would be entombed. Aboveground contaminated materials would be transported to an IDF, and hazardous materials would be transported to offsite locations for disposal. Facility disposition waste would require about 6,300 truck shipments from FFTF to an IDF and an offsite hazardous waste facility (see Table 4–124).

#### 4.2.12.2.1.2 Disposition of Remote-Handled Special Components

Two options for disposition of these materials were considered: treatment at Hanford or treatment at INL with the option of returning the treated material to Hanford or shipping it to NNSS for disposal.

**HANFORD OPTION**

Treatment of RH-SCs at Hanford would require transporting the treated components to an IDF for disposal and the caustic solution across the site for product reuse. This option would entail five onsite truck shipments with a potential exposure of 0.03 person-rem to transportation workers and 0.005 person-rem to the population. Accordingly, this option would result in 0 ($1.9 \times 10^{-5}$) LCFs among transportation workers and 0 ($2.9 \times 10^{-6}$) LCFs in the affected population.

**IDAHO OPTION**

This option would require four trucks or two rail shipments to transport RH-SCs to INL for treatment and four trucks or two rail shipments to transport the treated components to Hanford or NNSS for disposal. Transport to NNSS would result in higher transportation risks; therefore, it was included in the values presented in Table 4–124. This option would also require one truck for transport of caustic solution from treated sodium within the RH-SCs to Hanford for product reuse. Potential doses to transportation workers and the general population from rail shipments were estimated to be 0.17 and 0.08 person-rem, respectively. Potential doses to transportation workers and the general population from truck shipments were estimated to be 0.84 and 0.33 person-rem, respectively. Accordingly, this option would result in a maximum of 0 (0.0005) additional LCFs among workers and 0 (0.0002) additional LCFs among the exposed population.

#### 4.2.12.2.1.3 Disposition of Bulk Sodium

Two options for disposition of bulk sodium were considered: treatment at Hanford or treatment at INL, with the return to Hanford of treated sodium in the form of caustic sodium hydroxide solution.

**HANFORD REUSE OPTION**

Under this option, the bulk sodium would be treated at Hanford and the caustic solution would be transported across Hanford for onsite reuse. This option would entail about 200 onsite shipments of bulk sodium and caustic sodium hydroxide solution, with a potential exposure of about 0.12 person-rem to transportation workers and 0.01 person-rem to the population. Accordingly, this option would result in 0 ($6.9 \times 10^{-5}$) LCFs among transportation workers and 0 ($6.7 \times 10^{-6}$) LCFs in the affected population.

**IDAHO REUSE OPTION**

This option would require about 270 truck shipments or 140 rail shipments to transport bulk sodium to INL and return the caustic product to Hanford for reuse. The potential exposures to transportation workers and the general population from rail shipments was estimated to be about 0.16 and 0.20 person-rem, respectively, and for truck shipments, about 3.5 and 0.96 person-rem, respectively. Accordingly, this option would result in a maximum of 0 (0.0021) additional LCFs among workers and 0 (0.00057) additional LCFs among the exposed population.

#### 4.2.12.2.2 Impacts of Accidents During Transportation

As stated earlier, two sets of analyses were performed for the evaluation of transportation accident impacts: impacts of maximum reasonably foreseeable accidents and impacts of all accidents regardless of their severity or likelihood of occurrence.

For treatment options at INL, the maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 chance in 10 million per year) is a severe-impact, high-temperature fire involving a shipment of sodium metal. The consequences of such an accident in terms of population dose in the rural, suburban, and urban zones would be 0.22, 1.2, and 5.6 person-rem, respectively. The likelihood of occurrence of such consequences per transport is less than $1.3 \times 10^{-6}$, $2.5 \times 10^{-7}$, and $2.8 \times 10^{-8}$ in rural, suburban, and urban zones, respectively. This accident could result in a dose of 0.002 rem to an individual hypothetically exposed to the accident plume for 2 hours at a distance of 100 meters (330 feet), with a corresponding LCF risk of $9.0 \times 10^{-7}$.

The estimated total transportation accident risks under this alternative are a maximum radiation dose risk to the population of $1.5 \times 10^{-6}$ person-rem, resulting in $9.2 \times 10^{-10}$ LCFs (see Table 4–124, INL, rows 3 and 6), and maximum traffic fatalities of 0 (0.022) (see Table 4–124, INL, rows 4 and 7). Nearly all of the radiological risks would result from shipping caustic solution to Hanford. These results indicate that the accident risks would be very small.

For treatment options at Hanford, the consequences of the most severe accidents would be encompassed by those of facility accidents. The estimated total transportation accident risks from onsite shipments are very small (see Table 4–124): a population dose of $1.3 \times 10^{-9}$ person-rem, resulting in $7.5 \times 10^{-13}$ LCFs, and traffic accidents resulting in 0 (0.0001) fatalities (see Table 4–124, rows 5 and 8).

##### 4.2.12.2.2.1 Facility Disposition

It was estimated that the accident risks during transport of decommissioning waste could potentially result in 0 (0.004) traffic fatalities.

##### 4.2.12.2.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, the estimated total transportation accident risks are a maximum radiation dose risk to the population of $1.13 \times 10^{-9}$ person-rem, resulting in $6.8 \times 10^{-13}$ LCFs, and traffic accidents resulting in 0 (0.000005) fatalities. These results indicate that the accident risks would be very small.

**IDAHO OPTION**

Under this option, the estimated total transportation accident risks are a maximum radiation dose risk to the population of $8.8 \times 10^{-7}$ person-rem, resulting in $5.3 \times 10^{-10}$ LCFs, and traffic accidents resulting

in 0 (0.0004) fatalities. Nearly all of the radiological risks would result from shipping caustic solution to Hanford. These results indicate that the accident risks would be very small.

#### 4.2.12.2.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Under this option, the estimated total transportation accident risks are a maximum radiation dose risk to the population of $1.2 \times 10^{-10}$ person-rem, resulting in $7.1 \times 10^{-14}$ LCFs, and traffic accidents resulting in 0 (0.0001) fatalities. These results indicate that the accident risks would be very small.

**IDAHO REUSE OPTION**

Under this option, the estimated total transportation accident risks are a maximum radiation dose risk to the population of $6.4 \times 10^{-7}$ person-rem, resulting in $3.9 \times 10^{-10}$ LCFs, and traffic accidents resulting in 0 (0.02) fatalities. Most of the radiological risks would result from shipping caustic solution to Hanford. These results indicate that the accident risks would be very small.

### 4.2.12.2.3 Impacts of Construction and Operational Material Transports

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, canisters) were evaluated. The range of transportation impacts under this alternative would be 1.92 to 2.32 million kilometers (1.19 to 1.44 million miles) traveled, 0 (0.385 to 0.470) accidents, and 0 (0.0303 to 0.036) fatalities over the entire period, from construction through deactivation and closure (see Table 4–125).

#### 4.2.12.2.3.1 Facility Disposition

The impacts of transporting construction and operational material in support of facility disposition would be 1.9 million kilometers (1.2 million miles) traveled, 0 (0.38) accidents, and 0 (0.03) fatalities over the entire period.

#### 4.2.12.2.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

The impacts of transporting construction and operational material to support treatment of RH-SCs would be about 380,000 kilometers (about 240,000 miles) traveled, 0 (0.08) accidents, and 0 (0.005) fatalities.

**IDAHO OPTION**

The impacts of transporting construction and operational material in support of treatment of RH-SCs would be about 4,000 kilometers (about 2,500 miles) traveled, 0 (0.0008) accidents, and 0 (0.00005) fatalities. An environmental assessment has been prepared at INL to evaluate construction of an RTP at INL (DOE 2009); therefore, these construction impacts are not included.

#### 4.2.12.2.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

The impacts of transporting construction and operational material in support of bulk sodium disposition would be about 40,000 kilometers (about 25,000 miles) traveled, 0 (0.008) accidents, and 0 (0.0005) fatalities.

**IDAHO REUSE OPTION**

The impacts of transporting construction and operational material in support of bulk sodium disposition would be about 20,000 kilometers (about 12,000 miles) traveled, 0 (0.004) accidents, and 0 (0.0002) fatalities.

### 4.2.12.3 Alternative 3: Removal

The majority of activities under this alternative would be similar to those discussed under Alternative 2. This alternative would entail an additional 20 shipments of irradiated components such as reactor vessels, test assemblies and hardware, and Interim Examination and Maintenance cells to an IDF under facility disposition. These shipments would add a very small impact to the overall risks presented under Alternative 2 (see Table 4–124, Hanford, row 2).

Overall, if treatment of sodium metals and RH-SCs were performed at INL, about 140 offsite rail shipments would occur (see Table 4–124, INL (R) rows). If these materials were transported using trucks, about 279 offsite shipments would be made (see Table 4–124, INL (T) rows). In addition, about 6,300 truck shipments would be made to transport decommissioning waste to onsite storage and burial grounds. The total distance traveled carrying radioactive materials would range from 150,000 kilometers (93,200 miles) by rail to 270,000 kilometers (168,000 miles) by truck.

No offsite shipments are expected under the Hanford Option (treatment of RH-SCs at Hanford) or the Hanford Reuse Option (treatment of bulk sodium at Hanford). The number of onsite transports would be about 6,500 truck shipments (see Table 4–124, Hanford, rows 2, 5, and 8).

#### 4.2.12.3.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all transportation activities under this alternative (both offsite and onsite shipments if treatment of RH-SCs and bulk sodium occurred at INL, but onsite only if treatment occurred at Hanford) was estimated to range from 0.36 to 4.37 person-rem for treatment at INL, and the estimated dose would be 0.18 person-rem for treatment at Hanford (see column 4 of Table 4–124). The total dose to the exposed population would range from 0.283 to 1.293 person-rem for treatment at INL and would be 0.018 person-rem for treatment at Hanford. Accordingly, incident-free transportation of radioactive material would result in a maximum of 0 (0.00262) LCFs among transportation workers and 0 (0.00077) LCFs in the total affected population over the duration of the alternative.

##### 4.2.12.3.1.1 Facility Disposition

Under this alternative, the irradiated components, such as reactor vessels, test assemblies and hardware, and Interim Examination and Maintenance cells, as well other aboveground decommissioning waste, would be transported to an IDF and offsite locations for disposal. Facility disposition waste would require about 6,300 truck shipments from FFTF to an IDF and an offsite hazardous waste facility (see Table 4–124).

##### 4.2.12.3.1.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

**IDAHO OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

#### 4.2.12.3.1.3 Disposition of Bulk Sodium

Two options for disposition of bulk sodium were considered: treatment at Hanford or treatment at INL, with the return to Hanford of treated sodium in the form of caustic sodium hydroxide solution.

**HANFORD REUSE OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

**IDAHO REUSE OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

#### 4.2.12.3.2 Impacts of Accidents During Transportation

For treatment options at INL, the maximum reasonably foreseeable offsite transportation accident under Alternative 3 (with a probability of occurrence of more than 1 chance in 10 million per year) would be similar to that discussed under Alternative 2.

Estimates of the total transportation accident risks under this alternative are also similar to those described under Alternative 2. These results indicate the accident risks would be very small.

For treatment options at Hanford, the consequences of the most severe transportation accident would be encompassed by those of facility accidents. Estimates of the total transportation accident risks from onsite shipments are very small (see Table 4–124, column 8); the population dose was estimated to be $1.92 \times 10^{-9}$ person-rem, resulting in $1.15 \times 10^{-12}$ LCFs.

#### 4.2.12.3.2.1 Facility Disposition

It was estimated that the transport of decommissioning and irradiated component wastes would potentially result in 0 (0.004) traffic fatalities. The total population dose from accidents involving irradiated materials was estimated to be $6.6 \times 10^{-10}$ person-rem, resulting in $4.0 \times 10^{-13}$ LCFs (see Table 4–124).

#### 4.2.12.3.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

**IDAHO OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

#### 4.2.12.3.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

**IDAHO REUSE OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

#### 4.2.12.3.3 Impacts of Construction and Operational Material Transports

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, canisters) were evaluated. The range of transportation impacts under this alternative would be 2.12 to 2.45 million kilometers (1.32 to 1.52 million miles) traveled, 0 (0.425 to 0.49) accidents, and 0 (0.0303 to 0.035) fatalities over the entire period from construction through deactivation and closure (see Table 4–125).

##### 4.2.12.3.3.1 Facility Disposition

The impacts of transporting construction and operational material in support of facility disposition would be about 2.1 million kilometers (1.3 million miles) traveled, 0 (0.42) accidents, and 0 (0.03) fatalities over the entire period.

##### 4.2.12.3.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

**IDAHO OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

##### 4.2.12.3.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

**IDAHO REUSE OPTION**

Transportation risks for activities under this option would be the same as those under Alternative 2.

### 4.2.13 Environmental Justice

#### 4.2.13.1 Alternative 1: No Action

This section addresses potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations under FFTF Decommissioning Alternative 1. As public access to Hanford is restricted, the majority of impacts under this alternative would be associated with onsite activities and would not affect populations residing off site; thus, the potential for environmental justice concerns is small. Resource areas that could be impacted and that may affect populations residing off site include public and occupational health and safety due to normal operations and facility accidents, as well as air quality and transportation.

Section 4.2.10.1.1 discusses short-term impacts on the public resulting from normal operations under FFTF Decommissioning Alternative 1. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by

external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive air emissions from normal operations, total doses to average individuals of minority, American Indian, Hispanic or Latino, and low-income populations were compared to the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–126 summarizes the average individual total doses over the life of the project under this alternative. There are no appreciable differences between the average individual total doses. Therefore, FFTF Decommissioning Alternative 1 would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–126. FFTF Decommissioning Alternative 1 Average Individual Total Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Doses (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | $5.2\times10^{-5}$ | $6.8\times10^{-5}$ |
| American Indian | $4.0\times10^{-5}$ | $6.1\times10^{-5}$ |
| Hispanic or Latino | $4.9\times10^{-5}$ | $6.8\times10^{-5}$ |
| Low-income | $5.4\times10^{-5}$ | $6.2\times10^{-5}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix J, Section J.5.7.1.2.

Section 4.2.10.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under FFTF Decommissioning Alternative 1, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would account for less than 10 percent of the total dose received by the MEI from the general population. Therefore, FFTF Decommissioning Alternative 1 would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations.

Section 4.2.11.1.1 discusses the radiological impacts of airborne releases from facility accidents under Alternative 1. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Alternative 1 would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.2.11.1.2 discusses the hazardous chemical impacts of facility accidents under FFTF Decommissioning Alternative 1. The Hanford sodium storage tank failure scenario could result in a hazardous plume slightly exceeding the site boundary to the east of the 400 Area, but it is not expected to reach the far side of the Columbia River. The potentially affected area is located in Franklin County, census tract 206.01, block group 2. This block group does not contain a meaningfully greater minority or low-income population. Therefore, Alternative 1 would not pose disproportionately high and adverse impacts on minority or low-income populations due to hazardous chemical impacts of facility accidents.

Air quality impacts are discussed in Section 4.2.4.1. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American

Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.2.12.1 discusses the potential human health risks of transporting construction and operational materials between local or regional locations and Hanford. The impacts of transporting construction and operational materials to Hanford under this alternative would be very small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.2.13.2 Alternative 2: Entombment

This section addresses potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations under Alternative 2. As public access to Hanford is restricted, the majority of impacts under this alternative would be associated with onsite activities and would not affect populations residing off site; thus, the potential for environmental justice concerns is small. Resource areas that could be impacted and that may affect populations residing off site include public and occupational health and safety due to normal operations and facility accidents, as well as air quality and transportation.

##### 4.2.13.2.1 Facility Disposition

Section 4.2.10.2.1 discusses short-term radiological impacts on the public resulting from normal operations under Alternative 2. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

Under this alternative, radiological impacts on the public from normal operations would be minimal. Impacts of deactivation activities would be a fraction of those described under the No Action Alternative in Section 4.2.13.1. For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive emissions from normal operations, the average individual total dose to a member of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project was compared with the average individual total dose to a member of the remainder of the population over the life of the project. These results are presented in Appendix J. Table 4–127 summarizes the average individual total doses over the life of the project under this alternative. There are no appreciable differences between the average individual total doses. Therefore, facility disposition under the Entombment Alternative would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

Section 4.2.10.2.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations associated with facility disposition under the Entombment Alternative. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. The dose to an MEI located at the boundary of the Yakama Reservation would be less than one-tenth of that to the MEI from the general population. Therefore, facility disposition activities under the Entombment Alternative would not pose disproportionately high and adverse impacts on minority or low-income populations.

**Table 4–127. FFTF Decommissioning Alternative 2, Facility Disposition, Average Individual Total Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | $1.3\times10^{-9}$ | $1.7\times10^{-9}$ |
| American Indian | $9.3\times10^{-10}$ | $1.5\times10^{-9}$ |
| Hispanic or Latino | $1.2\times10^{-9}$ | $1.7\times10^{-9}$ |
| Low-income | $1.3\times10^{-9}$ | $1.6\times10^{-9}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix J, Section J.5.7.1.2.

Section 4.2.11.2.1.1 discusses the radiological impacts of airborne releases for facility accidents associated with facility disposition under the Entombment Alternative. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, facility disposition under the Entombment Alternative would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.2.11.2.2.1 discusses the hazardous chemical impacts of accidents associated with facility disposition under the Entombment Alternative. The Hanford sodium storage tank failure scenario could result in a hazardous plume extending slightly beyond the site boundary to the east of the 400 Area, but it is not expected to reach the far side of the Columbia River. The potentially affected area is located in Franklin County, census tract 206.01, block group 2. This block group does not contain a meaningfully greater minority or low-income population. Therefore, facility disposition under the Entombment Alternative would not pose disproportionately high and adverse impacts on minority or low-income populations due to hazardous chemical impacts of facility accidents.

Air quality impacts of facility disposition under Alternative 2 are discussed in Section 4.2.4.2.1. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.2.12.2.2.1 discusses the potential human health risks of transportation related to facility disposition under the Entombment Alternative. The impacts of transporting contaminated and hazardous materials to offsite locations for disposal under this alternative are not expected to result in any additional LCFs in the offsite population. The impacts of transporting construction and operational materials would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.2.13.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Section 4.2.10.2.1.2 discusses short-term radiological impacts on the public from normal operations associated with disposition of RH-SCs at Hanford. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general

population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive emissions from normal operations, average individual total doses to members of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project were compared to the average individual total dose to a member of the remainder of the population over the life of the project. These results are presented in Appendix J. Table 4–128 summarizes the average individual total doses over the life of the project under this option. There were no appreciable differences in average individual total doses. Therefore, disposition of RH-SCs at Hanford would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–128. FFTF Decommissioning Alternative 2, Hanford Option, Disposition of Remote-Handled Special Components, Average Individual Total Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | $2.6\times10^{-7}$ | $3.7\times10^{-7}$ |
| American Indian | $1.7\times10^{-7}$ | $3.2\times10^{-7}$ |
| Hispanic or Latino | $2.5\times10^{-7}$ | $3.6\times10^{-7}$ |
| Low-income | $2.6\times10^{-7}$ | $3.3\times10^{-7}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix J, Section J.5.7.1.2.

Section 4.2.10.2.1.2 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations associated with disposition of RH-SCs at Hanford. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. The dose to an MEI located at the boundary of the Yakama Reservation would be approximately one-fifth of that to the MEI from the general population. Therefore, disposition of RH-SCs at Hanford would not pose disproportionately high and adverse impacts on minority or low-income populations.

Section 4.2.11.2.1.2 discusses the radiological impacts of airborne releases from facility accidents associated with disposition of RH-SCs at Hanford under the Entombment Alternative. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, disposition of RH-SCs at Hanford under the Entombment Alternative would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.2.11.2.2.2 discusses the hazardous chemical impacts of accidents associated with disposition of RH-SCs at Hanford under the Entombment Alternative. Potential impacts under this option would be encompassed by those analyzed in Section 4.2.13.2.1 under facility disposition.

Air quality impacts of disposition of RH-SCs at Hanford under Alternative 2 are discussed in Section 4.2.4.2.2. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or

low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.2.12.2.1.2 discusses the potential human health risks of transportation related to disposition of RH-SCs at Hanford under the Entombment Alternative. This option would not require any offsite shipments. Onsite shipments of treated components and caustic sodium hydroxide solution are not expected to result in any additional LCFs in the offsite population. The impacts of transporting construction and operational materials would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

**IDAHO OPTION**

Section 4.2.10.2.1.2 discusses short-term radiological impacts on the public from normal operations associated with disposition of RH-SCs at INL. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive emissions from normal operations, average individual total doses to members of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project were compared with the average individual total dose to a member of the remainder of the population over the life of the project. These results are presented in Appendix J. Table 4–129 summarizes the average individual total doses over the life of the project under this option. The average individual total doses to minority and Hispanic or Latino individuals would slightly exceed the average individual total dose to the remainder of the population; however, there are no appreciable differences in the average individual total doses. Therefore, disposition of RH-SCs at INL would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–129. FFTF Decommissioning Alternative 2, Idaho Option, Disposition of Remote-Handled Special Components, Average Individual Total Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | $3.3\times10^{-7}$ | $3.1\times10^{-7}$ |
| American Indian | $2.6\times10^{-7}$ | $3.2\times10^{-7}$ |
| Hispanic or Latino | $3.5\times10^{-7}$ | $3.1\times10^{-7}$ |
| Low-income | $3.2\times10^{-7}$ | $3.2\times10^{-7}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix J, Section J.5.7.1.2.

Section 4.2.10.2.1.2 discusses impacts on the offsite MEI located south of INTEC as a result of normal operations associated with disposition of RH-SCs at INL. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Fort Hall Reservation and an individual subsisting on fish and wildlife were evaluated. The dose to an MEI located at the boundary of the Fort Hall Reservation would be less

than approximately one-tenth of that to the offsite MEI. Therefore, disposition of RH-SCs at INL would not pose disproportionately high and adverse impacts on minority or low-income populations.

Section 4.2.11.2.1.2 discusses the radiological impacts of airborne releases from facility accidents associated with disposition of RH-SCs at INL under the Entombment Alternative. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, disposition of RH-SCs at INL under the Entombment Alternative would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.2.11.2.2.2 discusses the hazardous chemical impacts of accidents associated with disposition of RH-SCs at INL under the Entombment Alternative. Potential impacts under this option would be encompassed by those analyzed in Section 4.2.13.2.1 under facility disposition.

Air quality impacts of disposition of RH-SCs at INL under Alternative 2 are discussed in Section 4.2.4.2.2. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.2.12.2.1.2 discusses the potential human health risks of transportation related to disposition of RH-SCs at INL under the Entombment Alternative. The impacts of transporting RH-SCs between Hanford, INL, and NNSS, as well as transporting caustic sodium hydroxide solution from INL to Hanford for product reuse under this option, are not expected to result in any additional LCFs in the offsite population. The impacts of transporting construction and operational materials would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.2.13.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Section 4.2.10.2.1.3 discusses short-term radiological impacts on the public from normal operations associated with disposition of bulk sodium at Hanford. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive emissions from normal operations, average individual total doses to members of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project were compared with the average individual total dose to a member of the remainder of the population over the life of the project. These results are presented in Appendix J. Table 4–130 summarizes the average individual total doses over the life of the project under this option. There are no appreciable differences between the average individual total doses. Therefore, disposition of bulk sodium at Hanford would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–130. FFTF Decommissioning Alternative 2, Hanford Option, Disposition of Bulk Sodium, Average Individual Total Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | $4.1\times10^{-5}$ | $5.5\times10^{-5}$ |
| American Indian | $3.1\times10^{-5}$ | $4.9\times10^{-5}$ |
| Hispanic or Latino | $3.9\times10^{-5}$ | $5.5\times10^{-5}$ |
| Low-income | $4.3\times10^{-5}$ | $5.0\times10^{-5}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix J, Section J.5.7.1.2.

Section 4.2.10.2.1.3 discusses impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations associated with disposition of bulk sodium at Hanford. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. The dose to an MEI located at the boundary of the Yakama Reservation would be less than approximately one-tenth of that to the MEI from the general population. Therefore, disposition of bulk sodium at Hanford would not pose disproportionately high and adverse impacts on minority or low-income populations.

Section 4.2.11.2.1.3 discusses the radiological impacts of airborne releases from facility accidents associated with disposition of bulk sodium at Hanford under the Entombment Alternative. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, disposition of bulk sodium at Hanford under the Entombment Alternative would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.2.11.2.2.3 discusses the hazardous chemical impacts of accidents associated with disposition of bulk sodium at Hanford under the Entombment Alternative. Potential impacts under this option would be encompassed by those analyzed in Section 4.2.13.2.1 under facility disposition.

Air quality impacts of disposition of bulk sodium at Hanford under Alternative 2 are discussed in Section 4.2.4.2.3. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.2.12.2.1.3 discusses the potential human health risks of transportation related to disposition of bulk sodium at Hanford under the Entombment Alternative. This option would not require any offsite shipments. Onsite shipments of bulk sodium and caustic solution are not expected to result in any additional LCFs in the offsite population. The impacts of transporting construction and operational materials would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

**IDAHO REUSE OPTION**

Section 4.2.10.2.1.3 discusses short-term radiological impacts on the public from normal operations associated with disposition of bulk sodium at INL. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive emissions from normal operations, average individual total doses to members of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project were compared with the average individual total dose to a member of the remainder of the population over the life of the project. These results are presented in Appendix J. Table 4–131 summarizes the average individual total doses over the life of the project under this option. The average individual total doses to minority, Hispanic or Latino, and low-income individuals would slightly exceed the average individual total dose to the remainder of the population; however there are no appreciable differences in the average individual total doses. Therefore, disposition of bulk sodium at INL would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

**Table 4–131. FFTF Decommissioning Alternative 2, Idaho Option, Disposition of Bulk Sodium, Average Individual Total Doses from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | $9.2\times10^{-6}$ | $8.3\times10^{-6}$ |
| American Indian | $7.8\times10^{-6}$ | $8.4\times10^{-6}$ |
| Hispanic or Latino | $9.7\times10^{-6}$ | $8.2\times10^{-6}$ |
| Low-income | $8.5\times10^{-6}$ | $8.4\times10^{-6}$ |

**Key:** FFTF=Fast Flux Test Facility.
**Source:** Appendix J, Section J.5.7.1.2.

Section 4.2.10.2.1.3 discusses impacts on the offsite MEI located southwest of the MFC as a result of normal operations associated with disposition of bulk sodium at INL. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Fort Hall Reservation and an individual subsisting on fish and wildlife were evaluated. The dose to an MEI located at the boundary of the Fort Hall Reservation would be approximately one-tenth of that to the offsite MEI. Therefore, disposition of bulk sodium at INL would not pose disproportionately high and adverse impacts on minority or low-income populations.

Section 4.2.11.2.1.3 discusses the radiological impacts of airborne releases from facility accidents associated with disposition of bulk sodium at INL under the Entombment Alternative. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, disposition of bulk sodium at INL under the Entombment Alternative would not pose disproportionately high and adverse impacts on the minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.2.11.2.2.3 discusses the hazardous chemical impacts of accidents associated with disposition of bulk sodium at INL under the Entombment Alternative. None of the accidents analyzed could result in a hazardous plume extending beyond the site boundary. Therefore, bulk sodium disposition at INL under the Entombment Alternative would not pose disproportionately high and adverse impacts on minority or low-income populations due to hazardous chemical impacts of facility accidents.

Air quality impacts of disposition of bulk sodium at INL under Alternative 2 are discussed in Section 4.2.4.2.3. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.2.12.2.1.3 discusses the potential human health risks of transportation related to disposition of bulk sodium at INL under the Entombment Alternative. The impacts of transporting bulk sodium from Hanford to INL, as well as transporting caustic sodium hydroxide solution from INL back to Hanford for product reuse under this option, are not expected to result in any additional LCFs in the offsite population. The impacts of transporting construction and operational materials would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

### 4.2.13.3 Alternative 3: Removal

This section addresses potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations under FFTF Decommissioning Alternative 3. As public access to Hanford is restricted, the majority of impacts under this alternative would be associated with onsite activities and would not affect populations residing off site; thus, the potential for environmental justice concerns is small. Resource areas that could be impacted and that may affect populations residing off site include public and occupational health and safety due to normal operations and facility accidents, as well as air quality and transportation.

#### 4.2.13.3.1 Facility Disposition

Section 4.2.10.3.1.1 discusses short-term radiological impacts on the public from normal operations associated with facility disposition under the Removal Alternative. Facility disposition would result in minimal releases of radioactivity and, therefore, negligible doses to the offsite population and the MEI. Similarly, the doses to minority and low-income populations, as well as the MEI at the boundary of the Yakama Reservation, would also be negligible. Therefore, facility disposition under the Removal Alternative would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

Section 4.2.11.3.1.1 discusses the radiological impacts of airborne releases for facility accidents associated with facility disposition under the Removal Alternative. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, facility disposition under the Removal Alternative would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.2.11.3.2 discusses the hazardous chemical impacts associated with facility disposition under the Removal Alternative. Hazardous chemical impacts under this alternative would be the same as those described in Section 4.2.13.2.1 under the Entombment Alternative.

Air quality impacts of facility disposition under Alternative 3 are discussed in Section 4.2.4.3.1. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.2.12.3.1.1 discusses the potential human health risks of transportation related to facility disposition under the Removal Alternative. The impacts of transporting contaminated and hazardous materials to offsite locations for disposal under this alternative are not expected to result in any additional LCFs in the offsite population. The impacts of transporting construction and operational materials would also be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.2.13.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Impacts of this option on aspects of environmental justice would be the same as those discussed in Section 4.2.13.2.2 under the Hanford Option.

**IDAHO OPTION**

Impacts of this option on aspects of environmental justice would be the same as those discussed in Section 4.2.13.2.2 under the Idaho Option.

#### 4.2.13.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Impacts of this option on aspects of environmental justice would be the same as those discussed in Section 4.2.13.2.3 under the Hanford Reuse Option.

**IDAHO REUSE OPTION**

Impacts of this option on aspects of environmental justice would be the same as those discussed in Section 4.2.13.2.3 under the Idaho Reuse Option.

### 4.2.14 Waste Management

This section evaluates the impacts of waste generation associated with the various FFTF Decommissioning alternatives and options (see Section 4.2.1) on the waste management infrastructure at Hanford. As summarized in Section 4.3 and detailed in Chapter 2, Waste Management alternatives were developed to manage the various waste volumes projected to be generated under the alternatives for Tank Closure, FFTF Decommissioning, and Waste Management. Section 4.3.14 of this EIS evaluates the impacts of waste generation associated with the construction, operations, deactivation, and closure of the waste management facilities.

The following analysis is consistent with DOE policy and DOE Manual 435.1-1, which require that DOE radioactive waste shall be treated, stored, and, in the case of LLW, disposed of at the site where the waste is generated, if practical, or at another DOE facility. The analysis of these FFTF Decommissioning alternatives and options is based on disposal of LLW and MLLW at Hanford. However, if DOE determines that use of Hanford's or another DOE site's waste management facilities is not practical or

cost-effective, DOE may approve the use of non-DOE (i.e., commercial) facilities to store, treat, and dispose of such waste.

Included in this section is a discussion of the waste inventories generated under each of the FFTF Decommissioning alternatives as a result of facility disposition and the options for disposition of RH-SCs and Hanford bulk sodium. The inventories include LLW, MLLW, hazardous waste, nonhazardous waste, liquid process waste, and 50 weight-percent sodium hydroxide.

#### LOW-LEVEL RADIOACTIVE WASTE

LLW and MLLW (e.g., personal protective equipment, tools, filters, empty containers) would be generated during activities such as routine operations, deactivation, decommissioning, and disposition of the SRF, the SPF, and the RTP under the action alternatives and options, as well as during routine surveillance and maintenance under FFTF Decommissioning Alternative 1, No Action. LLW is typically not treated or only minimally treated (e.g., compacted) before disposal. Through a combination of on- and offsite capabilities, secondary MLLW would be treated to meet RCRA land-disposal-restriction treatment standards prior to disposal. Therefore, this waste treatment would cause no or only minimal impacts on the Hanford waste management system. The LLW would be sent directly to disposal. The MLLW would be sent to disposal after treatment. All LLW and MLLW would be disposed of in an IDF.

#### HAZARDOUS WASTE

Hazardous waste is dangerous waste, as defined in the *Washington Administrative Code* (WAC 173-303). Hazardous waste generated during operations, deactivation, or monitoring would be packaged in DOT-approved containers and shipped off site to permitted commercial recycling, treatment, and disposal facilities. Hanford shipped 182,177 kilograms (402,000 pounds) of hazardous waste off site in 2005 (Poston et al. 2006). Management of the additional waste generated under the FFTF Decommissioning alternatives and options would require little, if any, additional planning. The waste would be treated and disposed of at offsite commercial facilities.

#### NONHAZARDOUS WASTE

Any nonhazardous solid waste generated from facility disposition activities or treatment facility construction, operations, or deactivation would be packaged and transported in conformance with standard industrial practices. Solid waste such as office paper, metal cans, and plastic and glass bottles that can be recycled would be sent off site for that purpose. The remaining nonhazardous solid waste would be sent for offsite disposal in a local landfill. This additional waste load would have only a minor impact on the handling and accumulation of nonhazardous solid waste at Hanford.

#### LIQUID PROCESS WASTE

Process waste would be generated by FFTF disposition activities and would possibly be generated in association with RH-SC treatment, bulk sodium disposition, and facility deactivation. Process liquids with substantial levels of radioactivity would be treated at the ETF or the TEDF or equivalent facilities at INL's MFC. Dilute process waste such as cooling waters or steam condensates would be routed to the Hanford or Idaho facilities, as applicable, whose mission it is to manage such wastes. It was assumed that the ETF and the TEDF, or their equivalents, would continue to be available to manage dilute process liquids generated under the FFTF Decommissioning alternatives. Wastewater management is further discussed in Section 4.2.6.

#### 4.2.14.1 Alternative 1: No Action

FFTF Decommissioning Alternative 1, No Action, includes deactivation of the FFTF complex followed by 100 years of administrative controls.

Surveillance and maintenance activities associated with storage of bulk sodium in the 400 Area SSF and maintenance of the FFTF reactor vessel, related piping and equipment, RH-SCs, and tanks through the 100-year administrative control period would generate relatively small volumes of waste on an annualized basis. Table 4–132 presents the estimated waste volumes generated under FFTF Decommissioning Alternative 1.

#### 4.2.14.2 Alternative 2: Entombment

##### 4.2.14.2.1 Waste Inventories

##### 4.2.14.2.2 Facility Disposition

FFTF Decommissioning Alternative 2, Entombment, provides for demolition of the FFTF RCB and immediately adjacent support facilities to below grade (other facilities within the PPA would be dismantled to grade), stabilization of below-grade spaces, and construction of a modified RCRA Subtitle C barrier to reduce infiltration, prevent intrusion, and isolate the below-grade portions of the reactor building. Accessible void spaces in the below-grade portions of the RCB would be grouted. These activities would produce a small quantity of secondary LLW and liquid LLW. Debris and other waste not placed in the RCB or used as backfill would be transported to trenches 31 and 34 of LLBG 218-W-5 or to IDF-East for disposal.

**Table 4–132. FFTF Decommissioning Alternatives and Options – Summary of Waste Generation Volumes**

| Waste Type | Project Phase | | | | | Peak Annual Generation | |
|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Annual Waste Volume |
| **Alternative 1: No Action** | | | | | | | |
| Low-level radioactive waste | N/A | N/A | 1,700 | N/A | 1,700 | 2008–2017 | 17 |
| Mixed low-level radioactive waste | N/A | N/A | 57 | N/A | 57 | 2008–2017 | 1 |
| Hazardous waste[a] | N/A | N/A | 396 | N/A | 396 | 2008–2017 | 4 |
| Nonradioactive/nonhazardous waste[b] | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Liquid low-level radioactive waste (liters) | N/A | N/A | 623,000 | N/A | 623,000 | 2008–2017 | 6,230 |
| **Alternative 2 Facility Disposition: Entombment** | | | | | | | |
| Low-level radioactive waste | N/A | N/A | 7 | N/A | 7 | 2017 | 7 |
| Mixed low-level radioactive waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Hazardous waste[a] | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Nonradioactive/nonhazardous waste[b] | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Liquid low-level radioactive waste (liters) | N/A | N/A | 182,000 | N/A | 182,000 | 2017 | 182,000 |
| **Alternative 3 Facility Disposition: Removal** | | | | | | | |
| Low-level radioactive waste | N/A | N/A | 692 | N/A | 692 | 2013–2014 | 346 |
| Mixed low-level radioactive waste | N/A | N/A | 8 | N/A | 8 | 2013–2014 | 4 |
| Hazardous waste[a] | N/A | N/A | 73 | N/A | 73 | 2013–2014 | 37 |
| Nonradioactive/nonhazardous waste[b] | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Liquid low-level radioactive waste (liters) | N/A | N/A | 324,000 | N/A | 324,000 | 2013–2014 | 162,000 |
| **Disposition of RH-SCs: Hanford Option** | | | | | | | |
| Low-level radioactive waste | N/A | 8 | 60 | N/A | 68 | 2018 | 60 |
| Mixed low-level radioactive waste | N/A | 7 | N/A | N/A | 7 | 2017 | 7 |
| Nonradioactive/nonhazardous waste[b] | N/A | N/A | 4 | N/A | 4 | 2018 | 4 |
| Liquid low-level radioactive waste (liters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Disposition of RH-SCs: Idaho Option** | | | | | | | |
| Low-level radioactive waste | N/A | 8 | 60 | N/A | 68 | 2018 | 60 |
| Mixed low-level radioactive waste | N/A | 7 | N/A | N/A | 7 | 2017 | 7 |
| Nonradioactive/nonhazardous waste[b] | N/A | N/A | 4 | N/A | 4 | 2018 | 4 |
| Liquid low-level radioactive waste (liters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Table 4–132. FFTF Decommissioning Alternatives and Options – Summary of Waste Generation Volumes *(continued)***

| Waste Type | Project Phase | | | | | Peak Annual Generation | |
|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Annual Waste Volume |
| **Disposition of Bulk Sodium: Hanford Reuse Option** | | | | | | | |
| Low-level radioactive waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Mixed low-level radioactive waste | 1 | 21 | 399 | N/A | 421 | 2019 | 399 |
| Nonradioactive/nonhazardous waste[b] | N/A | N/A | 454 | N/A | 454 | 2019 | 454 |
| Liquid low-level radioactive waste (liters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Disposition of Bulk Sodium: Idaho Reuse Option** | | | | | | | |
| Low-level radioactive waste | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Mixed low-level radioactive waste | 3 | 21 | 251 | N/A | 275 | 2016 | 262 |
| Nonradioactive/nonhazardous waste[b] | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Liquid low-level radioactive waste (liters) | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

[a] Hazardous waste is accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
[b] Nonhazardous solid waste is shipped to offsite commercial facilities for recycling, treatment, and disposal.
**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic yards, multiply by 1.308; liters to gallons, by 0.26417.
**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; N/A=not applicable; RH-SCs=remote-handled special components.
**Source:** SAIC 2010b.

#### 4.2.14.2.3 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, RH-SCs would be stored, treated, and disposed of at Hanford. This option would use storage and disposal facilities currently existing within the 200 Areas, thereby minimizing any impact. Treatment of RH-SCs would involve construction of a new RTP within the T Plant complex located in the 200-West Area. This option would generate waste from operations and deactivation of this facility.

**IDAHO OPTION**

RH-SCs removed from the FFTF RCB would be stored at Hanford prior to shipment to INL, where they would be treated. Treated components would be returned to Hanford or sent to NNSS for disposal, where they would be placed in existing disposal facilities. This option would generate waste from operations and deactivation of this facility.

#### 4.2.14.2.4 Disposition of Bulk Sodium

The bulk sodium (approximately 1.14 million liters [300,000 gallons]) would be converted to a caustic sodium hydroxide solution for product reuse in processing tank waste at the WTP or support for Hanford tank corrosion controls. Two options were identified for conversion of the bulk sodium to liquid caustic.

**HANFORD REUSE OPTION**

Under the Hanford Reuse Option, sodium from FFTF would be sent to a new SRF to be built in the 400 Area. Construction, operations, and deactivation of this new facility would generate a small amount of waste.

**IDAHO REUSE OPTION**

Under this option, sodium from FFTF and other sodium would be transported to INL for treatment in the SPF. The SPF is an existing facility within the MFC. Modifications would have to be made to the current facility. Construction, operations, and deactivation of the modifications would generate a small amount of waste.

Table 4–132 presents the estimated waste volumes generated under FFTF Decommissioning Alternative 2.

### 4.2.14.3 Alternative 3: Removal

#### 4.2.14.3.1 Waste Inventories

#### 4.2.14.3.2 Facility Disposition

FFTF Decommissioning Alternative 3, Removal, provides for demolition of above-grade structures and disposal of the contaminated debris in an IDF similar to Alternative 2, except the reactor vessel would be stabilized with grout, removed, and disposed of at an IDF. Under this alternative, the FFTF RCB and adjacent support facilities would be removed to 0.9 meters (3 feet) below grade; however, an engineered barrier would not be needed because the reactor vessel and other radioactively contaminated equipment would also be removed.

Debris and other waste would be handled in the same manner as under the FFTF Decommissioning Entombment Alternative (see Section 4.2.14.2.2).

#### 4.2.14.3.3 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

The steps involved in disposition of RH-SCs under the Hanford Option of this alternative would be identical to those under the Entombment Alternative, as discussed under the Hanford Option in Section 4.2.14.2.3.

**IDAHO OPTION**

Similar to the Hanford Option, the actions taken at INL would be the same under this alternative as those under the Entombment Alternative, as discussed under the Idaho Option in Section 4.2.14.2.3.

#### 4.2.14.3.4 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

The steps involved in the disposition of bulk sodium under the Hanford Reuse Option of this alternative would be identical to those under the Entombment Alternative, as discussed under the Hanford Reuse Option in Section 4.2.14.2.4.

**IDAHO REUSE OPTION**

Similar to the Hanford Reuse Option, the steps involved in disposition of bulk sodium at INL would be the same under this alternative as those under the Entombment Alternative, as discussed under the Idaho Reuse Option in Section 4.2.14.2.4.

Table 4–132 presents the estimated waste volumes generated under FFTF Decommissioning Alternative 3.

### 4.2.15 Industrial Safety

Illness, injury, and death are possible outcomes of any industrial accident. The accepted standard for measuring the outcome of an industrial accident is the number of TRCs of illness, injury, and death. This section addresses the potential impacts of illness, injury, and death that could be associated with implementation of each of the FFTF Decommissioning alternatives and options for disposition of RH-SCs and bulk sodium. Key underlying assumptions and industrial safety incident rates used in support of this analysis are the same as those described in Section 4.1.15 for the Tank Closure alternatives.

Using these incident rates and the projected labor hours, industrial safety impacts associated with each of the alternatives were determined (see Table 4–133). There are inherent uncertainties in estimating the number of TRCs and fatalities associated with future activities. Currently, there are no weighting factors assigned to the phases of an alternative that allow for normalizing the risks under each alternative. Therefore, when averaging the rate over all phases, this approach can result in slightly higher values for project operation and closure phases and lower values for activities that have higher risk of injury and illness.

As shown in Figure 4–29, more industrial safety impacts are associated with those alternatives that require higher numbers of labor hours.

**Table 4–133. FFTF Decommissioning Alternatives – Industrial Safety Impacts**

| Alternative | Labor Category | Million Labor Hours | Total Recordable Case Rate per 200,000 Labor Hours | Projected Total Recordable Cases | Fatality Rate per 200,000 Labor Hours | Projected Fatalities |
|---|---|---|---|---|---|---|
| Alternative 1: No Action | Construction | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Operations | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Deactivation | 0.042 | 2.0 | 0.42 | 0.26 | 0.00005 |
| | Closure | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | **Total** | **0.042** | | **0.42** | | **0.00005** |
| Alternative 2: Facility Disposition-Entombment | Construction | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Operations | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Deactivation | 0.62 | 2.0 | 6.2 | 0.26 | 0.0008 |
| | Closure | 0.19 | 2.0 | 1.9 | 0.26 | 0.0002 |
| | **Total** | **0.81** | | **8.10** | | **0.001** |
| Alternative 3: Facility Disposition-Removal | Construction | 0.0 | 2.0 | 0.00 | 0.26 | 0.0 |
| | Operations | 0.0 | 2.0 | 0.00 | 0.26 | 0.0 |
| | Deactivation | 0.80 | 2.0 | 8.0 | 0.26 | 0.001 |
| | Closure | 0.15 | 2.0 | 1.5 | 0.26 | 0.0002 |
| | **Total** | **0.95** | | **9.50** | | **0.0012** |
| Disposition of RH-SCs: Hanford Option | Construction | 0.34 | 2.0 | 3.40 | 0.26 | 0.0004 |
| | Operations | 0.08 | 2.0 | 0.80 | 0.26 | 0.0001 |
| | Deactivation | 0.04 | 2.0 | 0.40 | 0.26 | 0.0001 |
| | Closure | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | **Total** | **0.47** | | **4.70** | | **0.0006** |
| Disposition of RH-SCs: Idaho Option | Construction | 0.0 | 1.5 | 0.0 | 0.26 | 0.0 |
| | Operations | 0.08 | 1.5 | 0.6 | 0.26 | 0.0001 |
| | Deactivation | 0.04 | 1.5 | 0.3 | 0.26 | 0.00005 |
| | Closure | 0.0 | 1.5 | 0.0 | 0.26 | 0.0 |
| | **Total** | **0.12** | | **0.9** | | **0.0002** |
| Disposition of Bulk Sodium: Hanford Reuse Option | Construction | 0.27 | 2.0 | 2.70 | 0.26 | 0.0004 |
| | Operations | 0.26 | 2.0 | 2.60 | 0.26 | 0.0003 |
| | Deactivation | 0.05 | 2.0 | 0.50 | 0.26 | 0.0001 |
| | Closure | 0.0 | 2.0 | 0.00 | 0.26 | 0.0 |
| | **Total** | **0.58** | | **5.80** | | **0.0008** |
| Disposition of Bulk Sodium: Idaho Reuse Option | Construction | 0.05 | 1.5 | 0.38 | 0.26 | 0.00006 |
| | Operations | 0.22 | 1.5 | 1.65 | 0.26 | 0.0003 |
| | Deactivation | 0.001 | 1.5 | 0.01 | 0.26 | 0.000002 |
| | Closure | 0.0 | 1.5 | 0.00 | 0.26 | 0.0 |
| | **Total** | **0.27** | | **2.03** | | **0.0003** |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate. Totals may not equal the sum of the contributions due to rounding.
**Key:** FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; RH-SCs=remote-handled special components.
**Source:** Labor hours compiled from Appendix I.

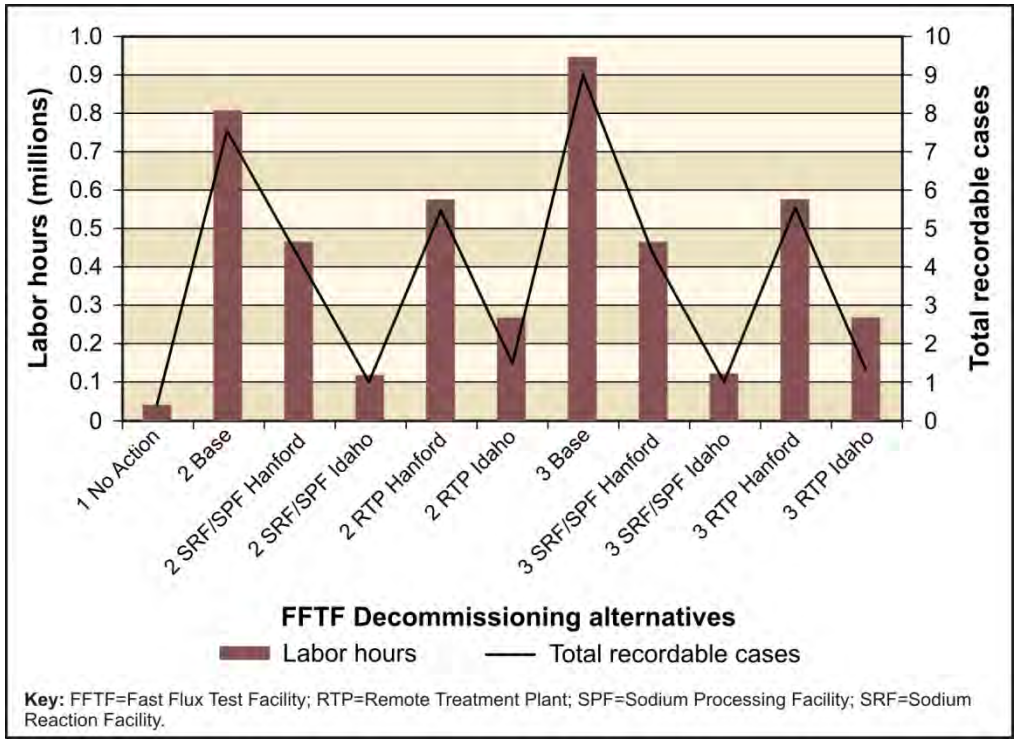


**Figure 4–29. Total Recordable Cases and Labor Hours by Alternative**

#### 4.2.15.1 Alternative 1: No Action

Approximately one TRC and no fatalities are projected to result from work under this alternative, which would include administrative controls for 100 years.

#### 4.2.15.2 Alternative 2: Entombment

##### 4.2.15.2.1 Facility Disposition

Completing the work identified under this alternative would require 810,000 labor hours, including the postclosure care period of 100 years. Approximately eight TRCs and no fatalities are projected.

##### 4.2.15.2.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Under this option, a facility would be built to process the RH-SCs removed from FFTF. Construction, operations, and deactivation would require 470,000 total labor hours over 4 years. Approximately five TRCs and no fatalities are projected.

**IDAHO OPTION**

Approximately one TRC and no fatalities are projected over the period when this work would be conducted. To calculate the number of potential TRCs, the average rate for Idaho operations from 2001 through 2006 (1.5 cases per 200,000 labor hours) was applied.

#### 4.2.15.2.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Construction, operations, and deactivation of the SRF in the 400 Area of Hanford would require a total of 580,000 labor hours. Approximately six TRCs were projected to be generated under this alternative. No fatalities are projected during any phase of this alternative.

**IDAHO REUSE OPTION**

This option would require shipment of the sodium to a new facility at the MFC at INL for conversion to a form acceptable for use in the WTP. This work would take place over a 4-year period and would require a total of 270,000 labor hours to complete. Approximately two TRCs and no fatalities are projected under this option. To calculate the number of potential TRCs, the average rate for Idaho operations from 2001 through 2006 (1.5 cases per 200,000 labor hours) was applied.

### 4.2.15.3 Alternative 3: Removal

#### 4.2.15.3.1 Facility Disposition

No more than 10 TRCs and no fatalities are projected to result from work conducted under this alternative.

#### 4.2.15.3.2 Disposition of Remote-Handled Special Components

**HANFORD OPTION**

Industrial safety consequences from implementation of this option would be the same as those discussed in Section 4.2.15.2.2 under the Hanford Option.

**IDAHO OPTION**

Industrial safety consequences from implementation of this option would be the same as those discussed in Section 4.2.15.2.2 under the Idaho Option.

#### 4.2.15.3.3 Disposition of Bulk Sodium

**HANFORD REUSE OPTION**

Industrial safety consequences from implementation of this option would be the same as those discussed in Section 4.2.15.2.3 under the Hanford Reuse Option.

**IDAHO REUSE OPTION**

Industrial safety consequences from implementation of this option would be the same as those discussed in Section 4.2.15.2.3 under the Idaho Reuse Option.

## 4.3 WASTE MANAGEMENT ALTERNATIVES

This section describes the potential short-term environmental and human health impacts associated with implementation of alternatives for administering ongoing solid waste management operations and proposed disposal of Hanford LLW and MLLW and a limited volume of offsite LLW and MLLW in an IDF to be located at Hanford. Specifically, some waste from tank closure activities (described in Section 4.1), as well as other LLW and MLLW from Hanford, including the waste resulting from FFTF decommissioning (described in Section 4.2) and waste from other DOE sites without appropriate disposal facilities, must be disposed of to facilitate cleanup of Hanford and other DOE sites. This section analyzes the impacts of expanding Hanford's waste disposal capacity to provide space for on- and offsite wastes. Associated storage, disposal, and closure activities, as well as facility-specific construction, operations, deactivation, and closure activities, are also analyzed.

Three Waste Management alternatives were considered and analyzed: (1) Waste Management Alternative 1: No Action Alternative, under which LLW, MLLW, and TRU waste would be stored and disposed of in existing Hanford facilities and no offsite waste would be received, construction/use of IDF-East would be discontinued, and IDF-East would be deactivated; (2) Waste Management Alternative 2: Disposal in IDF, 200-East Area only; and (3) Waste Management Alternative 3: Disposal in IDF, 200-East and 200-West Areas. Waste Management Alternative 2 would include storing LLW, MLLW, and TRU waste in the CWC prior to disposal in existing trenches 31 and 34, as well as conducting waste processing prior to disposal at new facilities or existing-facility expansions at the CWC, WRAP, and the T Plant. A total volume of 62,000 cubic meters (81,000 cubic yards) of LLW and 20,000 cubic meters (26,000 cubic yards) of MLLW from other DOE sites would be received for disposal under this alternative. Waste from tank closure and treatment operations, onsite non-CERCLA waste, FFTF decommissioning waste, waste management waste, and offsite waste from other DOE sites would be disposed of at IDF-East. A new RPPDF would be provided to dispose of equipment and soils resulting from tank farm clean closure activities that are not highly contaminated.

Waste Management Alternative 3 would involve the same waste storage and processing provisions as under Waste Management Alternative 2, and the same volume of offsite waste would be accepted for disposal; a new RPPDF would also be provided. However, an additional IDF would be provided in the 200-West Area. Waste from tank closure and treatment operations would be disposed of at IDF-East, while onsite non-CERCLA waste, FFTF decommissioning waste, waste management waste, and offsite waste from other DOE sites would be disposed of at IDF-West.

In addition, under each Waste Management action alternative (i.e., Alternatives 2 and 3), three disposal groups were analyzed: Disposal Group 1, Disposal Group 2, and Disposal Group 3. These disposal groups encompass the sizing requirements and associated construction, operations, and closure requirements for the IDF(s) and RPPDF that would be necessary to accommodate the varying waste volumes considered under each disposal configuration. These alternatives and options are described further in Chapter 2, Section 2.5.4, of this EIS.

### 4.3.1 Land Resources

#### 4.3.1.1 Alternative 1: No Action

##### 4.3.1.1.1 Land Use

Under the No Action Alternative, new facility construction would not be initiated within the 200 Areas. Storage and treatment activities would continue to take place within the CWC, WRAP complex, and T Plant complex. Disposal would also continue in LLBG 218-W-5 trenches 31 and 34. Barriers would not be used after closure of any of these facilities or trenches. Thus, there would be no change in land

use within the 200 Areas under this alternative. As this alternative would not require geologic material to be excavated from Borrow Area C, there would be no impact on land use within that area.

#### 4.3.1.1.2 Visual Resources

As noted above, there would be no construction under the No Action Alternative within the 200 Areas, and barriers would not be used after closure of facilities or trenches. Further, there would be no need to excavate geologic material from Borrow Area C. Thus, this alternative would have no impact on the visual environment.

However, ongoing construction, consolidation, operations, maintenance, and deactivation of facilities on Rattlesnake and Gable Mountains would occur under this alternative. Rattlesnake and Gable Mountains are within the viewshed of Borrow Area C and the 200 Areas, respectively, and ongoing activities would result in short-term adverse impacts on land and visual resources, including the development or use of previously undisturbed land. Visual impacts of existing structures and maintenance activities on Rattlesnake and Gable Mountains and land use for construction of new facilities are considered a short-term impact because, after a facility's mission has been completed, it would be deactivated and demolished, and vegetation and habitat would be restored to a natural state. However, the eventual consolidation or removal of unnecessary facilities/infrastructure on Rattlesnake and Gable Mountains would tend to improve the visual profile of the features, allow restoration of natural habitat, and enhance tribal religious and cultural experiences.

### 4.3.1.2 Alternative 2: Disposal in IDF, 200-East Area Only

#### 4.3.1.2.1 Land Use

Under this alternative, a number of new facilities or existing-facility expansions would be constructed. These include expansion of the T Plant, construction of a new CWC storage facility, and two expansions of WRAP (both for treating nontank waste): (1) a CH-Mixed TRU/TRU waste facility at the CWC and (2) an RH-Mixed TRU/TRU waste facility at WRAP (see Figure 4–2). These facilities would be constructed within the 200-West Area and would require a total of 2.7 hectares (6.6 acres) of land. Because all work would take place within the 200-West Area, which is within the area designated Industrial-Exclusive, there would be no change in land use under this alternative from the construction and operations of new processing and storage facilities.

In addition to the facilities noted above, IDF-East and an RPPDF would be constructed between the 200-East and 200-West Areas (see Figure 4–1). Waste generated in connection with the Waste Management alternatives, as well as waste associated with the FFTF Decommissioning and Tank Closure alternatives, would also be placed in these disposal facilities. Thus, the sizes of IDF-East and the RPPDF would vary depending upon the volume of waste generated under the various alternative combinations. Accordingly, waste volumes have been placed in three disposal groups, which are addressed separately below (see Appendix E, Section E.4.2, for a complete discussion of the waste groupings). As IDF-East and the RPPDF would be located within the Industrial-Exclusive area, their construction would be consistent with the existing land use designation of the area.

Construction, operations, and closure of the various facilities associated with each of the disposal groups under this alternative would require the use of geologic material to produce grout, fill excavated areas, and cover waste sites. This material would come from Borrow Area C. The area needed to supply this material would vary depending on the volume required for each disposal group. The area of land needed within the borrow area and the land requirements for IDF-East and the RPPDF are addressed below. As Borrow Area C has been designated Conservation (Mining), use of the area for this purpose would be consistent with the current site land use plan.

#### 4.3.1.2.1.1 Disposal Group 1

Disposal Group 1 would require that IDF-East and the RPPDF be 32.8 hectares (81 acres) and 29.5 hectares (73 acres) in size, respectively. Further, to support activities under this disposal group, a total of 41.7 hectares (103 acres) within Borrow Area C would be required to supply geologic material. Thus, including the land requirement of the expanded and new facilities noted above, a total of 107 hectares (264 acres) would be developed under this disposal group. Closure of IDF-East and the RPPDF would require an additional 1.6 hectares (4 acres) of land to accommodate modified RCRA Subtitle C barriers, making a total land commitment of 108 hectares (268 acres).

#### 4.3.1.2.1.2 Disposal Groups 2 and 3

Although the time required for construction and operations would vary, the land requirements for IDF-East and the RPPDF under Disposal Groups 2 and 3 would be the same. Under each disposal group, IDF-East would require 11.3 hectares (28 acres) of land, while the RPPDF would need 228 hectares (564 acres). The land required within Borrow Area C to supply geologic material would be 159 hectares (392 acres). Thus, including the new facilities noted above, the total land requirement at Hanford for each disposal group would be 401 hectares (991 acres). Placement of the modified RCRA Subtitle C barriers over IDF-East and the RPPDF would require an additional 7.7 hectares (19 acres) of land, making a total land commitment of approximately 409 hectares (1,010 acres).

### 4.3.1.2.2 Visual Resources

As processing and storage facilities would be placed within the 200-West Area, an area that is already highly developed, and would occupy a relatively small area (2.7 hectares [6.6 acres]), impacts on visual resources from their construction and operations would be minimal. The BLM Visual Resource Management Class IV rating of the 200-West Area would not change under this alternative. The visual impacts of constructing the IDF-East and the RPPDF, as well as developing Borrow Area C, are addressed below for each disposal group.

Ongoing construction, consolidation, operations, maintenance, and deactivation of facilities on Rattlesnake and Gable Mountains would also occur under this alternative. Rattlesnake and Gable Mountains are within the viewshed of Borrow Area C and the 200 Areas, respectively, and ongoing activities would result in short-term adverse impacts on land and visual resources, including the development or use of previously undisturbed land. Visual impacts of existing structures and maintenance activities on Rattlesnake and Gable Mountains and land use for construction of new facilities are considered a short-term impact because, after a facility's mission has been completed, it would be deactivated and demolished, and vegetation and habitat would be restored to a natural state. However, the eventual consolidation or removal of unnecessary facilities/infrastructure on Rattlesnake and Gable Mountains would tend to improve the visual profile of the features, allow restoration of natural habitat, and enhance tribal religious and cultural experiences.

#### 4.3.1.2.2.1 Disposal Group 1

As noted above (see Section 4.3.1.2.1.1), construction of the IDF and RPPDF would result in the conversion of 62.3 hectares (154 acres) to industrial use. During construction and operations, these changes would add noticeably to the overall industrial nature of the 200 Areas and would be visible from Rattlesnake Mountain, Gable Mountain, and Gable Butte. The viewscape from these areas is important to American Indians with cultural ties to Hanford (see Chapter 3, Section 3.2.8). Although there would be an overall increase in the industrial appearance of the 200 Areas, the BLM Visual Resource Management Class IV rating would not change.

Closure of the disposal facilities would involve constructing modified RCRA Subtitle C barriers over IDF-East and the RPPDF. These barriers would be slightly larger than the disposal sites and would be 2.7 meters (9 feet) high. The areas would be revegetated with native grasses, thus improving their postclosure appearance.

To supply geologic material under this disposal group, 41.7 hectares (103 acres) from Borrow Area C would be excavated. This excavation would change the existing visual setting of Borrow Area C from a predominantly natural setting with limited disturbance to one in which mining activities dominate. This impact would last for the duration of the project. It would also change the BLM visual resource management rating from Class II to Class IV. Excavation of the borrow area would change the viewscape from State Route 240 and Rattlesnake Mountain, an area important to American Indians with cultural ties to Hanford. Following closure, the area would be recontoured and revegetated with native plants to more closely resemble the predisturbance setting.

#### 4.3.1.2.2.2 Disposal Groups 2 and 3

Disposal Groups 2 and 3 would require 240 hectares (592 acres) of undeveloped land for construction of IDF-East and the RPPDF. These changes would noticeably add to the overall industrial nature of the 200 Areas and would be visible from Rattlesnake Mountain, Gable Mountain, and Gable Butte. This alteration in the viewscape would last for the operational period of the disposal sites. Although there would be an overall increase in the industrial appearance of the 200 Areas, the BLM Visual Resource Management Class IV rating would not change.

Closure of IDF-East and the RPPDF would involve constructing modified RCRA Subtitle C barriers over both facilities. These barriers would be slightly larger than the disposal sites and would be about 2.7 meters (9 feet) high. The areas would be revegetated with native grasses, thus improving their postclosure appearance.

To supply geologic material under Disposal Groups 2 and 3, a total of 159 hectares (392 acres) within Borrow Area C would need to be excavated. This excavation would change the existing visual setting of Borrow Area C from a predominantly natural setting with limited disturbance to one in which mining activities would dominate for the duration of the project. It would also change the BLM visual resource management rating from Class II to Class IV. Excavation of the borrow area would be readily visible from State Route 240 and Rattlesnake Mountain, an area important to American Indians with cultural ties to Hanford. Following closure, the area would be recontoured and revegetated with native vegetation to more closely resemble the pre-disturbance setting.

### 4.3.1.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

#### 4.3.1.3.1 Land Use

Under this Waste Management alternative, the same expanded or new facilities would be constructed as under Alternative 2 (see Section 4.3.1.2.1). These facilities would be built within the same locations in the 200-West Area and would require the same land (i.e., 2.7 hectares [6.6 acres]). Thus, because all work would take place within the area designated as Industrial-Exclusive, there would be no change in land use under this alternative.

In addition, under this Waste Management alternative, the RPPDF would be constructed between the 200-East and 200-West Areas; however, separate IDFs would be constructed within each area. Land requirements for the IDFs, RPPDF, and Borrow Area C are addressed below. Use of the 200 Areas and Borrow Area C, which are designated as Industrial-Exclusive and Conservation (Mining), respectively, would be consistent with the current site land use plan.

#### 4.3.1.3.1.1 Disposal Group 1

Disposal Group 1 would require construction of a 29.9-hectare (74-acre) IDF-East and a 2.4-hectare (6-acre) IDF-West. Additionally, a 29.5-hectare (73-acre) RPPDF would be built between the 200-East and 200-West Areas. To supply the required volume of geologic material needed under this alternative, it would be necessary to excavate 36.8 hectares (91 acres) from Borrow Area C. Thus, the total land requirement at Hanford for Disposal Group 1 under this alternative, including the processing and storage facilities noted above, would be about 102 hectares (251 acres). Final closure of the disposal facilities under modified RCRA Subtitle C barriers would require an additional 15 hectares (37 acres) of land, making a total land commitment of approximately 117 hectares (288 acres).

#### 4.3.1.3.1.2 Disposal Groups 2 and 3

Although the operational periods would vary for Disposal Groups 2 and 3, the land requirement would be identical. Thus, 9.3 hectares (23 acres) would be needed for IDF-East, 2.4 hectares (6 acres) for IDF-West, and 228 hectares (564 acres) for the RPPDF. In addition, excavation of 157 hectares (388 acres) of Borrow Area C would be needed to supply the required geologic material. Thus, including the land requirement of the expanded and new facilities noted above, a total of 400 hectares (988 acres) of land would be required for either of these disposal groups. Final closure of the disposal facilities under modified RCRA Subtitle C barriers would require an additional 12.5 hectares (31 acres) of land, making a total land commitment of approximately 413 hectares (1,020 acres).

### 4.3.1.3.2 Visual Resources

Impacts on the visual environment of construction and operations of the T Plant expansion; two WRAP expansions—a CH-Mixed TRU/TRU waste facility at the CWC and an RH-Mixed TRU/TRU waste facility at WRAP; and the new CWC storage facility would be similar to those described under Alternative 2 (see Section 4.3.1.2.2). As under Alternative 2, the RPPDF would be constructed between the 200-East and 200-West Areas; however, separate IDFs would be constructed within these areas. The visual impacts of constructing the IDFs and the RPPDF and of developing Borrow Area C under this alternative are addressed below for each disposal group.

Ongoing construction, consolidation, operations, maintenance, and deactivation of new or existing facilities on Rattlesnake and Gable Mountains would also occur under this alternative. These activities would have the same effects on visual resources as previously described in Section 4.3.1.2.2.

#### 4.3.1.3.2.1 Disposal Group 1

Although this disposal group includes an IDF in both the 200-East Area and 200-West Area, the total land area disturbed is nearly identical to the area disturbed under Alternative 2. Additionally, the area required within Borrow Area C for geologic material would be similar to that required under Alternative 2. Thus, although the placement of IDF-West on 2.4 hectares (6 acres) of undeveloped land would minimally add to the total visual impact, the overall impacts would be similar to those described for Disposal Group 1 under Alternative 2 (see Section 4.3.1.2.2.1).

#### 4.3.1.3.2.2 Disposal Groups 2 and 3

Under Disposal Groups 2 and 3 of Waste Management Alternative 3, the land required for IDF-East, IDF-West, the RPPDF, and Borrow Area C would be nearly the same as that needed under Alternative 2. Thus, although the placement of the IDF-West on 2.4 hectares (6 acres) of undeveloped land would minimally add to the total visual impact, the overall impacts would be similar to those described for Disposal Groups 2 and 3 under Alternative 2 (see Section 4.3.1.2.2.2).

### 4.3.2 Infrastructure

This subsection presents the potential impacts of the Waste Management alternatives and associated disposal groups on key utility infrastructure resources, including projected activity demands for electricity, fuel, and water. Total and peak annual utility infrastructure requirements were projected for each alternative and disposal group, as well as for applicable component project phases (i.e., construction, operations, deactivation, and closure). In general, Hanford waste treatment and storage activities and commensurate utility requirements would be identical under Alternatives 2 and 3. For the three disposal groups under each action alternative, utility infrastructure demands would vary primarily in direct relation to the size, number, and required lifespan of the disposal facilities (i.e., the IDF[s] and the RPPDF) constructed, operated, and ultimately closed under each disposal scenario.

The key underlying assumptions used to project utility infrastructure demands under each of the Waste Management alternatives and disposal groups were similar to those described in Section 4.1.2 under the Tank Closure alternatives. For example, it was assumed for analysis purposes that liquid fuels are not capacity-limiting resources because supplies would be replenished from offsite sources to support each alternative and would be provided at the point of use on an as-needed basis.

Hanford's site utility infrastructure is described in Chapter 3, Section 3.2.2, and INL's site utility infrastructure is described in Section 3.3.2. Table 4–134 summarizes the projected utility infrastructure resource requirements under the Waste Management alternatives and associated disposal groups. Projected demands on key utility infrastructure resources and the impacts on the respective utility systems from implementation of each of the alternatives and disposal groups are further discussed in the following sections.

**Table 4–134. Waste Management Alternatives – Summary of Utility Infrastructure Requirements**

| Alternatives | Activity Phase | Electricity (M megawatt-hours) | Diesel Fuel[a] (M liters) | Gasoline (M liters) | Water (M liters) |
|---|---|---|---|---|---|
| Alternative 1: No Action | Operations | 0.0056 | 4.22 | 0.035 | 10.6 |
| | Deactivation | 0.0 | 9.65 | 1.20 | 25.1 |
| | **Total[b]** | **0.0056** | **13.9** | **1.23** | **35.7** |
| | **Peak (Year)** | **0.00019 (2007–2035)** | **3.46 (2009)** | **0.012 (2036–2135)** | **25.5 (2009)** |
| Alternatives 2 and 3: Treatment and Storage[c] | Construction | 0.045 | 10.7 | 5.20 | 61.6 |
| | Operations | 0.50 | 31.1 | 3.24 | 364 |
| | Deactivation | 0.0068 | 0.28 | 0.044 | 4.98 |
| | **Total[b]** | **0.55** | **42.0** | **8.48** | **430** |
| | **Peak (Year)** | **0.018 (2011–2012)** | **2.60 (2011–2012)** | **1.01 (2011–2012)** | **23.9 (2011–2012)** |
| Alternative 2: Disposal Group 1[d] | Construction | 0.0 | 26.1 | 0.13 | 191 |
| | Operations | 0.0085 | 91.8 | 2.08 | 2,290 |
| | Closure | 0.0 | 97.5 | 11.0 | 134 |
| | **Total[b]** | **0.0085** | **215** | **13.2** | **2,620** |
| | **Peak (Year)** | **0.00019 (2007–2050)** | **39.0 (2051–2052)** | **3.68 (2051–2052)** | **67.0 (2051–2052)** |

**Table 4–134. Waste Management Alternatives – Summary of Utility Infrastructure Requirements *(continued)***

| Alternatives | Activity Phase | Electricity (M megawatt-hours) | Diesel Fuel[a] (M liters) | Gasoline (M liters) | Water (M liters) |
|---|---|---|---|---|---|
| Alternative 2: Disposal Group 2[d] | Construction | 0.0 | 101 | 0.49 | 736 |
| | Operations | 0.0085 | 940 | 31.5 | 19,600 |
| | Closure | 0.0 | 377 | 42.6 | 517 |
| | **Total[b]** | **0.0085** | **1,420** | **74.6** | **20,800** |
| | **Peak (Year)** | **0.00019 (2007–2050)** | **151 (2101–2102)** | **14.2 (2101–2102)** | **259 (2101–2102)** |
| Alternative 2: Disposal Group 3[d] | Construction | 0.0 | 101 | 0.49 | 736 |
| | Operations | 0.0085 | 1,700 | 57.4 | 35,500 |
| | Closure | 0.0 | 377 | 42.6 | 517 |
| | **Total[b]** | **0.0085** | **2,180** | **100** | **36,800** |
| | **Peak (Year)** | **0.00019 (2007–2050)** | **151 (2166–2167)** | **14.2 (2166–2167)** | **259 (2166–2167)** |
| Alternative 3: Disposal Group 1[d] | Construction | 0.0 | 26.0 | 0.13 | 190 |
| | Operations | 0.0085 | 91.4 | 2.07 | 2,280 |
| | Closure | 0.0 | 97.1 | 11.0 | 133 |
| | **Total[b]** | **0.0085** | **215** | **13.2** | **2,610** |
| | **Peak (Year)** | **0.00019 (2007–2050)** | **38.9 (2051–2052)** | **3.66 (2051–2052)** | **66.7 (2051–2052)** |
| Alternative 3: Disposal Group 2[d] | Construction | 0.0 | 101 | 0.49 | 737 |
| | Operations | 0.0085 | 937 | 31.5 | 19,500 |
| | Closure | 0.0 | 377 | 42.6 | 518 |
| | **Total[b]** | **0.0085** | **1,410** | **74.6** | **20,700** |
| | **Peak (Year)** | **0.00019 (2007–2050)** | **149 (2101–2102)** | **14.1 (2101–2102)** | **256 (2101–2102)** |
| Alternative 3: Disposal Group 3[d] | Construction | 0.0 | 101 | 0.49 | 737 |
| | Operations | 0.0085 | 1,700 | 57.3 | 35,300 |
| | Closure | 0.0 | 377 | 42.6 | 518 |
| | **Total[b]** | **0.0085** | **2,170** | **100** | **36,500** |
| | **Peak (Year)** | **0.00019 (2007–2050)** | **149 (2166–2167)** | **14.1 (2166–2167)** | **256 (2166–2167)** |

[a] Assumed to be inclusive of all No. 2 diesel fuel, including road diesel and heating fuel oil.

[b] Totals may not equal the sum of the contributions due to rounding.

[c] The storage and treatment components of each alternative reflect the requirements to support ongoing storage and treatment of onsite and offsite waste through facility deactivation.

[d] Disposal Groups 1 through 3 encompass waste disposal facility construction, operations, and closure activities in support of ongoing waste management activities in addition to those related to FFTF disposition and select Tank Closure alternatives as follows: (1) Disposal Group 1 supports Tank Closure Alternatives 2B, 3A, 3B, 3C, 4, 5, and 6C; (2) Disposal Group 2 supports Tank Closure Alternatives 2A and 6B; and (3) Disposal Group 3 supports Tank Closure Alternative 6A only.

**Note:** To convert liters to gallons, multiply by 0.26417. Values presented in the table have been rounded to no more than three significant digits, where appropriate.

**Key:** FFTF=Fast Flux Test Facility; M=million.

**Source:** SAIC 2010c.

#### 4.3.2.1 Alternative 1: No Action

##### 4.3.2.1.1 Electricity, Fuel, and Water

Ongoing waste storage, treatment, and disposal activities under Waste Management Alternative 1 would continue to represent a relatively small fraction of total Hanford utility infrastructure demands through 2035.

Under Waste Management Alternative 1, annual electrical energy demand to support ongoing waste management activities would remain relatively constant at 0.00019 million megawatt-hours through 2035 to specifically support ongoing waste disposal in trenches 31 and 34 in LLBG 218-W-5 (see Table 4–134). This demand is negligible compared with the 1.74-million-megawatt-hour annual capacity (199-megawatts load capacity) of the Hanford electric power transmission system and would also be a very small fraction (about 0.1 percent) of the 0.17 million megawatt-hours of electricity currently used annually at Hanford.

Peak annual diesel fuel consumption of 3.46 million liters (0.91 million gallons) would occur in 2009 as a result of the ongoing operations of the LLBGs coinciding with deactivation of IDF-East. Gasoline consumption associated with mobile equipment operations during the 100-year postclosure care period for the LLBGs would not peak until 2036 and is projected to remain constant at 0.012 million liters (0.003 million gallons) annually. This ongoing fuel demand would be a small fraction (about 0.3 percent) of the 4.3 million liters (1.1 million gallons) of liquid fuels currently used annually at Hanford. Water requirements would also peak in 2009 at 25.5 million liters (6.74 million gallons). This projected peak water demand would be about 0.1 percent of 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 3.1 percent of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford.

#### 4.3.2.2 Alternative 2: Disposal in IDF, 200-East Area Only

##### 4.3.2.2.1 Electricity, Fuel, and Water

In support of ongoing Hanford waste treatment and storage activities under Waste Management Alternative 2, electrical energy requirements would peak in the 2011–2012 timeframe due to construction of the T Plant expansion; two WRAP expansions—a CH-Mixed TRU/TRU waste facility at the CWC and an RH-Mixed TRU/TRU waste facility at WRAP; and the new CWC storage facility in the 200-West Area. It was assumed that construction of these facility additions would utilize existing utility tie-ins to the extent possible, although construction-related electricity demands could also be met via fuel-fired generators. Subsequent facility operations would extend to the year 2050 using existing utility systems. Nevertheless, the peak annual electrical energy demand in 2011–2012 of 0.018 million megawatt-hours (approximating an electric load of about 2.05 megawatts) would be about 1.0 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system (see Table 4–134).

Peak liquid fuel consumption under Alternative 2 would total about 3.61 million liters (0.95 million gallons) in the 2011–2012 timeframe to support expanded treatment and storage facility construction.

Peak water demands would also occur in the 2011–2012 timeframe, driven by water use for facility construction. The projected peak water demand of 23.9 million liters (6.31 million gallons) would be about 0.1 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 2.9 percent of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford.

#### 4.3.2.2.1.1 Disposal Group 1

Electrical energy requirements to support disposal facility construction, operations, and closure would be relatively minimal overall (see Table 4–134). For facility construction, it was assumed that any electric power required would be produced via fuel-fired generators. Under Waste Management Alternative 2, Disposal Group 1, activities, annual electrical energy demands are expected to remain relatively constant at 0.00019 million megawatt-hours through 2050 and limited to demands to support continued disposal operations in LLBG 218-W-5, as previously discussed under Alternative 1 (see Section 4.3.2.1.1). Neither operations nor eventual closure of IDF-East or the RPPDF between the 200-East and 200-West Areas is projected to require any electric power from the Hanford electric power distribution system because any demands would be met via fuel-fired generators.

Peak annual liquid fuel consumption for Disposal Group 1 activities would total about 42.7 million liters (11.3 million gallons) in the 2051–2052 timeframe, primarily associated with mobile equipment operations to effect landfill closure of IDF-East and the RPPDF using modified RCRA Subtitle C barriers. Similar to liquid fuel requirements, peak water demands would also occur in 2051–2052, driven by water use for dust control and soil compaction associated with IDF-East and RPPDF closure activities. The projected peak water demand of 67.0 million liters (17.7 million gallons) would be about 0.4 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 8.2 percent of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford.

#### 4.3.2.2.1.2 Disposal Group 2

Under Disposal Group 2, total and peak electrical energy requirements would be the same as those discussed under Alternative 2, Disposal Group 1 (see Section 4.3.2.2.1.1 above).

Total and peak liquid fuel consumption would be greater under this disposal group than under Disposal Group 1 due to the much larger RPPDF that would be constructed and the longer period of disposal operations (until 2100). Peak annual liquid fuel consumption for Disposal Group 2 activities would be about 165 million liters (43.6 million gallons) in the 2101–2102 timeframe, driven by IDF-East and RPPDF closure activities.

As for liquid fuels, peak water demands would also occur in the 2101–2102 timeframe associated with disposal facility closure activities. The projected peak annual water demand of 259 million liters (68.4 million gallons) would be about 1.4 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 32 percent of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford.

#### 4.3.2.2.1.3 Disposal Group 3

Under Alternative 2, Disposal Group 3, total and peak electrical energy requirements would be the same as those discussed in Section 4.3.2.2.1.1. Otherwise, activities under this Alternative 2 disposal group would have the highest total utility resource requirements due to the longer operational timeframe (until 2165) associated with IDF-East and the RPPDF. Still, the magnitude of the peak annual demands for liquid fuels and water is projected to be the same as that discussed under Alternative 2, Disposal Group 2 (see Section 4.3.2.2.1.2 and Table 4–134), but would occur later in time. Specifically, peak annual liquid fuel consumption for Disposal Group 3 activities would be about 165 million liters (43.6 million gallons) in the 2166–2167 timeframe, driven by IDF-East and RPPDF closure activities. The peak annual water demand of 259 million liters (68.4 million gallons) would also occur in the 2166–2167 timeframe associated with disposal facility closure activities.

#### 4.3.2.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

##### 4.3.2.3.1 Electricity, Fuel, and Water

Activities and associated utility infrastructure demands to support ongoing Hanford waste treatment and storage activities and proposed facility expansions under Waste Management Alternative 3 would be the same as those previously described in Section 4.3.2.2.1 under Alternative 2. While the Alternative 2 disposal groups assume construction of a single IDF in the 200-East Area, two IDFs would be constructed (one in the 200-East Area and the other in the 200-West Area), operated, and ultimately closed under all Alternative 3 disposal groups. Nevertheless, RPPDF considerations and related utility impacts would generally be identical to those under the Alternative 2 disposal scenarios.

###### 4.3.2.3.1.1 Disposal Group 1

Electrical energy requirements to support disposal facility construction, operations, and closure would be relatively minimal overall (see Table 4–134); total and peak electrical requirements under Alternative 3, Disposal Group 1, would be the same as those previously described under Alternative 2, Disposal Group 1 (see Section 4.3.2.2.1.1).

Peak annual liquid fuel consumption under Alternative 3, Disposal Group 1, activities would total about 42.6 million liters (11.3 million gallons) in the 2051–2052 timeframe, primarily associated with mobile equipment operations to effect landfill closure of the two IDFs and the RPPDF using modified RCRA Subtitle C barriers. Peak water demands would also occur in 2051–2052, driven by water use for dust control and soil compaction associated with IDF and RPPDF closure activities. The projected peak water demand of 66.7 million liters (17.6 million gallons) would be about 0.4 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 8.2 percent of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford.

###### 4.3.2.3.1.2 Disposal Group 2

Electrical energy requirements to support disposal facility construction, operations, and closure would be relatively minimal overall (see Table 4–134); total and peak electrical requirements under Alternative 3, Disposal Group 2, would be the same as those previously described under Alternative 2, Disposal Group 1 (see Section 4.3.2.2.1.1).

Alternative 3, Disposal Group 2, would entail peak annual liquid fuel consumption of approximately 163 million liters (43.0 million gallons) in the 2101–2102 timeframe, based on the projection that the larger of the two IDFs, IDF-East, and the RPPDF would be closed within that timeframe. Disposal facility closure is also projected to result in peak water demands in the same timeframe. The projected peak annual water demand of 256 million liters (67.6 million gallons) would be about 1.4 percent of 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 31 percent of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford.

###### 4.3.2.3.1.3 Disposal Group 3

Electrical energy requirements to support disposal facility construction, operations, and closure would be relatively minimal overall (see Table 4–134); total and peak electrical requirements under Alternative 3, Disposal Group 3, would be the same as those previously described under Alternative 2, Disposal Group 1 (see Section 4.3.2.2.1.1). Nonetheless, activities under this Alternative 3 disposal group would have the highest total utility resource requirements due to the longer operational timeframe (until 2165) associated with the two IDFs and the RPPDF. However, the magnitude of the peak annual demands for

liquid fuels and water is projected to be the same as that discussed under Alternative 3, Disposal Group 2 (see Section 4.3.2.3.1.2); however, peak demands would be shifted to the 2166–2167 timeframe (see Table 4–134).

## 4.3.3 Noise and Vibration

Facility construction, operations, decommissioning, deactivation, and closure activities, as applicable to each alternative, would result in minor noise impacts of employee vehicles, trucks, construction equipment, generators, and other equipment compared with the Tank Closure alternatives discussed in Section 4.1.3. The offsite noise levels from activities in the 200 and 400 Areas would be negligible due to the distance to the Hanford boundary. Use of heavy diesel equipment for construction and closure activities under most of the alternatives is expected to cause the highest noise levels. For example, if 488 items of construction equipment were operating at the RPPDF during its construction with a sound pressure level of 88 dBA at 15 meters (50 feet), the contribution to the sound level at the nearest site boundary would be 21 dBA (SAIC 2010c). During a normal daytime shift, the estimated maximum sound level at the site boundary from construction equipment operation would be well below the Washington State standard daytime maximum noise level limit of 60 dBA for industrial sources impacting residential receptors (WAC 173-60). Noise levels from deactivation, construction, operations, and closure activities are expected to be less than those from this RPPDF construction activity.

Some disturbance of wildlife near the 200 Areas could occur as a result of construction-type noise during construction, operations, deactivation, and closure activities, as applicable to each alternative. Mitigation of impacts on threatened and endangered species is discussed in Section 4.3.7.

The number of employee vehicles and trucks moving materials during various phases of waste management activities would vary over the duration of the project and by alternative. The increase in the number of employee vehicle and truck trips is discussed below under each alternative.

Activities at Hanford associated with Waste Management alternatives that would involve excavation, earthmoving, transporting fill material, and other vehicle traffic through Hanford could result in ground vibration that could affect operations of LIGO. Most of the activities identified to have impacts on this facility would be activities requiring the use of heavy vehicles or large construction equipment. It is expected that blasting would also have an impact on this facility if it is required for mining. Although DOE would coordinate vibration-producing activities with LIGO, the impacts of this type of activity under the alternatives are expected to result in some interference with the operations of this facility.

### 4.3.3.1 Alternative 1: No Action

The increase in the number of employee vehicle and truck trips under Waste Management Alternative 1 is expected to result in an increase in traffic noise levels of less than 1 dBA along routes to the site. This increase would occur primarily during the peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. The highest number of employee trips is expected to occur in year 2009 due to IDF-East deactivation (SAIC 2010c). The increase in employee and truck traffic from the discussion of local traffic (see Section 4.3.9) was compared to the existing average traffic volume (see Chapter 3, Section 3.2.9.4). For the purpose of comparison between the alternatives, increases in traffic noise levels can be estimated from the ratios of the projected traffic volumes to the existing traffic volume (see Appendix F, Section F.3).

### 4.3.3.2 Alternative 2: Disposal in IDF, 200-East Area Only

The increase in the number of employee vehicle and truck trips under Waste Management Alternative 2 at Hanford is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during the peak traffic hours. The highest number of employee

trips is expected to occur during the period from 2019–2050 due to WRAP operations. Under Disposal Groups 1 through 3, activities would result in an increase of less than 1 dBA in traffic noise levels along routes to the site. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.3.3.1). The highest number of employee trips is expected to occur in various years due to closure of the RPPDF and IDF-East.

#### 4.3.3.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

The increase in the number of employee vehicle and truck trips under Waste Management Alternative 3 at Hanford is expected to result in an increase of less than 1 dBA in traffic noise levels along routes to the site. This increase would occur primarily during the peak traffic hours. The highest number of employee trips is expected to occur from 2019 through 2050 from WRAP operations (SAIC 2010c). Under Disposal Groups 1 through 3, activities would result in an increase of less than 2 dBA in traffic noise levels along routes to the site. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion is similar to that previously described under Alternative 1 (see Section 4.3.3.1). The higher numbers of employee trips are expected to occur in various years due to RPPDF closure under Disposal Groups 2 and 3 and closure of IDF-East and the RPPDF under Disposal Group 1.

### 4.3.4 Air Quality

Activities under the various Waste Management alternatives would result in some air quality impacts due to air pollutant emissions from employee vehicles, trucks, and construction equipment and, as applicable under some alternatives, heating equipment, generators, and process equipment. Criteria pollutant concentrations for the activities under each alternative were modeled, and the year with peak concentrations for each alternative, pollutant, and averaging time was identified (see Appendix G). These concentrations are presented in Table 4–135, where they are compared with the ambient standards. The maximum concentrations that would result from these activities under each alternative would be below the ambient standards, except for the annual standard for concentrations of $PM_{10}$ under Disposal Groups 2 and 3 and the 24-hour standard under Alternatives 1, 2, and 3, Disposal Groups 1, 2, and 3. Standards could be exceeded similarly for $PM_{2.5}$ under all alternatives, the 1-hour nitrogen dioxide concentrations under all alternatives, the 1-hour carbon monoxide concentration under Alternatives 2 and 3, and the 8-hour carbon monoxide and 1-hour sulfur dioxide concentrations under Alternatives 2 and 3 for Disposal Groups 2 and 3. The peak period identified under each alternative and the primary contributing activities are discussed for each alternative below. Maximum air quality impacts are expected to occur along State Route 240 or along or near the Hanford boundary. The concentration estimates for PM are high as a result of the high estimated emissions. PM concentrations would be reduced by applying appropriate dust control measures (see Chapter 7, Section 7.1).

Construction activities considered in estimating PM emissions included general construction equipment activity, windblown particulates from disturbed areas, resuspension of road dust, and fuel combustion in construction equipment.

As described in Section 4.1.4, the emissions calculations resulted in a substantial overestimate of $PM_{10}$ and $PM_{2.5}$ emissions. A refined analysis of emissions, based on more-detailed engineering of the construction activities and application of appropriate control technologies, is expected to result in substantially lower estimates of emissions and ambient concentrations from major construction activities under any of the alternatives.

**Table 4–135. Waste Management Alternatives – Maximum Incremental Criteria Pollutant Concentrations at the Hanford Site**

| Pollutant and Averaging Period | Standard[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Alternative 2 | | | | Alternative 3 | | | |
| | | Alternative 1 | T&S | DG1 | DG2 | DG3 | T&S | DG1 | DG2 | DG3 |
| **Carbon Monoxide** | | | | | | | | | | |
| 8-hour | 10,000[b] | 72.6 | 2,240 | 7,880 | **41,200** | **41,200** | 2,240 | 8,030 | **41,000** | **41,000** |
| 1-hour | 40,000[b] | 462 | 12,200 | **49,800** | **257,000** | **257,000** | 12,200 | **50,300** | **256,000** | **256,000** |
| **Nitrogen Dioxide** | | | | | | | | | | |
| Annual | 100[b] | 1.35 | 3.85 | 19.3 | 88.9 | 88.9 | 3.85 | 19.4 | 88.4 | 88.4 |
| 1-hour | 188[c] | **2,020** | **6,940** | **34,600** | **179,000** | **179,000** | **6,940** | **35,000** | **178,000** | **178,000** |
| **$PM_{10}$[d]** | | | | | | | | | | |
| Annual | 50[e] | 4.86 | 4.36 | 27.2 | **124** | **124** | 5.08 | 27.3 | **124** | **124** |
| 24-hour | 150[b] | **507** | **717** | **3,360** | **17,200** | **17,200** | **717** | **3,420** | **17,300** | **17,300** |
| **$PM_{2.5}$[d]** | | | | | | | | | | |
| Annual | 15[d] | 4.86 | 4.36 | **27.2** | **124** | **124** | 5.08 | **27.3** | **124** | **124** |
| 24-hour | 35[d] | **507** | **717** | **3,360** | **17,200** | **17,200** | **717** | **3,420** | **17,300** | **17,300** |
| **Sulfur Dioxide** | | | | | | | | | | |
| Annual | 50[e] | 0.000482 | 0.00915 | 0.0382 | 0.176 | 0.176 | 0.00915 | 0.0384 | 0.175 | 0.175 |
| 24-hour | 260[e] | 0.0494 | 1.29 | 4.70 | 24.5 | 24.5 | 1.29 | 4.78 | 24.4 | 24.4 |
| 3-hour | 1,300[b] | 0.26 | 6.36 | 23.7 | 120 | 120 | 6.36 | 24.0 | 120 | 120 |
| 1-hour | 197[c] | 0.723 | 16.5 | 68.4 | **353** | **353** | 16.5 | 69.2 | **352** | **352** |

[a] The more stringent of the Federal and Washington State standards is presented if both exist for the averaging period. The NAAQS (40 CFR 50), other than those for ozone, particulate matter, lead, and those based on annual averages, would not be exceeded more than once per year. The 24-hour $PM_{10}$ standard is attained when the expected number of days with a 24-hour average concentration above the standard is less than or equal to 1. The annual arithmetic mean $PM_{10}$ standard is attained when the expected annual arithmetic mean concentration is less than or equal to the standard. The annual $PM_{2.5}$ standard is met when the 3-year average of the annual means is less than or equal to the standard. The 24-hour $PM_{2.5}$ standard is met when the 3-year average of the 98th percentile 24-hour averages is less than or equal to the standard. The 1-hour nitrogen dioxide standard is met when the 3-year average 98th percentile of the daily maximum 1-hour average does not exceed the standard value.

[b] Federal and Washington State standard.

[c] Federal standard.

[d] The Federal standards for $PM_{2.5}$ are 15 micrograms per cubic meter annual average and 35 micrograms per cubic meter 24-hour average. No specific data for $PM_{2.5}$ were available, but for analysis purposes, concentrations were assumed to be the same as $PM_{10}$.

[e] Washington State standard.

**Note:** NAAQS also includes standards for lead and ozone. No sources of lead emissions have been identified for the alternatives evaluated. Washington State also has ambient standards for fluorides. Concentrations in **bold** text indicate potential exceedance of the standard.

**Key:** DG=Disposal Group; NAAQS=National Ambient Air Quality Standards; $PM_n$=particulate matter with an aerodynamic diameter less than or equal to *n* micrometers; T&S=treatment and storage.

**Source:** Appendix G, Section G.3.

The sulfur dioxide emission factor used for fuel-burning sources was based on equipment burning a distillate fuel with a sulfur content of about 0.0015 percent (15 ppm), which is being phased in beginning in 2007. No adjustment was made for more-restrictive emission standards for nitrogen dioxide and PM, which were scheduled to be phased in beginning in 2007. In future years, pollutant emissions and impacts are expected to be smaller than estimated in this analysis, as better fuels, combustion technologies, emission controls, and alternative energy sources are developed.

The contributions to the total ambient concentrations from sources in the region and existing and reasonably anticipated sources at Hanford that are unrelated to waste management activities are expected to change over the period of the activities evaluated in this EIS and are addressed in the cumulative impacts section. The existing contributions of Hanford sources and regional monitored concentrations are discussed in Chapter 3, Section 3.2.4.

The Clean Air Act, as amended, requires Federal actions to conform to the host state's "state implementation plan" (see Appendix G, Section G.4). The final rule, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans," requires a conformity determination for certain-size projects in nonattainment areas. Hanford is within an area currently designated as in attainment for criteria air pollutants. Therefore, a conformity determination for these alternatives is not necessary to meet the requirements of the final rule (40 CFR 93, Subpart B).

Both carcinogenic and noncarcinogenic toxic pollutant concentrations were evaluated. The exposure of members of the public to airborne pollutants would result from process emissions released during operations and from equipment used during construction and operations. Selected air toxics were modeled because they represent toxic constituents associated with emissions from operation of gasoline- and diesel-fueled equipment. Maximum concentrations for each alternative and the Washington State acceptable source impact levels are presented in Table 4–136. These concentrations were below the acceptable source impact levels for all alternatives. The acceptable source impact levels are used by the state in the permitting process and represent concentrations that are sufficiently low to protect human health and safety from potential carcinogenic and other toxic effects (WAC 173-460).

**Table 4–136. Waste Management Alternatives – Maximum Incremental Toxic Chemical Concentrations at the Hanford Site**

| Pollutant | Averaging Period | Acceptable Source Impact Level[a] (micrograms per cubic meter) | Maximum Modeled Increment (micrograms per cubic meter) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Alternative 1 | Alternative 2 | | | | Alternative 3 | | | |
| | | | | T&S | DG1 | DG2 | DG3 | T&S | DG1 | DG2 | DG3 |
| Ammonia | 24-hour | 70.8 | 0.216 | 0.874 | 3.84 | 20.0 | 20.0 | 0.874 | 3.91 | 19.9 | 19.9 |
| Benzene | Annual | 0.0345 | 0.000288 | 0.00128 | 0.00701 | 0.0323 | 0.0323 | 0.00128 | 0.00704 | 0.0321 | 0.0321 |
| 1,3-Butadiene | Annual | 0.00588 | 0.000012 | 0.000067 | 0.000183 | 0.000842 | 0.000842 | 0.000067 | 0.000184 | 0.000837 | 0.000837 |
| Formaldehyde | Annual | 0.167 | 0.000362 | 0.00247 | 0.00603 | 0.0278 | 0.0278 | 0.00247 | 0.00606 | 0.0276 | 0.0276 |
| Mercury | 24-hour | 0.09 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Toluene | 24-hour | 5,000 | 0.0265 | 1.84 | 6.00 | 31.2 | 31.2 | 1.84 | 6.1 | 31.1 | 31.1 |
| Xylene | 24-hour | (b) | 0.00999 | 0.526 | 1.78 | 9.27 | 9.27 | 0.526 | 1.81 | 9.23 | 9.23 |

[a] WAC 173-460. Acceptable source impact levels were updated in this environmental impact statement.
[b] Not listed in WAC 173-460.
**Key:** DG=Disposal Group; T&S=treatment and storage.
**Source:** Appendix G, Section G.3.

For noninvolved workers at nearby facilities, the highest annual concentration of each toxic chemical was used to estimate the Hazard Quotient for each chemical, as described in Appendix G. The Hazard Quotients were summed to give the Hazard Index from noncarcinogenic chemicals associated with the alternative. A Hazard Index of less than 1 indicates that adverse health effects of non-cancer-causing agents are not expected. Hazard Indices for each alternative are summarized in Table 4–137. For carcinogens, the highest annual concentration was used to estimate the increased cancer risk from a chemical. Cancer risks from nonradioactive toxic pollutant emissions under each alternative are summarized in Table 4–138.

**Table 4–137. Waste Management Alternatives – Nonradioactive Airborne Toxic Chemical Hazard Index for the Nearest Noninvolved Worker at the Hanford Site**

| Chemical | Hazard Quotient | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Alternative 2 | | | | Alternative 3 | | | |
| | Alternative 1 | T&S | DG1 | DG2 | DG3 | T&S | DG1 | DG2 | DG3 |
| Ammonia | $1.17\times10^{-3}$ | $2.32\times10^{-3}$ | $1.81\times10^{-2}$ | $7.13\times10^{-2}$ | $7.13\times10^{-2}$ | $2.32\times10^{-3}$ | $1.78\times10^{-2}$ | $7.11\times10^{-2}$ | $7.11\times10^{-2}$ |
| Mercury | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Toluene | $3.03\times10^{-6}$ | $9.42\times10^{-5}$ | $4.63\times10^{-4}$ | $1.82\times10^{-3}$ | $1.82\times10^{-3}$ | $9.42\times10^{-5}$ | $4.52\times10^{-4}$ | $1.82\times10^{-3}$ | $1.82\times10^{-3}$ |
| Xylene | $7.13\times10^{-5}$ | $1.37\times10^{-3}$ | $6.95\times10^{-3}$ | $2.74\times10^{-2}$ | $2.74\times10^{-2}$ | $1.37\times10^{-3}$ | $6.80\times10^{-3}$ | $2.73\times10^{-2}$ | $2.73\times10^{-2}$ |
| **Hazard Index** | $1.24\times10^{-3}$ | $3.79\times10^{-3}$ | $2.55\times10^{-2}$ | $1.01\times10^{-1}$ | $1.01\times10^{-1}$ | $3.79\times10^{-3}$ | $2.50\times10^{-2}$ | $1.00\times10^{-1}$ | $1.00\times10^{-1}$ |

**Key:** DG=Disposal Group; T&S=treatment and storage.
**Source:** Appendix G, Section G.3.

**Table 4–138. Waste Management Alternatives – Nonradioactive Airborne Toxic Chemical Cancer Risk for the Nearest Noninvolved Worker at the Hanford Site**

| Chemical | | Alternative 2 | | | | Alternative 3 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Alternative 1 | T&S | DG1 | DG2 | DG3 | T&S | DG1 | DG2 | DG3 |
| Benzene | $1.26\times10^{-7}$ | $4.14\times10^{-7}$ | $2.93\times10^{-6}$ | $1.16\times10^{-5}$ | $1.16\times10^{-5}$ | $4.14\times10^{-7}$ | $2.87\times10^{-6}$ | $1.15\times10^{-5}$ | $1.15\times10^{-5}$ |
| 1,3-Butadiene | $1.98\times10^{-8}$ | $5.44\times10^{-8}$ | $3.16\times10^{-7}$ | $1.24\times10^{-6}$ | $1.24\times10^{-6}$ | $5.44\times10^{-8}$ | $3.10\times10^{-7}$ | $1.24\times10^{-6}$ | $1.24\times10^{-6}$ |
| Formaldehyde | $2.60\times10^{-7}$ | $8.83\times10^{-7}$ | $4.44\times10^{-6}$ | $1.75\times10^{-5}$ | $1.75\times10^{-5}$ | $8.83\times10^{-7}$ | $4.36\times10^{-6}$ | $1.75\times10^{-5}$ | $1.75\times10^{-5}$ |

**Key:** DG=Disposal Group; T&S=treatment and storage.
**Source:** Appendix G, Section G.3.

#### 4.3.4.1 Alternative 1: No Action

Criteria pollutant concentrations from activities under Waste Management Alternative 1 are presented in Table 4–135. The peak concentrations occur in 2009 for all criteria pollutants. The peak period concentration would result primarily from IDF deactivation activities. $PM_{10}$ would exceed the 24-hour standard in 2009. $PM_{2.5}$ concentrations would exceed the 24-hour emissions standard periodically from 2007 through 2035. Figure 4–30 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–136. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–137 and 4–138.

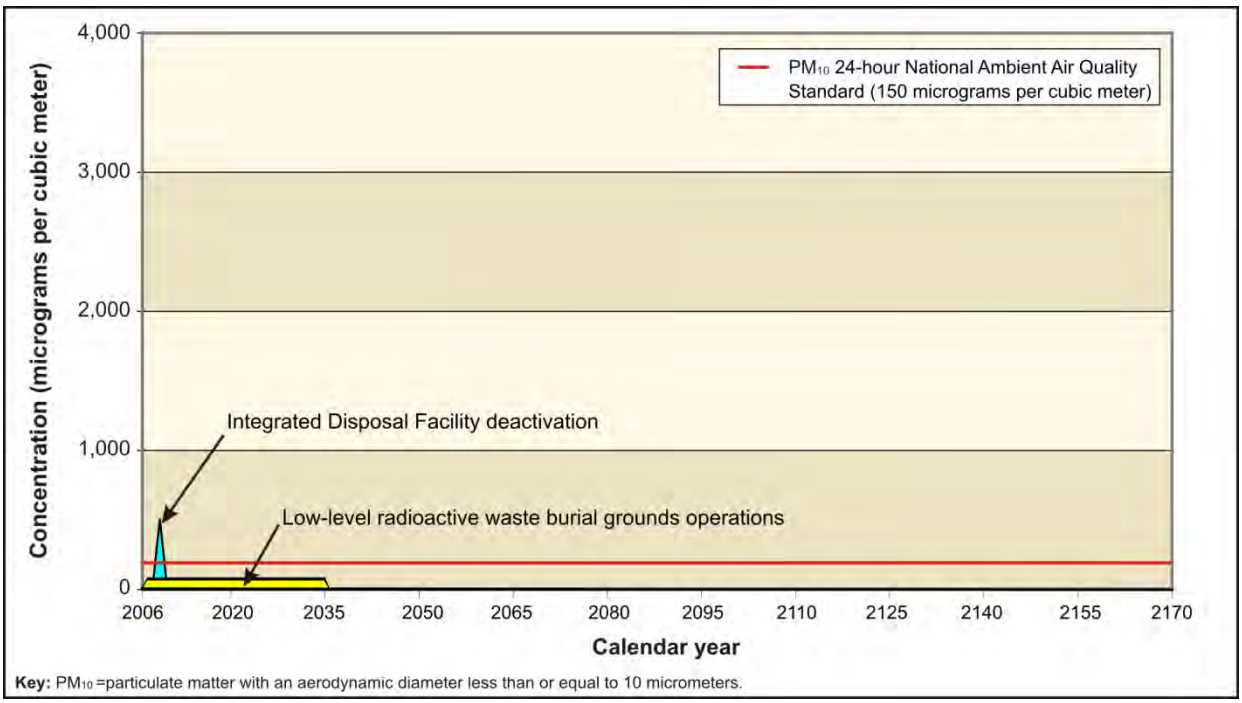


**Figure 4–30. Waste Management Alternative 1 $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.3.4.2 Alternative 2: Disposal in IDF, 200-East Area Only

Criteria pollutant concentrations from activities under Waste Management Alternative 2, including treatment and storage and activities related to the three disposal groups, are presented in Table 4–135. Peak concentrations of carbon monoxide and sulfur dioxide would occur from 2011 through 2012. Peak concentrations of nitrogen oxide would occur from 2013 through 2018. Peak concentrations of PM would occur from 2019 through 2050. These peak period concentrations under Waste Management Alternative 2 would result primarily from the WRAP CH-Mixed TRU/TRU waste facility at CWC and CWC storage facility construction (for carbon monoxide and sulfur dioxide); from T Plant complex operations (for nitrogen dioxide); and from CWC storage facility, WRAP CH-Mixed TRU/TRU waste facility, and WRAP RH-Mixed TRU/TRU waste facility operations (for PM). $PM_{10}$ concentrations would exceed the 24-hour ambient concentration standard from 2011 through 2050. $PM_{2.5}$ concentrations would exceed the 24-hour standard from 2011 through 2051. Figure 4–31 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities.

Under Disposal Group 1, the peak concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide would occur from 2051 through 2052. Peak concentrations of PM would occur from 2019 through 2021. These peak period concentrations under Waste Management Alternative 2, Disposal Group 1, would result primarily from IDF-East and RPPDF closure (for carbon monoxide, nitrogen dioxide, and sulfur dioxide) and from RPPDF construction and IDF-East operations (for PM). $PM_{10}$ and $PM_{2.5}$ concentrations would exceed the 24-hour ambient concentration standard from 2006 through 2052. Figure 4–32 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities.

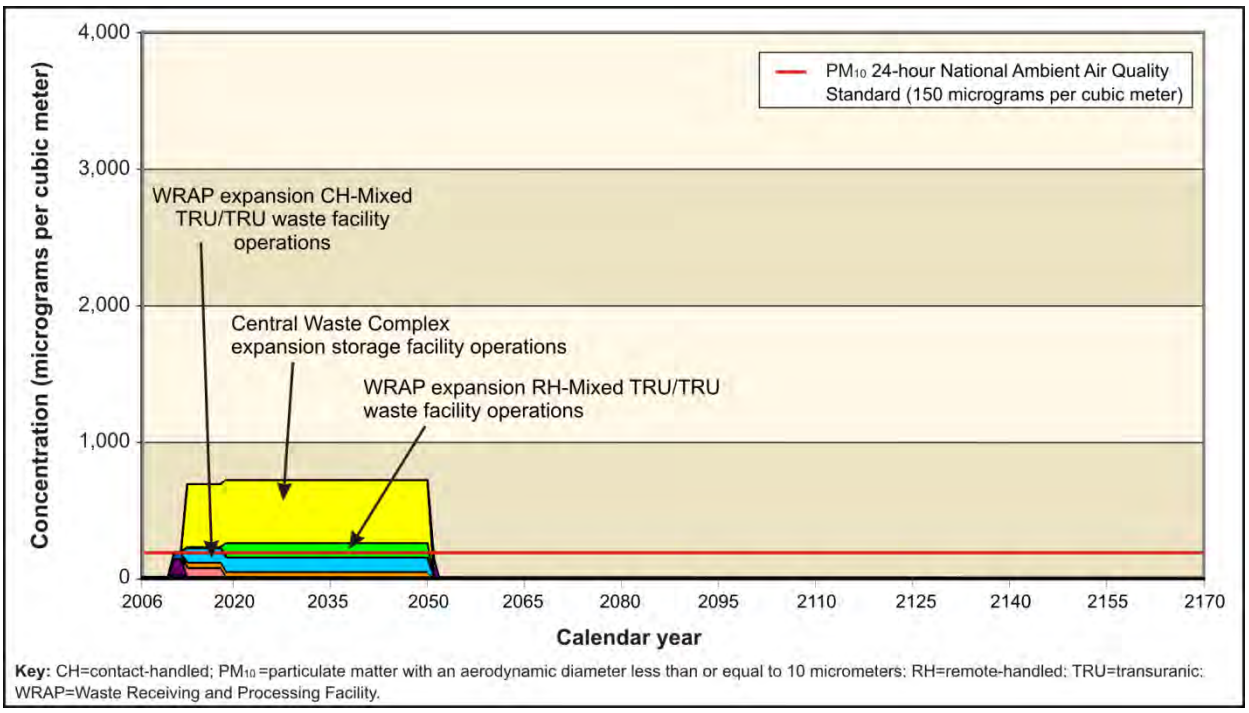


**Figure 4–31. Waste Management Alternative 2 (Treatment and Storage) $PM_{10}$ Maximum 24-Hour Concentration**

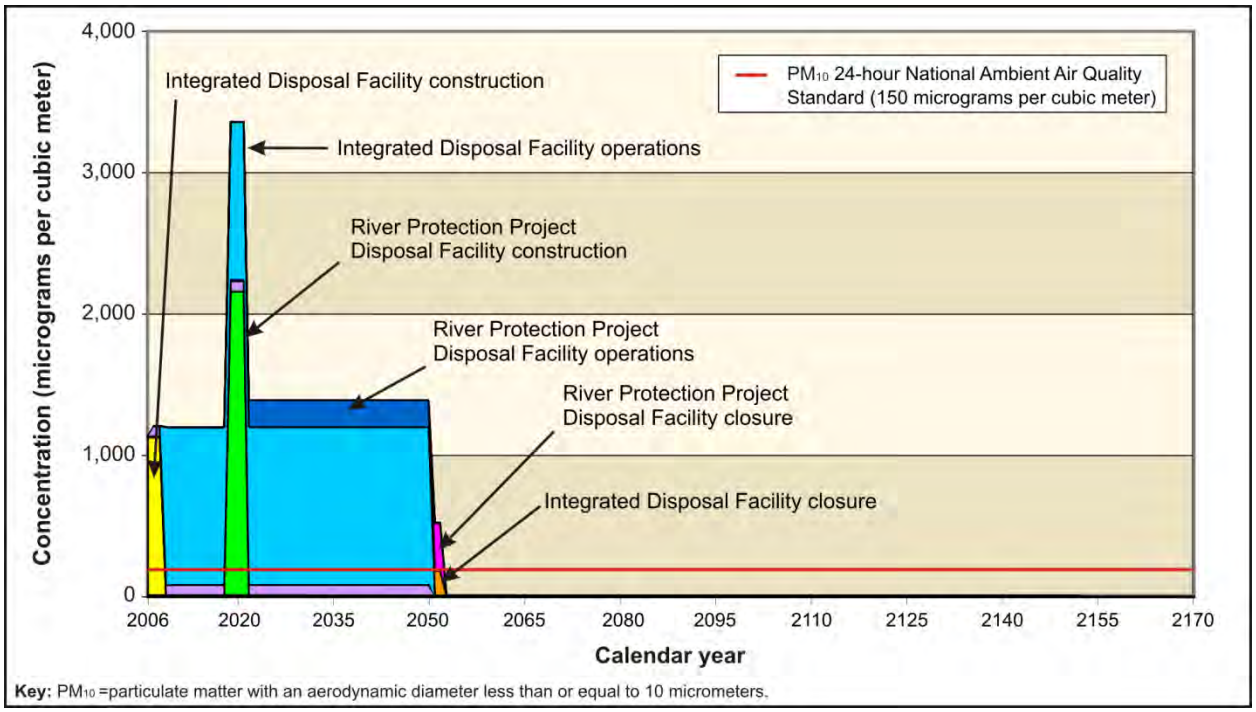


**Figure 4–32. Waste Management Alternative 2, Disposal Group 1, $PM_{10}$ Maximum 24-Hour Concentration**

For Disposal Group 2, peak concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide would occur from 2101 through 2102. Peak concentrations of PM would occur from 2019 through 2021. These peak period concentrations would result primarily from RPPDF and IDF-East closure (for carbon monoxide, nitrogen dioxide, and sulfur dioxide [annual averages]), and from RPPDF construction (for PM). $PM_{10}$ and $PM_{2.5}$ concentrations would exceed the 24-hour ambient concentration standard from 2006 through 2102. Figure 4–33 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities.

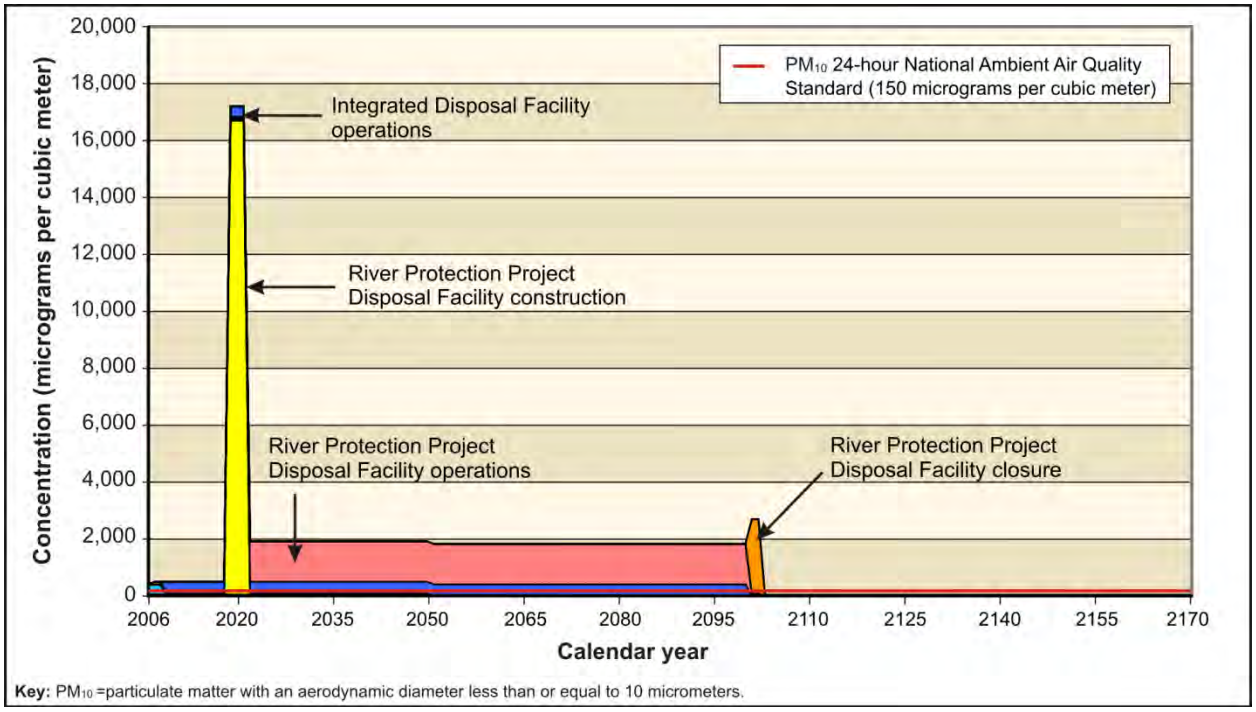


**Figure 4–33. Waste Management Alternative 2, Disposal Group 2, $PM_{10}$ Maximum 24-Hour Concentration**

For Disposal Group 3, peak concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide would occur from 2166 through 2167. Peak concentrations of PM would occur from 2019 through 2021. These peak concentrations would result from the same activities as discussed under Disposal Group 2. $PM_{10}$ and $PM_{2.5}$ concentrations would exceed the 24-hour ambient concentration standard from 2006 through 2167. Figure 4–34 shows the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–136. The guidelines would not be exceeded. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–137 and 4–138.

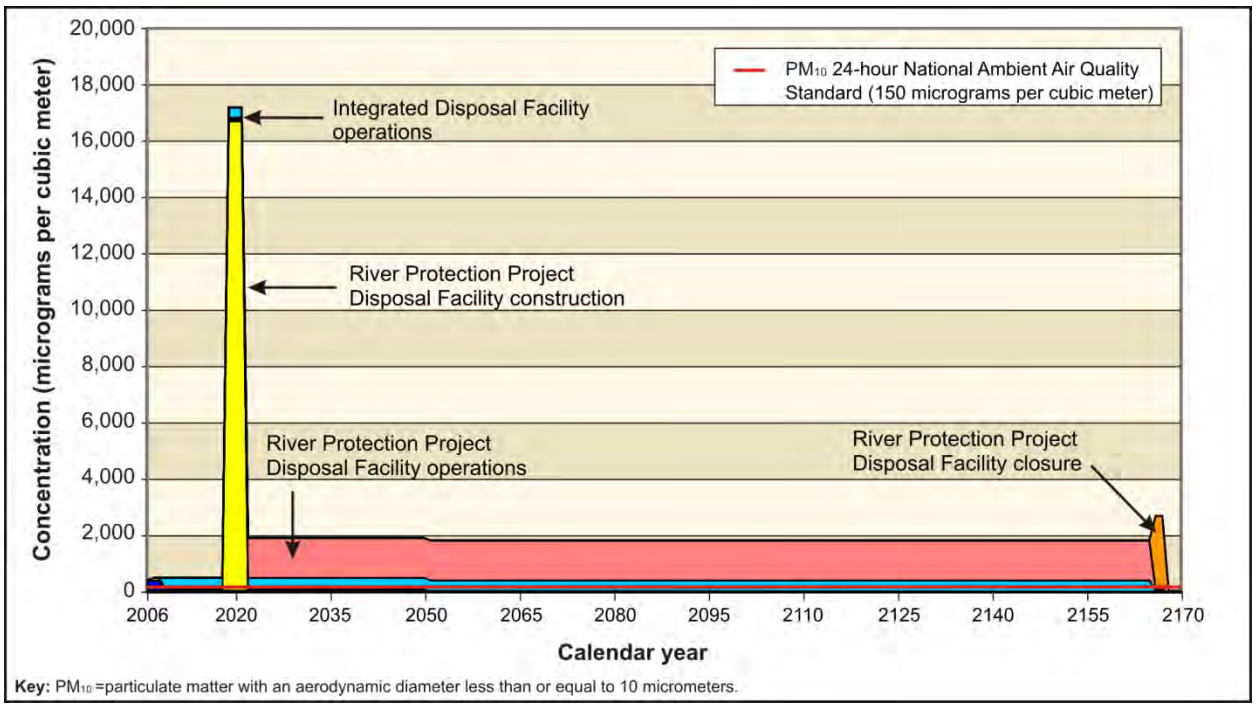


**Figure 4–34. Waste Management Alternative 2, Disposal Group 3, $PM_{10}$ Maximum 24-Hour Concentration**

#### 4.3.4.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Criteria pollutant concentrations from activities under Waste Management Alternative 3 and activities related to the three disposal groups are presented in Table 4–135. The peak concentrations occur in the same years and arise from the same activities as discussed under Waste Management Alternative 2, Disposal Groups 2 and 3. $PM_{10}$ concentrations would exceed the 24-hour ambient concentration standard for the same durations described under Alternative 2 and the three disposal groups. Figures 4–35 through 4–38 show the 24-hour $PM_{10}$ concentrations over the project duration and the contribution of major activities.

Under Disposal Group 1, peak concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide would occur from 2051 through 2052. Peak concentrations of PM would occur from 2019 through 2021. The peak period concentrations under Disposal Group 1 would result primarily from RPPDF, IDF-East, and IDF-West closure (for carbon monoxide, nitrogen dioxide, and sulfur dioxide) and from RPPDF construction and IDF-East operations (for PM).

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–136. The guidelines would not be exceeded. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–137 and 4–138.

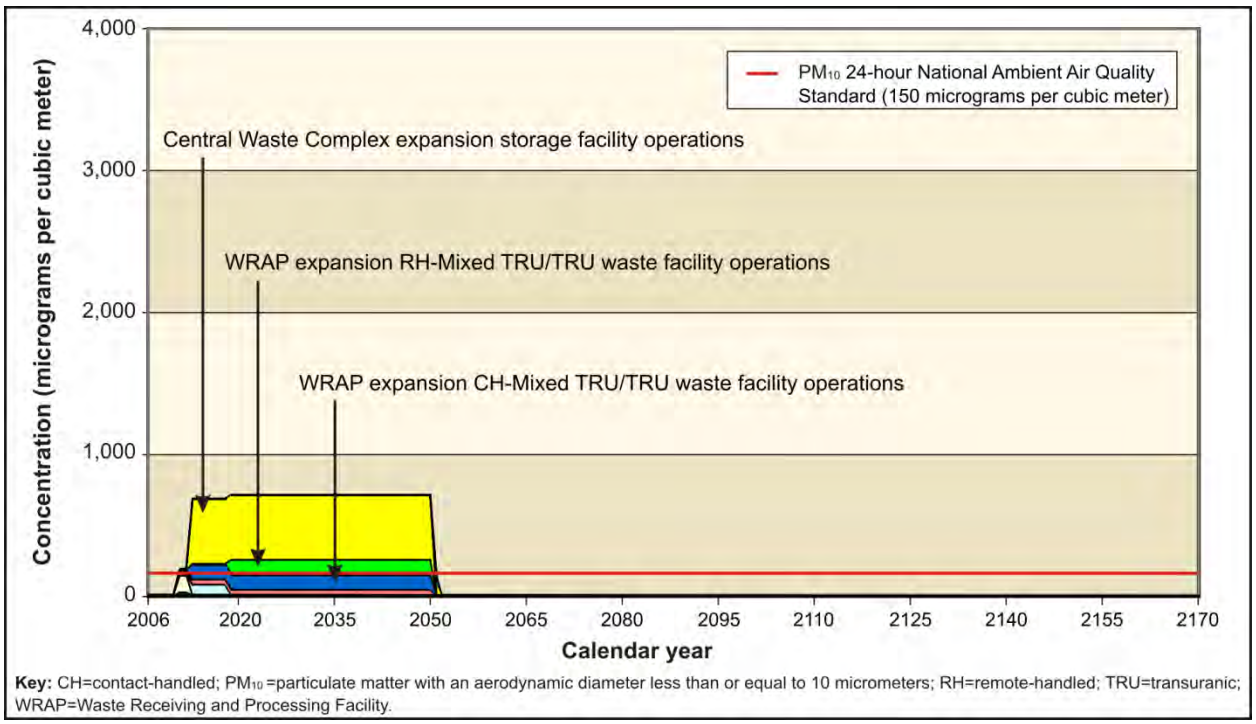


**Figure 4–35. Waste Management Alternative 3 (Treatment and Storage) $PM_{10}$ Maximum 24-Hour Concentration**

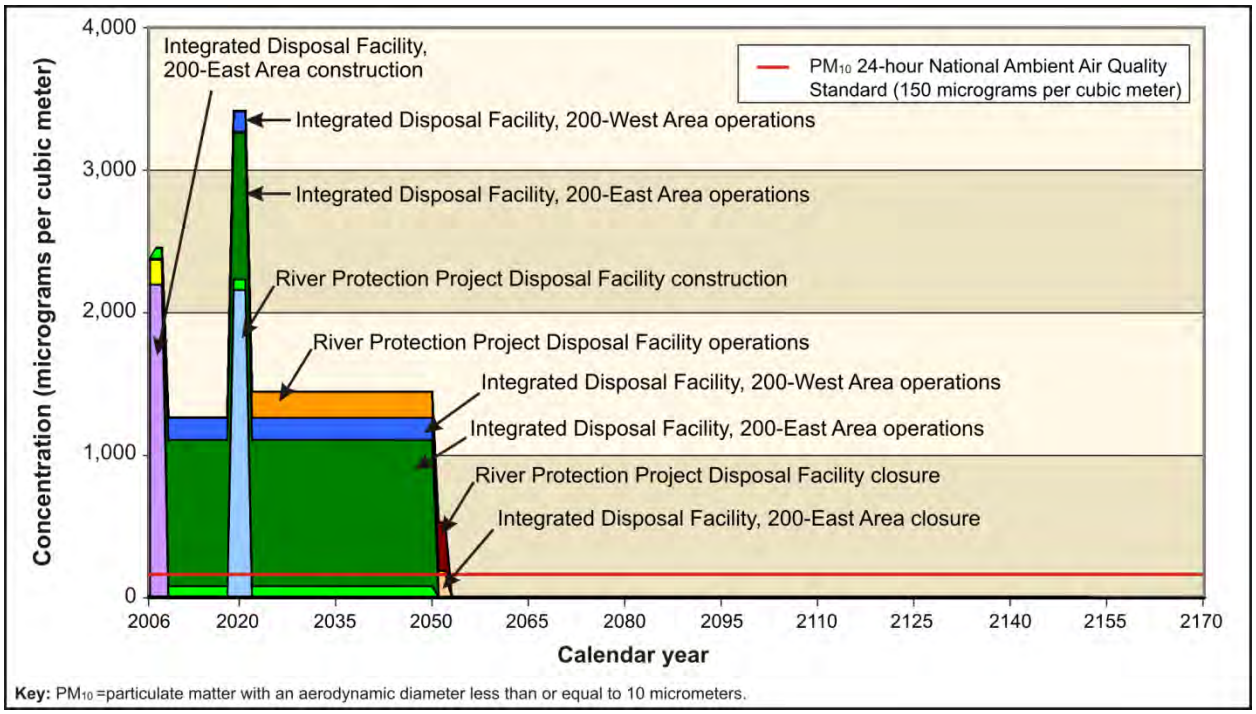


**Figure 4–36. Waste Management Alternative 3, Disposal Group 1, $PM_{10}$ Maximum 24-Hour Concentration**

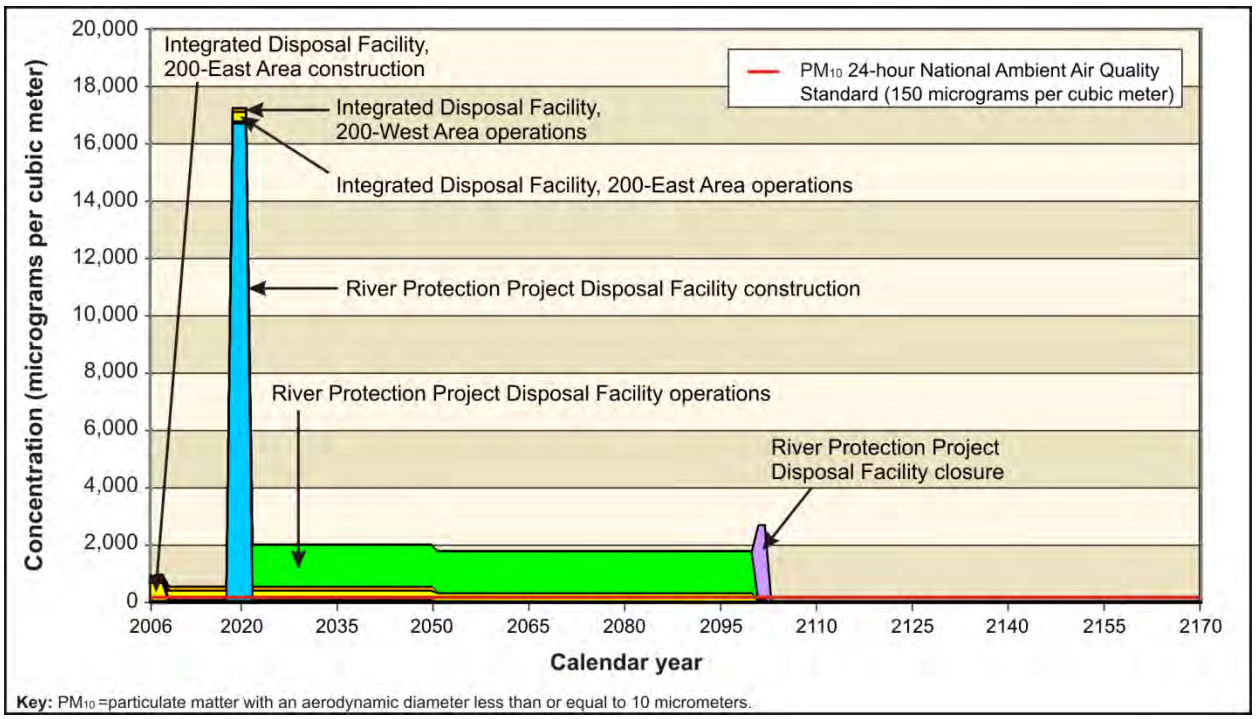


**Figure 4–37. Waste Management Alternative 3, Disposal Group 2, $PM_{10}$ Maximum 24-Hour Concentration**

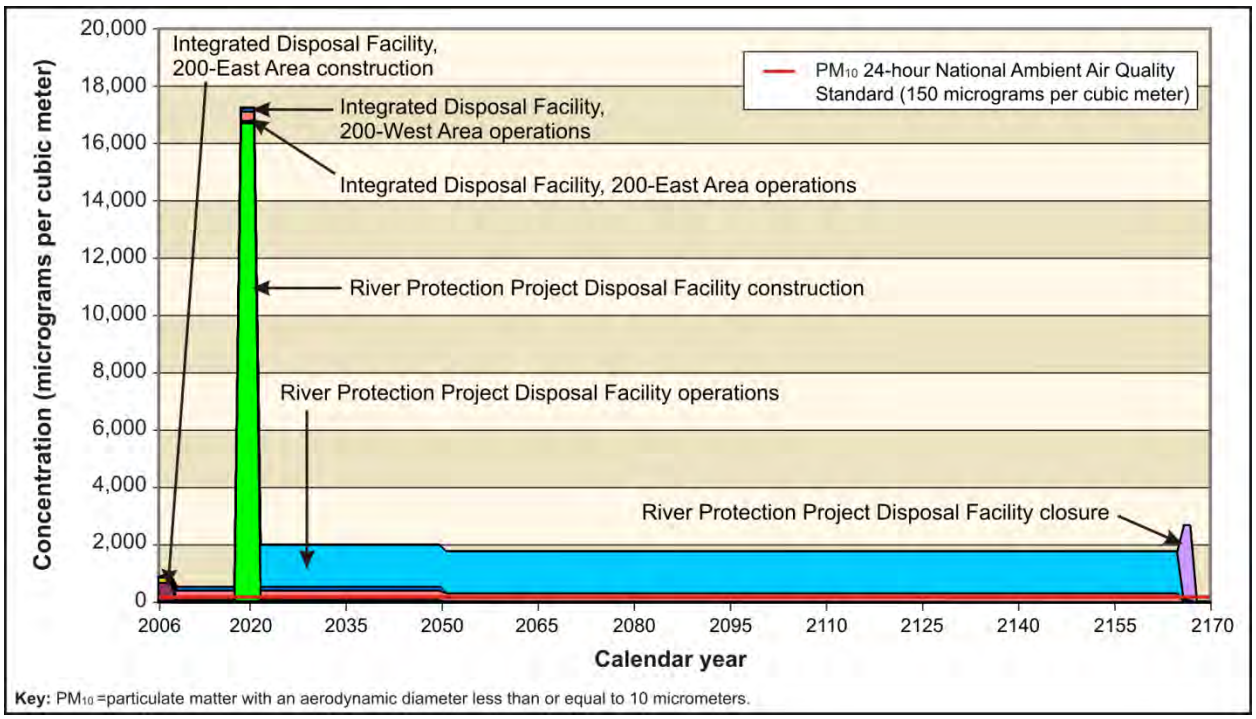


**Figure 4–38. Waste Management Alternative 3, Disposal Group 3, $PM_{10}$ Maximum 24-Hour Concentration**

### 4.3.5 Geology and Soils

Impacts on geology and soils would generally be directly proportional to the total area of land disturbed by facility construction, as well as operations, deactivation, and closure activities associated with waste treatment, storage, and disposal. Consumption of geologic resources, including rock, mineral, and soil resources, would constitute the major indirect impact on geologic and soil resources, as summarized in Table 4–139 for each of the Waste Management alternatives and disposal groups. In general, Hanford waste treatment and storage activities and commensurate geologic resource requirements would be identical under Alternatives 2 and 3. For the three disposal groups under each action alternative, direct impacts on geology and soils and associated demand for geologic resources would vary primarily in direct relation to the size, number, and required lifespan of the disposal facilities (i.e., the IDF[s] and the RPPDF) that would be constructed, operated, and ultimately closed under each disposal scenario. For disposal facility operations, it was assumed that uncontaminated soils and sediments excavated during facility construction would typically be stockpiled on site for backfill or other uses. The other key underlying assumptions used to analyze the potential environmental impacts on geology and soils and the acquisition and use of geologic resources were similar to those described in Section 4.1.5 under the Tank Closure alternatives.

#### 4.3.5.1 Alternative 1: No Action

Interim waste treatment, storage, and disposal activities under Alternative 1 would have little additional direct impact on geology and soils. No new facilities would be constructed or expanded under Alternative 1, although geologic resources would continue to be consumed in support of waste disposal operations in trenches 31 and 34 in LLBG 218-W-5 through 2035. Waste disposal operations there would consist partly of in-trench stabilization (encasement) of waste with concrete grout. Earthwork and ground disturbance would be required in association with deactivating IDF-East, which would occur in 2009 under the No Action Alternative. Entombment and ground disturbance would consist of backfilling the facility with previously excavated material. Following the cessation of waste disposal in LLBG 218-W-5 and filling it to grade with soil, the facility would be subject to a 100-year postclosure care period, but would not undergo closure. In support of postclosure care, sodium bentonite clay or grout would be required for completion of groundwater monitoring wells. Total geologic resource requirements under Alternative 1 are projected to be 6,230 cubic meters (8,150 cubic yards) (see Table 4–139). It is expected that this volume would be supplied by Borrow Area C, as further described in Section 4.1.5.

Hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect Hanford facilities are summarized in Chapter 3, Section 3.2.5.1.4. Maximum considered earthquake ground motions for Hanford encompass those that may cause substantial structural damage to buildings (equivalent to an MMI of VII and up), thus presenting safety concerns for occupants. Ground shaking of MMI VII associated with postulated earthquakes is possible and is supported by the historical record for the region. However, this level of ground motion is expected to primarily affect the integrity of inadequately designed or nonreinforced structures (see Appendix F, Table F–7). DOE Order 420.1B requires nuclear and nonnuclear facilities to be designed, constructed, and operated so that the public, workers, and environment are protected from adverse impacts of natural phenomena hazards, including earthquakes. The order stipulates natural phenomena hazards mitigation for DOE facilities and specifically provides for reevaluation and upgrade of existing DOE facilities when there is a significant degradation in the safety basis for the facility. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components, as well as the evaluation, modification, and upgrade of existing structures, systems, and components, so that DOE facilities can safely withstand the effects of natural phenomena hazards, such as earthquakes. Analyses of the potential effects of a beyond-design-basis earthquake on existing facilities and activities under this alternative and the potential consequences for human health and the environment are provided in Section 4.3.11.1.

**Table 4–139. Waste Management Alternatives – Summary of Major Geologic and Soil Resource Impact Indicators and Requirements**

| Parameter and Resource | Alternatives and Disposal Groups | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Alternative 1: No Action** | **Alternatives 2 and 3: Treatment and Storage** | **Alternative 2: Disposal Group 1** | **Alternative 2: Disposal Group 2** | **Alternative 2: Disposal Group 3** | **Alternative 3: Disposal Group 1** | **Alternative 3: Disposal Group 2** | **Alternative 3: Disposal Group 3** |
| New, permanent land disturbance[a] | 0.0 | 2.7 | 108 | 409 | 409 | 117 | 413 | 413 |
| **Construction and Operations Materials** | | | | | | | | |
| Concrete | 5,540 | 9,840 | 8,410 | 8,410 | 8,410 | 8,410 | 8,410 | 8,410 |
| Cement[b] | 1,370 | 2,000 | 2,090 | 2,090 | 2,090 | 2,090 | 2,090 | 2,090 |
| Sand[b] | 2,690 | 4,480 | 4,080 | 4,080 | 4,080 | 4,080 | 4,080 | 4,080 |
| Gravel[b] | 3,510 | 6,150 | 5,320 | 5,320 | 5,320 | 5,320 | 5,320 | 5,320 |
| **Other Borrow Materials[c]** | | | | | | | | |
| Sand | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Gravel | 34.4 | 0.0 | 209,000 | 808,000 | 808,000 | 208,000 | 809,000 | 809,000 |
| Soil | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Closure-Specific Materials** | | | | | | | | |
| Grout[d] | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Cement | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Sand[e] | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Barrier materials[f] | 0.0 | 0.0 | 1,760,000 | 6,800,000 | 6,800,000 | 1,540,000 | 6,730,000 | 6,730,000 |
| **Total[g]** | **6,230** | **10,600** | **1,980,000** | **7,610,000** | **7,610,000** | **1,760,000** | **7,550,000** | **7,550,000** |

a Reflects land area assumed to be permanently disturbed for new facilities. The value also includes land area excavated from Borrow Area C or elsewhere to supply geologic materials listed in the table.
b Component of concrete.
c Resources for miscellaneous uses not exclusively tied to facility construction, operations, or closure, such as site grading and backfill for excavations.
d Grout comprises cement, sand, fly ash, and other materials.
e Principal component of grout that would be obtained from onsite deposits.
f Volume includes soil, sand, gravel, rock, and asphalt for construction of modified Resource Conservation and Recovery Act Subtitle C barriers.
g Excludes concrete, cement, and grout. Totals may not equal the sum of the contributions due to rounding.

**Note:** All values are expressed in cubic meters except land disturbance, which is in hectares. To convert cubic meters to cubic yards, multiply by 1.308; hectares to acres, by 2.471. Values presented in the table have been rounded to no more than three significant digits, where appropriate.

**Source:** SAIC 2010c.

#### 4.3.5.2 Alternative 2: Disposal in IDF, 200-East Area Only

Under this Waste Management alternative, ongoing Hanford waste treatment and storage would have limited, but direct, impacts on site geology and soils. Impacts would primarily be associated with construction of new facilities or existing-facility expansions, including a T Plant expansion, storage facility, and two expansions of WRAP: (1) a CH-Mixed TRU/TRU waste facility at the CWC, and (2) an RH-Mixed TRU/TRU waste facility at WRAP. Construction activities would permanently disturb about 2.7 hectares (6.6 acres) of land in the 200-West Area. In addition, a small area of Borrow Area C would be excavated to support this construction. Although the expanded facilities would generally be constructed at grade with concrete slab foundations, excavation to depths of up to 3 meters (10 feet) may be necessary, especially for reinforced concrete floor and wall construction for below-grade service areas. Nevertheless, the expansions would have little impact on the lateral and vertical extent of the Hanford formation, which composes the uppermost strata across the 200 Areas.

Although the 200-West Area has previously been disturbed and native soils may have been altered by fill placement, denuded surface soils and unconsolidated sediments in excavations would be subject to wind and water erosion if left exposed over an extended period of time. Adherence to standard best management practices for soil erosion and sediment control during construction would minimize soil erosion and loss. To reduce the risk of exposing contaminated soils, areas in which new facilities would be constructed under this alternative would be surveyed prior to any ground disturbance. Any contamination would be remediated as necessary. After construction, the previously disturbed areas would not be subject to long-term soil erosion. Operations and eventual deactivation of the expanded treatment and storage facilities are not expected to have any direct impact on geology and soils.

Geologic resources, mainly consisting of aggregate (sand and gravel) and cement for concrete work, would be required for expanded treatment and storage facility construction. Total geologic resource requirements under Alternative 2 are projected to be 10,600 cubic meters (13,900 cubic yards) (see Table 4–139). It is expected that this volume would be supplied by Borrow Area C, as stated above and further described in Section 4.1.5.

As described in Section 4.3.5.1, hazards from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions with the potential to affect Hanford facilities were evaluated. As stated in DOE Order 420.1B, DOE requires nuclear and nonnuclear facilities to be designed, constructed, and operated so that the public, workers, and environment are protected from adverse impacts of natural phenomena hazards, including earthquakes. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components, as well as for the evaluation, modification, and upgrade of existing structures, systems, and components, so that DOE facilities can safely withstand the effects of natural phenomena hazards, such as earthquakes. Analyses of the potential effects of a beyond-design-basis earthquake affecting the expanded facilities and related activities and the potential consequences on human health and the environment are provided in Section 4.3.11.2.1.

##### 4.3.5.2.1 Disposal Group 1

Excavation work associated with constructing an expanded IDF-East and the RPPDF between the 200-East and 200-West Areas would constitute the major direct impact on geology and soils under this alternative. Construction of IDF-East and the RPPDF would require excavation to a depth of approximately 14 meters (45 feet) (see Appendix E, Sections E.3.4 and E.3.5). Blasting should not be required to support construction of these facilities because the gravel, sand, and silt deposits of the Hanford formation, which compose the uppermost strata across the 200 Areas, are up to 65 meters (213 feet) thick across the 200 Areas. Coarse aggregate (gravel) would be used to construct drainage layers that are integral to each engineered disposal facility. Completed facilities would occupy

about 62.3 hectares (154 acres) of land. An additional 41.7 hectares (103 acres) would also be excavated from Borrow Area C, for a total of 104 hectares (257 acres) of new, permanent land disturbance. At the end of their life cycles, the facilities would be closed with an engineered barrier that would extend over an additional 1.6 hectares (4 acres) of previously disturbed land, as further described below. As with any ground-disturbing activity, denuded surface soils and unconsolidated sediments in excavations and graded areas would be subject to wind and water erosion if left exposed over an extended period of time. Adherence to standard best management practices for soil erosion and sediment control during construction would minimize soil erosion and loss. During the 3-year construction period for each of the facilities, temporary seeding, mulching, and the use of geotextile covers and similar best management practices would be employed to minimize soil erosion in disturbed areas. After construction, the previously disturbed areas would not be subject to long-term soil erosion because the areas would either lie within the footprint of the completed structures or the temporarily disturbed areas would be revegetated.

Disposal facility operations through 2050 under this disposal scenario, including the continued operation of LLBG 218-W-5, are not expected to have any additional direct impact on geology and soils. Operations of IDF-East and the RPPDF would require the use of soil to cover each layer of emplaced waste. However, the soil would be derived from stockpiles excavated during facility construction. Similarly, disposal operations in trenches 31 and 34 in LLBG 218-W-5 would require the consumption of cement and aggregate (sand and gravel) to produce concrete for in-trench stabilization (encasement) of waste, until filled. Previously excavated soil also would be used for operational cover of emplaced waste until the trenches can be filled. Once filled, the LLBG 218-W-5 trenches would be backfilled with soil to grade to complete deactivation.

Following completion of disposal activities in IDF-East and the RPPDF, these engineered facilities would be closed with a modified RCRA Subtitle C barrier. The 2.7-meter-thick (9-foot-thick) engineered barrier would be composed of layers of topsoil in the upper part, which would support a mixed perennial grass ground cover, underlain by layers of sand, gravel, asphalt, and/or riprap in the lower part. Best management practices for soil erosion and sediment control would be employed during barrier construction, including watering to control fugitive dust. The final barriers would encompass approximately 63.9 hectares (158 acres), slightly larger than the footprints of the disposal facilities (see Section 4.3.1.2.1.1). During the 100-year postclosure care period for IDF-East and the RPPDF, sodium bentonite clay or grout would be required for completion of groundwater monitoring wells.

Alternative 2, Disposal Group 1, activities would not preclude the use of rare or otherwise valuable geologic or soil resources. The surficial soils, unconsolidated strata, and underlying basaltic bedrock of the 200 Areas are present elsewhere, both in the region and at Hanford. However, as described, relatively large quantities of geologic resources would be required to support facility construction and, more substantially, to construct engineered barriers to effect final landfill closure of IDF-East and the RPPDF. Total geologic resource requirements under Alternative 2, Disposal Group 1, are projected to be 1,980,000 cubic meters (2,590,000 cubic yards) (see Table 4–139). It is expected that this volume would be supplied by Borrow Area C, as stated above and further described in Section 4.1.5.

Design consideration of hazards associated with large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative case would be substantially the same as those described in Section 4.3.5.2. Analyses of the potential effects of a beyond-design-basis earthquake on disposal facilities and related activities and the potential consequences on human health and the environment are provided in Section 4.3.11.2.1.

#### 4.3.5.2.2 Disposal Group 2

The type and intensity of anticipated direct impacts on geology and soils under Waste Management Alternative 2, Disposal Group 2, including factors that could lead to increased wind and water erosion, would be somewhat greater than those described under Alternative 2, Disposal Group 1 (see Section 4.3.5.2.1 above). Under this alternative and disposal group, the RPPDF constructed would be substantially larger (by about a factor of eight) than that required under Disposal Group 1. Nevertheless, the size of IDF-East required under this disposal group would be only about one-third the size of that constructed under Alternative 2, Disposal Group 1. On the whole, the total scale of the direct impacts associated with new disposal facility construction would be greater under this disposal group. In total, the completed facilities would occupy about 240 hectares (592 acres) of land (see Section 4.3.1.2.1.2).

Both IDF-East and the RPPDF would operate until 2100 under this alternative and disposal grouping. Disposal operations in LLBG 218-W-5 would be identical to those described under Alternative 2, Disposal Group 1 (see Section 4.3.5.2.1). An additional 159 hectares (392 acres) would also be excavated from Borrow Area C, making a total of 398 hectares (984 acres) of new, permanent land disturbance.

Following completion of disposal activities in IDF-East and the RPPDF, each facility would be closed under a modified RCRA Subtitle C barrier, as described above in Section 4.3.5.2.1. The final barriers would encompass a total land area of about 247 hectares (611 acres) and would be subject to a 100-year postclosure care period.

Total geologic resource requirements under Alternative 2, Disposal Group 2, are projected to be 7,610,000 cubic meters (9,950,000 cubic yards), with the demand mainly driven by construction of the engineered barriers for landfill closure of IDF-East and the RPPDF (see Table 4–139). It is expected that this volume would be supplied by Borrow Area C, as stated above and further described in Section 4.1.5.

#### 4.3.5.2.3 Disposal Group 3

Direct impacts on geology and soils from disposal facility construction, operations, and closure, as well as associated geologic resource demands, under this disposal grouping would be identical to those described above for Alternative 2, Disposal Group 2 (see Section 4.3.5.2.2). Although IDF-East and the RPPDF would be operated through 2165 before being landfill-closed under this disposal group, the larger operational period is not expected to measurably change the direct or indirect impacts.

### 4.3.5.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Direct impacts on geology and soils and geologic resource demands associated with construction, operations, and deactivation of expanded Hanford waste treatment and storage facilities would be the same as those discussed under Waste Management Alternative 2 (see Section 4.3.5.2).

#### 4.3.5.3.1 Disposal Group 1

Direct impacts on geology and soils and associated geologic resource requirements to support Waste Management Alternative 3, Disposal Group 1, activities would be very similar to those described under Alternative 2, Disposal Group 1 (see Section 4.3.5.2.1), despite the fact that two IDFs (in the 200-East and 200-West Areas) would be constructed under Alternative 3. The two IDFs together would be sized to provide approximately the same disposal capacity as the single IDF that would be constructed under Alternative 2, Disposal Group 1. IDF-East would be constructed in the same location as under Waste Management Alternative 2 and would receive only waste generated by the Tank Closure alternatives. IDF-West would be located north of WRAP and northwest of LLBG 218-W-5. It would be sized to receive the balance of the waste that would not be disposed of in IDF-East. Construction and operations activities associated with the two IDFs under this alternative and disposal group would be the same as

those associated with the single IDF under Alternative 2, Disposal Group 1. Elements associated with construction and operations of the RPPDF under this alternative group and disposal operations in LLBG 218-W-5 would likewise be identical to those under Alternative 2, Disposal Group 1 (see Section 4.3.5.2.1). In total, the two IDFs and new RPPDF would occupy about 61.9 hectares (153 acres) of land. Following completion of disposal activities in the IDF(s) and the RPPDF, each facility would be closed under a modified RCRA Subtitle C barrier, as described above in Section 4.3.5.2.1. An additional 36.8 hectares (91 acres) would also be excavated from Borrow Area C, making a total of about 98.7 hectares (244 acres) of new, permanent land disturbance. The final barriers would encompass a slightly larger land area than the footprints of the three disposal facilities and total approximately 76.9 hectares (190 acres).

Total geologic resource requirements for Waste Management Alternative 3, Disposal Group 1, are projected to be 1.76 million cubic meters (2.3 million cubic yards), with the demand mainly driven by construction of the engineered barriers for landfill closure of the two IDFs and the RPPDF (see Table 4–139). It is expected that this volume would be supplied by Borrow Area C, as stated above and further described in Section 4.1.5.

Design consideration of hazards associated with large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions that could potentially affect new and existing facilities under this alternative case would be substantially the same as those described in Section 4.3.5.2. Analyses of the potential effects of a beyond-design-basis earthquake affecting the disposal facilities and related activities and the potential consequences for human health and the environment are provided in Section 4.3.11.3.1.

#### 4.3.5.3.2 Disposal Group 2

Under Waste Management Alternative 3, Disposal Group 2, direct and secondary impacts on geology and soils would be greater than those described under Alternative 3, Disposal Group 1 (see Section 4.3.5.3.1). Under this disposal group, the RPPDF that would be constructed would be substantially larger (by about a factor of eight) than that required under Disposal Group 1, although the combined size of IDF-East and IDF-West would be only about one-third the size of those constructed under Alternative 3, Disposal Group 1. On the whole, the total scale of direct impacts associated with new disposal facility construction would be greater under this disposal group. In total, the completed facilities would occupy about 240 hectares (593 acres) of land.

IDF-East and the RPPDF would operate until 2100 and IDF-West until 2050 under this alternative and disposal group. Disposal operations in LLBG 218-W-5 would be identical to those described under Alternative 2, Disposal Group 1 (see Section 4.3.5.2.1). An additional 157 hectares (388 acres) would also be excavated from Borrow Area C, making a total of 397 hectares (981 acres) of new, permanent land disturbance.

Following completion of disposal activities in IDF-East, IDF-West, and the RPPDF, each facility would be closed under a modified RCRA Subtitle C barrier, as previously described above in Section 4.3.5.2.1. The final barriers would encompass a total land area of about 253 hectares (624 acres) and would be subject to a 100-year postclosure care period.

Total geologic resource requirements under Alternative 3, Disposal Group 2, are projected to be 7.55 million cubic meters (9.88 million cubic yards), with the demand largely driven by construction of the engineered barriers (see Table 4–139). It is expected that this volume would be supplied by Borrow Area C, as stated above and further described in Section 4.1.5.

#### 4.3.5.3.3 Disposal Group 3

Direct impacts on geology and soils from disposal facility construction, operations, and closure, as well as associated geologic resource demands, under this disposal grouping would be identical to those described above for Waste Management Alternative 3, Disposal Group 2 (see Section 4.3.5.3.2). Although IDF-East and the RPPDF would be operated through 2165 before being landfill-closed under this disposal group, compared with landfill closure in 2100 under Disposal Group 2, the additional operational years are not expected to measurably change the direct or indirect impacts.

### 4.3.6 Water Resources

#### 4.3.6.1 Alternative 1: No Action

Interim waste storage, treatment, and disposal activities under Waste Management Alternative 1 are not expected to have any incremental impact on water resources over the short term. No facilities would be constructed or expanded under Alternative 1, although waste disposal operations in trenches 31 and 34 in LLBG 218-W-5 would continue through 2035. While the facility would not be closed under a barrier after cessation of waste disposal, it would be subject to a 100-year postclosure care period that would include groundwater monitoring.

Earthmoving would be involved in deactivating IDF-East in 2009, which would include backfilling the facility with previously excavated material. Stormwater runoff could convey soil, sediments, and other pollutants (e.g., site debris, petroleum, oils, lubricants from heavy equipment) from the work sites and staging areas. However, any such potential for runoff to impact water quality beyond the confines of the 200 Areas would be low. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, staked haybales, mulch), as well as spill prevention and waste management practices, would be employed to minimize suspended sediment and other deleterious material transport and any potential water-quality impacts. Projected water use under Alternative 1 and its impact on site utility infrastructure are discussed in Section 4.3.2.1.

Long-term impacts on water resources associated with ongoing waste management and disposal, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.1.

#### 4.3.6.2 Alternative 2: Disposal in IDF, 200-East Area Only

Direct impacts on surface-water resources and quality associated with construction of expanded Hanford waste treatment and storage facilities would be negligible. The expanded facilities would be constructed in previously developed portions of the 200-West Area where no surface-water features or surface-water drainages are located and the depth to groundwater is generally greater than about 50 meters (164 feet). Any effect on stormwater runoff quality would likely be highly localized and of short duration. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, staked haybales, mulch), as well as spill prevention and waste management practices, would be employed to minimize suspended sediment and other deleterious material transport from the construction site and potential water quality impacts. Further, ground-disturbing activities would be conducted in accordance with current NPDES and state waste discharge general permits for stormwater discharges associated with construction activities, both of which are issued by Ecology. These permits specifically require the development and implementation of a stormwater pollution prevention plan. The expanded facilities would incorporate appropriate stormwater management controls to collect, detain, and convey stormwater from the building and other impervious surfaces to minimize water quality impacts during operations.

There would be no direct discharge of effluents to either surface water or groundwater from facility operations. Process wastewater, including any radioactive liquid effluents, generated from operation of the expanded facilities would be discharged to existing treatment facilities that already service the 200 Areas, as described in Section 4.1.6.2.1. Nonhazardous sanitary wastewater (sewage) would be managed via appropriate sanitary wastewater collection and treatment systems.

Water would be required during construction for soil compaction, dust control, and other uses, including concrete production. Standard construction practices dictate that, at least initially, construction water would be trucked to construction locations on an as-needed basis for these uses until water supply and wastewater treatment utilities are in place. During operations, water would be required to support process makeup requirements and facility cooling, waste treatment processing, the potable and sanitary needs of the operations workforce, and other uses. Some water would also be required during deactivation for activities such as facility decontamination. Projected water use for these activities under Waste Management Alternative 2 and its impact on site utility infrastructure are further discussed in Section 4.3.2.2.

No incremental impact on the Hanford vadose zone or groundwater is expected from operation of these facilities in the 200-West Area. There would be no direct discharge of effluents to either surface water or the ground, as described above. Following completion of their mission in 2050, the facilities would be deactivated, and all residual waste and any hazardous or radioactive materials would be removed for disposal. Waste generation and management activities under this alternative are further discussed in Section 4.3.14.2.

Long-term impacts on water resources associated with ongoing waste management and disposal, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.2.2.

#### 4.3.6.2.1 Disposal Group 1

No direct impact on water resources is expected from constructing an expanded IDF-East and the RPPDF between the 200-East and 200-West Areas. No natural surface-water features would be impacted from construction of IDF-East in an area that has already been heavily disturbed. In the case of the relatively undeveloped area where the RPPDF would be constructed, natural drainage features across the area are very poorly defined or nonexistent, and flow is ephemeral, if it occurs at all.

Disposal facility construction is not expected to impact regional groundwater flow because the depth of the completed disposal facilities would not exceed about 13.1 meters (43 feet) and the depth of the water table beneath the 200 Areas is generally greater than about 50 meters (164 feet).

Site clearing, grading, and facility excavation work would expose soils and sediments to possible erosion from infrequent heavy rainfall or wind. Stormwater runoff from exposed areas could convey soil, sediments, and other pollutants (e.g., contaminated debris and spilled materials, such as petroleum, oils, and lubricants from heavy equipment) from construction and staging areas. Any such potential for runoff to impact runoff quality beyond the confines of the work areas would be low, and both disposal area locations are more than 11 kilometers (6.8 miles) from the Columbia River. Regardless, appropriate soil erosion and sediment control measures (e.g., sediment fences, staked haybales, mulching and seeding of temporarily disturbed areas), as well as spill prevention and waste management practices, would be employed to minimize suspended sediment and other deleterious material transport and any potential water quality impacts. In addition, during facility construction, temporary covers would be used as necessary to limit precipitation run-on into the disposal facilities. Further, all excavation work and related ground-disturbing activities during construction would be conducted in accordance with current NPDES and appropriate state waste discharge general permits for stormwater discharges associated with

construction and industrial activities, both of which are issued by Ecology. These permits specifically require the development and implementation of a stormwater pollution prevention plan.

Normal disposal facility operations through 2050 under this disposal scenario, including the continued operation of trenches 31 and 34 in LLBG 218-W-5 until closed, as well as IDF-East and the RPPDF, are not expected to have any additional direct impact on water resources. Trenches 31 and 34 are lined, RCRA-compliant disposal facilities equipped with a leachate collection system (see Appendix E, Section E.3.3.2). There would be no direct discharge of effluents to either surface water or groundwater from facility operations. For continued operations of trenches 31 and 34 in LLBG 218-W-5, precipitation and snowmelt captured by the trench liner systems would be drained to a sump, pumped to a holding tank, and removed by tanker truck for treatment at the ETF.

The completed IDF-East and RPPDF would incorporate appropriate stormwater management engineering and operational controls to collect, detain, and convey stormwater away from disposal to minimize water-quality impacts during operations, including run-on of stormwater and precipitation that could otherwise infiltrate emplaced waste. To be specific, these new engineered facilities would include a redundant (double) liner system, a leachate collection and removal system, and a leak detection system to protect subsurface water quality (see Appendix E, Section E.3.4.1). As discussed for LLBG 218-W-5, leachate collected by the IDF-East and RPPDF systems would similarly be detained and trucked to the ETF for treatment and disposal. Additional operational controls could include the use of temporary roll-on/roll-off geomembrane covers to further limit infiltration and leachate generation during waste disposal.

Following completion of disposal activities in IDF-East and the RPPDF, each facility would be closed under a modified RCRA Subtitle C barrier, as previously described in Section 4.3.5.2.1. Similarly, the LLBG would also be backfilled to grade and ultimately closed. The modified RCRA Subtitle C barrier is designed for a 500-year performance period. During the DOE-administered 100-year postclosure care period for IDF-East and the RPPDF, proper operation and maintenance of the barrier, including installed groundwater-monitoring systems and barrier erosion control features, would ensure that postclosure impacts on surface-water hydrology and quality and on the Hanford vadose zone and groundwater are minimal. Nevertheless, this barrier would degrade over time, allowing infiltration and contaminant migration from disposal facilities and across the 200 Areas. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.2.1. Waste generation and management activities under this alternative are further discussed in Section 4.3.14.2.

Potable and raw water demand to support waste management disposal activities would primarily be driven by the need to provide dust control during disposal facility construction, operations, and closure via construction of the modified RCRA Subtitle C barriers; water might also be needed to aid soil compaction. Portable sanitary facilities would be provided to meet the workday potable and sanitary needs of decommissioning personnel, which would constitute a relatively small percentage of the total water demand. Projected water use under Alternative 2, Disposal Group 1, and its impact on site utility infrastructure are discussed in Section 4.3.2.2.1.1.

#### 4.3.6.2.2 Disposal Group 2

The potential for direct and secondary impacts on water resources under Alternative 2, Disposal Group 2, would be somewhat greater than those described under Alternative 2, Disposal Group 1 (see Section 4.3.6.2.1). While the construction, operation, and closure activities and associated impacts would be very similar, a substantially larger RPPDF would be constructed under this alternative and disposal group (see Section 4.3.5.2.2), and both IDF-East and the RPPDF would operate until 2100 instead of 2050. Disposal operations in LLBG 218-W-5 would be identical to those described under

Alternative 2, Disposal Group 1 (see Section 4.3.6.2.1). Following completion of disposal activities in IDF-East and the RPPDF, each facility would be closed under a modified RCRA Subtitle C barrier, the same as for Disposal Group 1. Overall, it is expected that the potential for direct and secondary impacts on water resources, including groundwater, over the short term would be small for the same reasons previously described in Section 4.3.6.2.1. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.2.2. Total water use would be greater under this disposal group due to the demand for construction, operations, and closure of a larger RPPDF and the extension of disposal operations over a longer timeframe. Projected water use under Alternative 2, Disposal Group 2, and its impact on site utility infrastructure are further discussed in Section 4.3.2.2.1.2.

#### 4.3.6.2.3 Disposal Group 3

Activities under this alternative would represent the maximum potential impacts on water resources from disposal facility construction, operations, and closure over the short term and would generally be similar in nature to those described under Alternative 2, Disposal Group 1 (see Section 4.3.6.2.1). The size of IDF-East and the RPPDF constructed under this alternative and the associated impact considerations would be identical to those considered under Alternative 2, Disposal Group 2 (see Section 4.3.5.2.2). However, IDF-East and the RPPDF would operate until 2165 instead of 2100, and disposal facility closure would consequently occur much later under this alternative and disposal group. Nonetheless, any potential for direct and secondary impacts on water resources is still expected to be relatively small. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.2.3. Projected water use under Alternative 2, Disposal Group 3, and its impact on site utility infrastructure are discussed in Section 4.3.2.2.1.3.

### 4.3.6.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Direct impacts on water resources associated with construction, operations, and deactivation of expanded Hanford waste treatment and storage facilities would be the same as those discussed under Waste Management Alternative 2 in Section 4.3.6.2.

#### 4.3.6.3.1 Disposal Group 1

No direct impacts on water resources are expected from constructing an expanded IDF-East, a new IDF-West, and the RPPDF between the 200-East and 200-West Areas. No natural surface-water features would be impacted from construction of IDF-East because the area has already been heavily disturbed. In the case of the relatively undeveloped areas where IDF-West and the RPPDF would be constructed, natural drainage features across the affected areas are very poorly defined or nonexistent, and flow is ephemeral, if it occurs at all. In general, the nature and intensity of ground-disturbing activities, effects on water resources, and application of soil erosion, sediment control, and stormwater management provisions would generally be the same as those described under Alternative 2, Disposal Group 1 (see Section 4.3.6.2.1).

As described in Section 4.3.5.3.1, IDF-East would receive only waste generated by the Tank Closure alternatives. IDF-West would receive the balance of the waste. Segregation of the waste in this manner may have implications for long-term facility performance and contamination transport, but is not expected to have any differing operating impacts on water resources in the short term.

All other design considerations, operating parameters, closure considerations, and potential effects on water resources would be the same as those described under Alternative 2, Disposal Group 1 (see Section 4.3.6.2.1), because both the 200-East and 200-West IDFs and the RPPDF would operate through 2050 under this alternative and disposal group before being landfill-closed. Disposal operations

in LLBG 218-W-5 would also be identical to those described under Alternative 2, Disposal Group 1. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.3.1. Projected water use under Alternative 2, Disposal Group 3, and its impact on site utility infrastructure are discussed in Section 4.3.2.3.1.1.

#### 4.3.6.3.2 Disposal Group 2

The potential for direct and secondary impacts on water resources under Waste Management Alternative 3, Disposal Group 2, would be somewhat greater than those described above under Alternative 3, Disposal Group 1. While the construction, operations, and closure activities and associated impacts would be very similar, a substantially larger RPPDF would be constructed under this alternative and disposal group (see Section 4.3.5.3.2). In addition, IDF-East and the RPPDF would operate until 2100 instead of 2050 under this alternative and disposal group. Disposal operations in LLBG 218-W-5 would be identical to those previously described. Following completion of disposal activities in IDF-East and the RPPDF, each facility would be closed under a modified RCRA Subtitle C barrier, the same as for Disposal Group 1. Construction, extended operations, and eventual closure of relatively larger disposal facilities would increase the potential for water-quality impacts in the short term. Still, it is expected that the potential for direct and secondary impacts on water resources, including groundwater, over the short term would be small for the same reasons previously described in Section 4.3.6.3.1. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.3.2. Total water use would be greater under this disposal group due to the demand for construction, operations, and closure of a larger RPPDF and the extension of disposal operations over a longer timeframe. Projected water use under Alternative 3, Disposal Group 2, and its impact on site utility infrastructure are further discussed in Section 4.3.2.3.1.2.

#### 4.3.6.3.3 Disposal Group 3

Potential direct and secondary impacts on water resources associated with disposal facility construction, operations, and closure activities would be somewhat greater than those under Alternative 3, Disposal Group 2 (see Section 4.3.6.3.2). Although the sizes of the two IDFs and the RPPDF constructed would be identical to the sizes described under Alternative 3, Disposal Group 2, IDF-East and the RPPDF would operate until 2165 instead of 2100, and disposal facility closure would occur much later as a consequence. Nonetheless, any potential for direct and secondary impacts on water resources is still expected to be relatively small based on the rationale summarized in Section 4.3.6.3.1. Long-term impacts on water resources, including contaminant release to and transport through the Hanford groundwater system, are evaluated in Chapter 5, Section 5.3.1.3.3. This alternative would have the highest total water use under Alternative 3 due to the extended operations period for IDF-East and the RPPDF. Projected water use under Alternative 3, Disposal Group 3, and its impact on site utility infrastructure are further discussed in Section 4.3.2.3.1.3.

### 4.3.7 Ecological Resources

#### 4.3.7.1 Alternative 1: No Action

Under the No Action Alternative, no new facility construction would be initiated within the 200 Areas. Storage and treatment activities would continue to take place within the CWC, WRAP, and T Plant complex. Disposal would also continue in LLBG 218-W-5 trenches 31 and 34, and no barriers would be emplaced after closure of any of the facilities or trenches. Thus, there would be no additional impacts on ecological resources within the 200 Areas under this alternative. As this alternative would not require geologic material to be excavated from Borrow Area C, there would be no impacts on ecological resources within that area.

#### 4.3.7.2 Alternative 2: Disposal in IDF, 200-East Area Only

##### 4.3.7.2.1 Terrestrial Resources

Under this alternative, a number of new facilities or existing-facility expansions would be constructed in the 200-West Area. These include expansion of the T Plant; two expansions of WRAP: (1) a CH-Mixed TRU/TRU waste facility at the CWC, and (2) an RH-Mixed TRU/TRU waste facility at WRAP; and construction of a new CWC storage facility (see Figure 4–2). These facilities would require a total of 2.7 hectares (6.6 acres) of land. Of this total, up to 0.4 hectares (1 acre) of sagebrush habitat (and associated microbiotic crusts) could be disturbed by construction of the RH-Mixed TRU/TRU waste facility at WRAP. Hanford guidance would not require the replacement of this sagebrush habitat (DOE 2003f:21). Other facilities would be built on previously disturbed land. Operations are not expected to impact terrestrial resources.

###### 4.3.7.2.1.1 Disposal Group 1

Disposal Group 1 would involve construction of IDF-East and the RPPDF between the 200-East and 200-West Areas (see Figures 4–1 and 4–2). The former would disturb 32.8 hectares (81 acres), while the latter would disturb 29.5 hectares (73 acres). Nearly all the land that would be disturbed by these facilities is sagebrush habitat. Disturbance of sagebrush habitat would destroy microbiotic crusts. Hanford guidance may require the replacement of sagebrush habitat within IDF-East at a ratio of 1:1 and the RPPDF at a ratio of 3:1. Specific measures to mitigate the loss of sagebrush habitat would be set forth in a mitigation action plan prior to initiation of construction (DOE 2003f:21, 43). Operations are not expected to impact terrestrial resources. Closure of IDF-East and the RPPDF would involve placement of barriers, which would encompass slightly more land (1.6 hectares [4 acres]) than the waste disposal facilities, resulting in sagebrush habitat disturbance totaling 63.9 hectares (158 acres).

Under this disposal group, 41.7 hectares (103 acres) of Borrow Area C would be excavated to supply needed geologic material. As noted in Chapter 3, Section 3.2.7.1, the two major plant communities present within the area are Sandberg's bluegrass/cheatgrass (782.3 hectares [1,933 acres]) and needle-and-thread grass/Indian ricegrass (107 hectares [265 acres]). The latter represents an unusual and relatively pristine community type at Hanford and thus is considered a more highly valued community than the former. It is not possible to determine the specific impacts on ecological resources of developing Borrow Area C because the particular portion of the site from which geologic material would be excavated is not known. However, most of Borrow Area C can be developed without substantial adverse impacts on species or habitats (Sackschewsky and Downs 2007:8). To the extent that it is possible, the needle-and-thread grass/Indian ricegrass community should be avoided.

###### 4.3.7.2.1.2 Disposal Groups 2 and 3

As construction of IDF-East and the RPPDF under Disposal Groups 2 and 3 would disturb the same area (11.3 hectares [28 acres] and 228 hectares [564 acres], respectively) they are grouped together. Construction of both facilities could disturb up to their total area in sagebrush habitat depending on the exact placement of each. Disturbance of sagebrush habitat would destroy microbiotic crusts. Hanford guidance may require the replacement of sagebrush habitat within IDF-East at a ratio of 1:1 and the RPPDF at a ratio of 3:1. Specific measures to mitigate the loss of sagebrush habitat would be set forth in a mitigation action plan prior to construction (DOE 2003f:21, 43). Operations are not expected to impact terrestrial resources. Closure of IDF-East and the RPPDF would involve emplacement of barriers that would encompass slightly more land (7.7 hectares [19 acres]) than the waste disposal facilities. Sagebrush habitat disturbance could total 247 hectares (611 acres). The loss of any sagebrush habitat would be mitigated.

Under Disposal Groups 2 and 3, 159 hectares (392 acres) of Borrow Area C would be developed to supply needed geologic material. Impacts on terrestrial resources from the excavation of geologic material from the area would be somewhat greater than those described above for Disposal Group 1.

#### 4.3.7.2.2 Wetlands and Aquatic Resources

There are no wetlands or aquatic resources within any of the areas where expanded or new facilities would be constructed in the 200-East Area, 200-West Area, or between these two areas. Additionally, these resources are not found within Borrow Area C. Thus, there would be no impacts on wetlands or aquatic resources under this alternative.

#### 4.3.7.2.3 Threatened and Endangered Species

Construction and operations of the CWC, WRAP, and T Plant complex within the 200-West Area would not adversely affect any special status species because none have been recorded within the areas where these facilities would be built (Sackschewsky and Downs 2007:3). Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, designated critical habitat would not be adversely affected.

##### 4.3.7.2.3.1 Disposal Group 1

Under this disposal group, construction of IDF-East and the RPPDF would disturb a total of 62.3 hectares (154 acres) of sagebrush habitat. While no Federal or state threatened or endangered species were observed within either of the potential sites for these facilities, the sage sparrow (state candidate) was observed within IDF-East (see Chapter 3, Section 3.2.7.4). Surveys within the area to be occupied by the RPPDF identified the black-tailed jackrabbit, sage sparrow, and loggerhead shrike (all state candidates; the loggerhead shrike is also a Federal species of concern); one special status plant species, crouching milkvetch (state watch), was also observed. As noted above for construction and operations of the CWC, WRAP, and T Plant complex, designated critical habitat for the bull trout would not be affected by activities associated with this disposal group. Operations of new facilities within the 200 Areas are not expected to impact any federally or state-listed species.

State watch species should be considered during project planning, though mitigation would not be required. Impacts on state candidate species, which are considered Level III resources under the *Hanford Site Biological Resources Management Plan*, require mitigation where impacts would occur. When avoidance and minimization are not possible or are insufficient, mitigation via rectification or compensation is recommended (DOE 2001b:4.9, 8.11). A comprehensive mitigation action plan that would deal with impacts on listed species (as well as sagebrush habitat) would be developed prior to construction.

As noted in Chapter 3, Section 3.2.7.4, surveys have identified Piper's daisy, stalked-pod milkvetch (state watch), crouching milkvetch, and the long-billed curlew (state monitor) within the boundaries of Borrow Area C. Mitigation requirements for Piper's daisy and the two species of milkvetch are addressed above. Although avoidance and minimization of impacts on state monitor species is recommended, mitigation is not required (DOE 2001b:4.11). A mitigation action plan would be developed prior to excavation.

##### 4.3.7.2.3.2 Disposal Groups 2 and 3

Under both Disposal Groups 2 and 3, IDF-East and the RPPDF would disturb a total of 240 hectares (592 acres) of sagebrush habitat. The same areas would be used for these facilities under these disposal groups as those under Disposal Group 1, so the same species could be affected. However, because more habitat would be disturbed, the potential to impact these species would be greater. Mitigation

requirements would be similar to those noted above, including the need to prepare a mitigation action plan prior to the start of construction.

### 4.3.7.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

#### 4.3.7.3.1 Terrestrial Resources

Under this Waste Management alternative, the same expanded and new facilities would be constructed in the same locations within the 200-West Area as under Alternative 2. Further, they would occupy the same area. Thus, the impacts on terrestrial resources under Alternative 3 would be the same as those discussed in Section 4.3.7.2.1.

##### 4.3.7.3.1.1 Disposal Group 1

Although the RPPDF would be located in the same area and would be the same size (29.5 hectares [73 acres]) as under Alternative 2, two IDFs would be constructed under this alternative. IDF-East would be situated in the same location as under Alternative 2, but would be 29.9 hectares (74 acres) in size. IDF-West would be 2.4 hectares (6 acres) in size (see Figures 4–1 and 4–2). Due to the general similarity in size, impacts on the 200-East Area under this alternative would be essentially the same as those described above under Alternative 2 (see Section 4.3.7.2.1). The area where IDF-West would be located has been burned in the past and is presently considered recovering shrub-steppe habitat, and sagebrush has been replanted in the western portion of the site. However, its loss would not be mitigable according to the *Hanford Site Biological Resources Management Plan* (DOE 2001b; Sackschewsky and Downs 2007:4). Operations are not expected to impact terrestrial resources. Closure of IDF-East, IDF-West, and the RPDDF would encompass slightly more land (15 hectares [37 acres]) than the waste disposal facilities. Sagebrush habitat disturbance could total 76.9 hectares (190 acres). The loss of any additional sagebrush habitat would be mitigated.

To support activities under this disposal group, a total of 36.8 hectares (91 acres) within Borrow Area C would be required to supply geologic material. Although 4.9 hectares (12 acres) less land would be required under this alternative than under Alternative 2, the impacts on terrestrial resources of developing the site would be similar to those described in Section 4.3.7.2.1.1.

##### 4.3.7.3.1.2 Disposal Groups 2 and 3

Under Waste Management Alternative 3, the RPPDF would be located and sized (228 hectares [564 acres]) as noted under Alternative 2; thus, the impacts related to Disposal Groups 2 and 3 would be the same (see Section 4.3.7.2.1.2). As under Disposal Group 1, two IDFs would be constructed under Disposal Groups 2 and 3. IDF-West would be located in the same area and would be the same size as under Disposal Group 1. However, IDF-East would be smaller (i.e., 9.3 hectares [23 acres] versus 29.9 hectares [74 acres]). Thus, the impacts of construction and operations of IDF-East under Disposal Groups 2 and 3 would be somewhat less than those described under Disposal Group 1. Closure of IDF-East, IDF-West, and the RPPDF would encompass slightly more land (12.5 hectares [31 acres]) than the waste disposal facilities. Sagebrush habitat disturbance could total 253 hectares (624 acres). The loss of any additional sagebrush habitat would be mitigated.

As the requirement for geologic material would be about the same under this alternative as under Alternative 2, nearly the same land area (i.e., 157 hectares [388 acres] under Alternative 3 versus 159 hectares [392 acres] under Alternative 2) would need to be excavated from Borrow Area C. Thus, the impacts of developing the site on terrestrial resources would be the same as those described in Section 4.3.7.2.1.2.

#### 4.3.7.3.2 Wetlands and Aquatic Resources

There are no wetlands or aquatic resources within any of the areas where expanded or new facilities would be constructed in the 200-East Area, the 200-West Area, or between these two areas. Additionally, these resources are not found within Borrow Area C. Thus, there would be no impacts on wetlands or aquatic resources under this alternative.

#### 4.3.7.3.3 Threatened and Endangered Species

As noted in Section 4.3.7.3.1, there would be no difference in the number and size of expanded or new facilities required under Waste Management Alternative 3 compared with Alternative 2 (see Section 4.3.7.2.3). As special status species have not been recorded within the areas where new facilities or existing-facility expansions of the CWC, WRAP, and T Plant complex would be built, there would be no adverse impacts on this group of organisms. Both the Columbia and Yakima Rivers adjacent to Hanford have been designated as critical habitat for the bull trout. However, as there would be no short-term impacts on either river from construction or operation of new facilities associated with this alternative, designated critical habitat would not be adversely affected.

##### 4.3.7.3.3.1 Disposal Group 1

Impacts on threatened and endangered species resulting from construction of the RPPDF would be the same as those described above under Waste Management Alternative 2 because the facility would be located in the same area and would be the same size. In addition, impacts resulting from construction of IDF-East would be similar to those under Alternative 2 because the area to be disturbed would be only slightly smaller (2.8 hectares [7 acres]) (see Section 4.3.7.2.3.1). However, under this alternative, IDF-West would encompass 2.4 hectares (6 acres) within the 200-West Area. Surveys of the proposed site of IDF-West identified one listed species, the stalked-pod milkvetch (state watch) (see Chapter 3, Section 3.2.7.4). Although mitigation would not be required for this species, it should be considered during project planning.

As the requirement for geologic material would be about the same under this alternative as under Alternative 2, nearly the same land area would need to be excavated from Borrow Area C. Thus, the impacts on threatened and endangered species of developing the site would be the same as those described in Section 4.3.7.2.3.1.

##### 4.3.7.3.3.2 Disposal Groups 2 and 3

Impacts on threatened and endangered species resulting from construction of the RPPDF would be the same as those described above under Waste Management Alternative 2 because the facility would be located in the same area and would be the same size. In addition, impacts resulting from construction of IDF-East would be similar to those under Alternative 2 because the area to be disturbed would be only slightly smaller. Similar to Disposal Group 1, under this alternative, IDF-West would encompass 2.4 hectares (6 acres) within the 200-West Area, resulting in possible disturbance of the stalked-pod milkvetch. While this species should be considered during project planning, mitigation would not be required.

As the requirement for geologic material would be about the same under this alternative as under Alternative 2, nearly the same land area would need to be excavated from Borrow Area C. Thus, the impacts on threatened and endangered species of developing the site would be the same as those described in Section 4.3.7.2.3.2.

## 4.3.8 Cultural and Paleontological Resources

### 4.3.8.1 Alternative 1: No Action

Under the No Action Alternative, there would be no new construction within the 200 Areas. Treatment activities and storage would resume within the CWC, WRAP complex, and T Plant complex, and waste disposal would continue in LLBG 218-W-5 trenches 31 and 34. In addition, there would be no need to excavate geologic material from Borrow Area C. Therefore, there would be no changes to the 200 Areas, and no known cultural or paleontological resources would be impacted.

#### 4.3.8.1.1 Prehistoric Resources

Prehistoric resources located in the 200-East and 200-West Areas would not be disturbed under this alternative, as discussed above in Section 4.3.8.1.

#### 4.3.8.1.2 Historic Resources

Historic resources located in the 200-East and 200-West Areas would not be disturbed under this alternative, as discussed above in Section 4.3.8.1.

#### 4.3.8.1.3 American Indian Interests

Under this Waste Management alternative, there would be no impacts on American Indian interests.

#### 4.3.8.1.4 Paleontological Resources

There would be no impacts on known paleontological resources under this Waste Management alternative, as discussed above in Section 4.3.8.1.

### 4.3.8.2 Alternative 2: Disposal in IDF, 200-East Area Only

#### 4.3.8.2.1 Prehistoric Resources

Prehistoric resources located in the 200-East and 200-West Areas would not be disturbed under this Waste Management alternative because no known resources are located in the vicinity of the expanded storage and treatment and disposal facilities that would be constructed. If prehistoric resources were discovered during construction or excavation of geologic material, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented. This condition applies to all disposal groups.

##### 4.3.8.2.1.1 Disposal Groups 1, 2, and 3

Potential impacts on prehistoric resources are described in Section 4.3.8.2.1 and would be similar under all disposal groups.

#### 4.3.8.2.2 Historic Resources

Historic resources located in the 200-East and 200-West Areas would not be disturbed under this Waste Management alternative because no known resources are located in the vicinity of the expanded storage and treatment and disposal facilities that would be constructed. If historic resources were discovered during construction or excavation of geologic material, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating,

recording, curating, and managing these resources, would be implemented. This condition applies to all disposal groups.

#### 4.3.8.2.2.1 Disposal Groups 1, 2, and 3

Potential impacts on historic resources are described in Section 4.3.8.2.2 and would be similar under all disposal groups.

#### 4.3.8.2.3 American Indian Interests

Under this Waste Management alternative, there would be visual impacts on the viewscape from higher elevations such as Rattlesnake Mountain. If there were visual impacts on areas of interest, appropriate mitigation measures would be developed in consultation with area tribes. This condition applies to all disposal groups.

#### 4.3.8.2.3.1 Disposal Group 1

Under Waste Management Alternative 2, Disposal Group 1, IDF expansion and construction of the RPPDF would affect 62.3 hectares (154 acres) of land in the 200 Areas. In addition, a modified RCRA Subtitle C barrier would be constructed over both IDF-East and the RPPDF, increasing the area of the viewscape. Construction and operations would be visible from Rattlesnake Mountain, Gable Mountain, and Gable Butte, all of which have cultural importance to American Indians. An additional 41.7 hectares (103 acres) of Borrow Area C would be excavated to supply geologic material. Excavation would change the viewscape from Rattlesnake Mountain. Following closure, the area would be recontoured and revegetated.

#### 4.3.8.2.3.2 Disposal Groups 2 and 3

Waste Management Alternative 2, Disposal Group 2 or 3, would require 240 hectares (592 acres) of undeveloped land for construction of IDF-East and the RPPDF. This construction would noticeably change the area and be visible from Rattlesnake Mountain, Gable Mountain, and Gable Butte. This viewscape would last for the operational period of the sites.

Construction of modified RCRA Subtitle C barriers over other facilities during closure would increase the area of the viewscape. In addition, 159 hectares (392 acres) of land would be excavated from Borrow Area C. Excavated areas would be visible from Rattlesnake Mountain. Excavations in Borrow Area C would be recontoured and revegetated.

#### 4.3.8.2.4 Paleontological Resources

There would be no impacts on paleontological resources under this alternative because no such resources have been discovered in the 200 Areas or Borrow Area C. As is the case with cultural resources, if any paleontological resources were discovered during construction or excavation of geologic material, procedures are in place to properly manage the discovery site.

#### 4.3.8.2.4.1 Disposal Groups 1, 2, and 3

Potential impacts on paleontological resources are described in Section 4.3.8.2.4 and would be similar under all disposal groups.

#### 4.3.8.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

##### 4.3.8.3.1 Prehistoric Resources

Prehistoric resources located in the 200-East and 200-West Areas would not be disturbed under this Waste Management alternative because no known resources are located in the vicinity of the expanded storage and treatment and disposal facilities that would be constructed. If prehistoric resources were discovered during construction or excavation of geologic material, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented. This condition applies to all disposal groups.

###### 4.3.8.3.1.1 Disposal Groups 1, 2, and 3

Potential impacts on prehistoric resources are described in Section 4.3.8.3.1 and would be similar under all disposal groups.

##### 4.3.8.3.2 Historic Resources

Historic resources located in the 200-East and 200-West Areas would not be disturbed under this Waste Management alternative because no known resources are located in the vicinity of the expanded storage and treatment and disposal facilities that would be constructed. If historic resources were discovered during construction or excavation of geologic material, procedures set forth in the *Hanford Cultural Resources Management Plan* (DOE 2003g), which provides guidance for identifying, evaluating, recording, curating, and managing these resources, would be implemented. This condition applies to all disposal groups.

###### 4.3.8.3.2.1 Disposal Groups 1, 2, and 3

Potential impacts on historic resources are described in Section 4.3.8.3.2 and would be similar under all disposal groups.

##### 4.3.8.3.3 American Indian Interests

Under this Waste Management alternative, impacts on the viewscape from construction and operations of the T Plant expansion, two WRAP expansions, and the new CWC storage facility would be similar to those described under Alternative 2. There would be visual impacts on the viewscape from higher elevations such as Rattlesnake Mountain, Gable Mountain, and Gable Butte. If there were visual impacts on areas of interest, appropriate mitigation measures would be developed in consultation with area tribes.

###### 4.3.8.3.3.1 Disposal Group 1

This disposal group includes an IDF in both the 200-East and 200-West Areas. The total land area disturbed and the land required within Borrow Area C for excavation of geologic material would be nearly the same as under Alternative 2. Therefore, the visual impact on Rattlesnake Mountain would be the same as that described under Alternative 2, Disposal Group 1 (see Section 4.3.8.2.3.1). The placement of IDF-West on 2.4 hectares (6 acres) of undeveloped land would minimally add to the visual impact.

#### 4.3.8.3.3.2 Disposal Groups 2 and 3

Under Waste Management Alternative 3, Disposal Group 2 or 3, the land required for IDF-East, IDF-West, the RPPDF, and Borrow Area C would be nearly the same as that required under Alternative 2. Therefore, visual impacts on American Indian interests would be the same as those under Alternative 2 (see Section 4.3.8.2.3.2).

#### 4.3.8.3.4 Paleontological Resources

There would be no impacts on paleontological resources under this Waste Management alternative because no such resources have been discovered in the 200 Areas or Borrow Area C. As is the case with cultural resources, if any paleontological resources were discovered during construction or excavation of geologic material, procedures in place to properly manage the discovery site would be implemented. This condition applies to all disposal groups.

#### 4.3.8.3.4.1 Disposal Groups 1, 2, and 3

Potential impacts on paleontological resources are described in Section 4.3.8.3.4 and would be similar under all disposal groups.

### 4.3.9 Socioeconomics

The primary (direct) and secondary (indirect) impacts of waste disposal management on employment, regional demographics, housing and community services, and local transportation were analyzed for this section of this EIS. The potential primary impacts were identified by analyzing projected changes in employment (in terms of FTEs) and truck activity related to the activities under each alternative (see Appendix I). The projected changes in employment and truck activity have the potential to generate economic impacts that may affect the need for housing units, public services, and local transportation in the region.

The key underlying assumptions used to project changes in employment under each of the Waste Management alternatives and associated options were similar to those described in Section 4.1.9 under the Tank Closure alternatives. In addition to the No Action Alternative, the Waste Management alternatives propose various strategies for storage and treatment of both onsite and offsite waste. Waste Management Alternative 2 includes three disposal options that would use facilities located in the 200-East Area. Waste Management Alternative 3 includes three disposal options that would use facilities located in both the 200-East and 200-West Areas. Table 4–140 summarizes the indicators used to analyze the socioeconomic impacts under each alternative.

**Table 4–140. Waste Management Alternatives and Options – Summary of Peak Estimated Socioeconomic Indicators**

| Alternatives and Options | Peak Annual Workforce[a] (Peak Year) | Peak Daily Commuter Traffic | Peak Daily Truck Loads (Peak Year) | |
|---|---|---|---|---|
| | | | Off Site | On Site |
| **Alternative 1: No Action** | 109 (2009) | 88 | Less than 1 (2009) | 6 (2009) |
| **Alternatives 2 and 3: Waste Treatment and Storage** | 449 (2019–2050) | 360 | 2 (2011–2012) | 7 (2011–2012) |
| **Alternative 2 – Disposal in IDF, 200-East Area Only** | | | | |
| Disposal Group 1 | 1,180 (2051–2052) | 943 | 28 (2051–2052) | 428 (2051–2052) |
| Disposal Group 2 | 4,540 (2101–2102) | 3,640 | 34 (2101–2102) | 1,500 (2101–2102) |
| Disposal Group 3 | 4,540 (2166–2167) | 3,640 | 34 (2166–2167) | 1,500 (2166–2167) |
| **Alternative 3 – Disposal in IDF, 200-East and 200-West Areas** | | | | |
| Disposal Group 1 | 1,170 (2051–2052) | 940 | 28 (2051–2052) | 372 (2051–2052) |
| Disposal Group 2 | 4,500 (2101–2102) | 3,600 | 33 (2101–2102) | 1,480 (2101–2102) |
| Disposal Group 3 | 4,500 (2166–2167) | 3,600 | 33 (2166–2167) | 1,480 (2166–2167) |

[a] Workforce is rounded into full-time-equivalent quantities.
**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate.
**Key:** IDF=Integrated Disposal Facility.
**Source:** Appendix I; SAIC 2010c.

#### 4.3.9.1 Alternative 1: No Action

Because construction activities would be minimal under Alternative 1: No Action, the peak workforce was estimated to reach only 109 FTEs in 2009. This workforce, along with an additional 81 indirect jobs created as a secondary impact, would have little impact on regional economic characteristics, demographic characteristics, or housing and community services. In addition, the 114 offsite truck trips (less than 1 trip per day) and 1,460 onsite trips per year (approximately 6 trips per day), along with additional commuters (up to 88 vehicles per day in the peak year), would have little impact on local transportation in the ROI.

#### 4.3.9.2 Alternative 2: Disposal in IDF, 200-East Area Only

Under Alternative 2, at a peak of 449 FTEs from 2019 through 2050 (see Table 4–140), employment activity would be dominated by the workforce required to operate WRAP. The existence of these direct jobs is expected to result in the creation of another 336 indirect jobs in the ROI during the peak years. During the same time period, there could be up to 360 additional vehicles per day during the commute times. Local offsite truck traffic could run as high as 504 trucks (2 trips per day) during the peak years 2011 and 2012. Construction of the expanded facilities at WRAP would account for the major portion of this offsite and onsite truck traffic (1,880 truckloads, or approximately 7 trips per day). The socioeconomic impacts below would be affected by this workforce and its use of local vehicles in addition to any workers and vehicles needed for each of the disposal group options discussed below.

#### 4.3.9.2.1 Regional Economic Characteristics

##### 4.3.9.2.1.1 Disposal Group 1

The projected workforce that would be needed for construction of the barriers over IDF-East and the RPPDF would dominate the total workforce in 2051 and 2052. The estimated peak of 1,180 FTEs is less than 1 percent of the projected labor force (about 211,000) in the ROI in 2051 (BEA 2007). In addition to the direct employees associated with constructing barriers for Disposal Group 1, approximately 880 indirect positions would likely be created as a secondary impact on the ROI.

##### 4.3.9.2.1.2 Disposal Group 2

The projected workforce needed for construction of the barriers over IDF-East and the RPPDF would peak in 2101 and 2102. The estimated peak of 4,540 FTEs would be approximately 1.4 percent of the projected labor force (about 314,000) in the ROI in 2101, compared with approximately 10 percent in 2006 (BEA 2007). An additional 3,400 indirect jobs would be created in the ROI during 2101 and 2102.

##### 4.3.9.2.1.3 Disposal Group 3

The projected workforce needed for construction of the barriers over IDF-East and the RPPDF would peak much later than under Disposal Group 2, beginning in 2166. The estimated peak of 4,540 FTEs would be approximately 1 percent of the projected labor force (about 447,000) in the ROI in 2166, compared with approximately 10 percent in 2006 (BEA 2007). Creation of an additional 3,400 indirect jobs in the ROI would also occur in 2166 and 2167.

#### 4.3.9.2.2 Demographic Characteristics

##### 4.3.9.2.2.1 Disposal Group 1

The vast majority of workers under Disposal Group 1 would come from the local workforce in the ROI. There would be little in-migration of new workers and their families; therefore, any changes in demographic characteristics of the Tri-Cities area and the ROI would be minimal.

##### 4.3.9.2.2.2 Disposal Groups 2 and 3

The near-term impacts (less than 100 years) from the workforces under Disposal Groups 2 and 3 would have little impact on the local workforce in the ROI. There would be little in-migration of new workers and their families; therefore, any changes in demographic characteristics of the Tri-Cities area and the ROI would be minimal.

#### 4.3.9.2.3 Housing and Community Services

For each of the three disposal groups, the peak workforce required would be relatively small compared with the local population and would have little or no impacts on demands for housing, schools, and other community services within the ROI.

#### 4.3.9.2.4 Local Transportation

##### 4.3.9.2.4.1 Disposal Group 1

Under Alternative 2, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to 943 passenger vehicles per day are expected to commute to the site during the peak years of 2051 and 2052. Based on the predicted offsite truck activity of up to 7,210 truck trips per year (28 trips per day) in 2051 and 2052 and the predicted commuter traffic, the LOS on offsite roads in the

Hanford area is expected to be impacted (see Chapter 3, Section 3.2.9.4). Onsite truck trips would also peak in 2051 and 2052; up to 111,000 onsite truck trips per year (approximately 428 trips per day) would be needed to transport concrete aggregate materials and other borrow materials for construction of the barriers over IDF-East and the RPPDF.

#### 4.3.9.2.4.2 Disposal Groups 2 and 3

Under Alternative 2, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to 3,640 passenger vehicles per day are expected to commute to the site during the peak years of 2101 and 2102 for Disposal Group 2, and 2166 and 2167 for Disposal Group 3. Based on the predicted offsite truck activity of up to 8,840 truck trips (34 trips per day) in the peak years and the predicted commuter traffic, the LOS on offsite roads in the Hanford area is expected to be impacted (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak at 392,000 truck trips per year (approximately 1,500 trips per day) when concrete aggregate materials and other borrow materials are being transported to construct the barriers over IDF-East and the RPPDF.

### 4.3.9.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

As under Waste Management Alternative 2, the socioeconomic impacts under Alternative 3 would be affected by the workforce and local vehicles needed for treatment and storage of the waste as well as any workers and vehicles needed for each of the disposal group options below (see Table 4–140).

#### 4.3.9.3.1 Regional Economic Characteristics

#### 4.3.9.3.1.1 Disposal Group 1

Similar to Waste Management Alternative 2, the projected workforce needed for construction of the barriers over IDF-East and the RPPDF would dominate the total workforce for 2 years, beginning in 2051. The peak estimate of 1,170 FTEs would be less than 1 percent of the projected labor force of about 211,000 in 2051 in the ROI (BEA 2007). In addition to these direct employees, approximately 880 indirect positions would likely be created as a secondary impact on the ROI during the peak years.

#### 4.3.9.3.1.2 Disposal Group 2

Similar to Waste Management Alternative 2, the projected workforce needed for construction of the barriers over IDF-East and the RPPDF would peak in 2101 and 2102. The peak estimate of 4,500 FTEs would be approximately 1.4 percent of the projected labor force of about 314,000 in the ROI in 2101, compared with approximately 10 percent in 2006 (BEA 2007). Approximately 3,400 indirect jobs in 2101 and 2102 would likely be created in the ROI in addition to these direct employees.

#### 4.3.9.3.1.3 Disposal Group 3

Similar to Waste Management Alternative 2, the projected closure workforce needed for construction of the barriers over IDF-East and the RPPDF would peak much later than under Disposal Group 2, beginning in 2166. The estimated peak (4,500 FTEs) would be approximately 1 percent of the projected labor force (about 447,000) in the ROI in 2166, compared with approximately 10 percent in 2006 (BEA 2007). The existence of these jobs is expected to result in the creation of another 3,400 indirect jobs in the ROI.

#### 4.3.9.3.2 Demographic Characteristics

##### 4.3.9.3.2.1 Disposal Group 1

Similar to Waste Management Alternative 2, the vast majority of workers under Disposal Group 1 would come from the local workforce in the ROI. There would be little in-migration of new workers and their families; therefore, any changes in demographic characteristics of the Tri-Cities area and the ROI would be minimal.

##### 4.3.9.3.2.2 Disposal Groups 2 and 3

Similar to Waste Management Alternative 2, the near-term impacts (less than 100 years) of the estimated workforces under Disposal Groups 2 and 3 would have little effect on the local workforce in the ROI. As there would be little in-migration of new workers and their families, any changes in demographic characteristics of the Tri-Cities area and the ROI would be minimal.

#### 4.3.9.3.3 Housing and Community Services

For each of the three disposal groups, the peak workforce required would be relatively small compared to the local population and would have little or no impacts on demands for housing, schools, and other community services within the ROI.

#### 4.3.9.3.4 Local Transportation

##### 4.3.9.3.4.1 Disposal Group 1

Similar to Waste Management Alternative 2, under Alternative 3, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to 940 passenger vehicles per day are expected to commute to the site during the peak years of 2051 and 2052. Based on the predicted offsite truck activity of up to 7,180 truck trips per year (28 trips per day) in 2051 and 2052 and the predicted commuter traffic, the LOS on offsite roads in the Hanford area is expected to be impacted (see Chapter 3, Section 3.2.9.4). Onsite truck trips would also peak in 2051 and 2052; up to 97,000 onsite truck trips per year (approximately 372 trips per day) would be needed to transport concrete aggregate materials and other borrow materials for construction of the barriers over IDF-East, IDF-West, and the RPPDF.

##### 4.3.9.3.4.2 Disposal Groups 2 and 3

Under Waste Management Alternative 3, assuming an average of 1.25 persons per passenger vehicle (Malley 2007), up to about 3,600 passenger vehicles per day are expected to commute to the site during the peak years (2101–2102 for Disposal Group 2, and 2166–2167 for Disposal Group 3). Based on predicted offsite truck activity, up to 8,570 truck trips (33 trips per day) in peak years, and predicted commuter traffic, the LOS on offsite roads in the Hanford area is expected to be impacted (see Chapter 3, Section 3.2.9.4). Onsite truck trips would peak at 384,000 truck trips per year (approximately 1,480 trips per day) when concrete aggregate materials and other borrow materials are being transported for construction of the barriers over IDF-East, IDF-West, and the RPPDF.

### 4.3.10 Public and Occupational Health and Safety—Normal Operations

Details of the assessment methodology for determining radiological exposure to workers and members of the public are presented in Appendix K. Radiological impacts are presented for three public receptors: the general population living within 80 kilometers (50 miles) of Hanford, an MEI living near the site boundary, and an onsite member of the public who works at the Columbia Generating Station, LIGO, or US Ecology. Impacts on the general population were evaluated for a residential scenario whereby people

are exposed to radioactive materials emitted from project facilities. Radiological exposure would occur through inhalation, direct exposure to the radioactive plume and material deposited on the ground, and ingestion of contaminated food products from animals raised locally and fruits and vegetables grown in a family garden (DOE 1995:A-7). Impacts on the offsite MEI were evaluated for a scenario that included the same exposure pathways assumed for the general population, but assuming a greater amount of time spent outdoors and a higher rate of contaminated food consumption. Impacts on an individual working at the Columbia Generating Station, LIGO, or US Ecology would occur due to inhalation and exposure to the plume and material deposited on the ground. The respective doses are presented as total effective doses.

In addition to members of the public, workers directly involved in activities associated with the Waste Management alternatives and nearby noninvolved workers may receive radiation doses. Doses to a worker were calculated based on an FTE worker. This dose evaluation assumed that an FTE worker has a 2,080-hour work year. In practice, the number of workers who might receive a radiation dose may be larger than the number assumed in this analysis, resulting in a smaller average dose per worker. A noninvolved worker is a person working at the site who is incidentally exposed to the radioactive air emissions associated with the alternatives considered. The noninvolved worker was assumed to be about 100 meters (110 yards) away or at a nearby facility only on workdays.

Small operational impacts on members of the public are expected from all of the Waste Management alternatives. Routine radioactive air emissions resulting from LLBG operations are expected to be negligible; the more likely source of emissions from waste management operations would be the waste processing facilities, where waste containers would be opened and waste sorted, reduced in size or otherwise treated, and repackaged. Consequently, the analyses of impacts on the public were based on the radioactive air emissions projected to occur from waste processing facilities such as a new facility at the T Plant or an expansion of WRAP.

#### 4.3.10.1 Alternative 1: No Action

##### 4.3.10.1.1 Radiological Impacts on the Public

Under the Waste Management No Action Alternative, there would be no incremental radiological impacts on the public due to operations. WRAP and T Plant emissions from current waste processing activities contribute to the offsite radioactive air emissions that make up the current affected environment. Therefore, they are accounted for in the offsite doses discussed in Chapter 3.

##### 4.3.10.1.2 Radiological Impacts on Workers

Table 4–141 presents dose and risk estimates for an involved FTE worker receiving an average exposure. The average annual radiation worker dose would be 200 millirem, less than the Administrative Control Level of 500 millirem (DOE 2006a:2; Fluor Hanford 2006:2-1). A worker receiving the average annual radiation dose over the 29 years of this activity would receive a cumulative dose of 5,800 millirem, corresponding to a risk of about $3 \times 10^{-3}$ (1 chance in 300) of developing an LCF.

The total effective dose equivalent to the worker population from the 29 years of occupational exposure under this alternative was estimated to be 37 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, no LCFs due to occupational radiological exposure are expected in the worker population.

**Table 4–141. Waste Management Alternative 1 Radiological Impacts on Workers**

| | Years[a] | Dose | Latent Cancer Fatality Risk[b] |
|---|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | | |
| Average annual impact | 2007–2035 | 200 millirem | $1\times10^{-4}$ |
| Impact over life of project[c] | 2007–2035 | 5,800 millirem | $3\times10^{-3}$ |
| **Life-of-Project Worker Population** | 2007–2035 | 37 person-rem | 0 ($2\times10^{-2}$) |

a Years indicate the portion of the project during which a worker dose is expected under this alternative.

b For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

c Impact over the life of the project is the average impact a full-time-equivalent radiation worker would receive while working on this project. It is determined by multiplying the average annual impact by the smaller of the project duration (29 years) or 40 years (assuming a worker spends a 40-year career supporting this project).

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.3.

### 4.3.10.2 Alternative 2: Disposal in IDF, 200-East Area Only

Under this Waste Management alternative, doses to the public would result from radioactive air emissions associated with waste processing in new or expanded facilities constructed at the T Plant and the CWC. Worker doses would result from waste processing facility and waste disposal operations.

#### 4.3.10.2.1 Radiological Impacts on the Public

Table 4–142 presents estimated doses to the general population and the MEI under Alternative 2. Activities resulting in radioactive air emissions would occur from 2013 through 2051. Over the operational life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a cumulative dose of 0.000077 person-rem, and the MEI would receive a cumulative dose of 0.0000056 millirem. Using the risk factor of 0.0006 LCFs per person-rem (DOE 2003h:9), no LCFs are expected in the general population under this alternative. The probability of the MEI developing an LCF would be essentially zero (less than 1 chance in 300 billion). The MEI would be located across the river east-northeast of the 200-East Area. Radioactive air emissions would remain fairly constant over the duration of the alternative, with an annual population dose of 0.0000020 person-rem and an annual MEI dose of 0.00000015 millirem.

Radioactive air emissions from the 200 Area solid waste management facilities could also impact a member of the public who works at Hanford. The annual radiation dose to an individual at US Ecology who is exposed while at work would be 0.00000064 millirem. Over the 39-year period during which there would be radioactive emissions from waste management activities, a worker at US Ecology would receive a cumulative dose of 0.000025 millirem, with a corresponding risk of developing an LCF of essentially zero (about 1 chance in 100 billion).

**Table 4–142. Waste Management Alternative 2 Radiological Impacts on the Public**

| Receptor | Impacts over Life of Project[a] | | Peak Annual Impacts | |
|---|---|---|---|---|
| | **Dose (person-rem)** | **Latent Cancer Fatalities[b]** | **Dose (person-rem per year)** | **Latent Cancer Fatalities[b]** |
| General population | 0.000077 | 0 ($5\times10^{-8}$) | 0.0000020 | 0 ($1\times10^{-9}$) |
| | **Dose (millirem)** | **Lifetime Risk of a Latent Cancer Fatality[c]** | **Dose (millirem per year)** | **Lifetime Risk of a Latent Cancer Fatality[c]** |
| Maximally exposed individual | 0.0000056 | $3\times10^{-12}$ | 0.00000015 | $9\times10^{-14}$ |
| Maximally exposed onsite individual | 0.000025 | $1\times10^{-11}$ | 0.00000064 | $4\times10^{-13}$ |

a Impacts accrued over the operational life of the project analyzed in this alternative, 2013–2051.

b The reported value is the projected number of latent cancer fatalities (LCFs) among the population and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

c The lifetime risk of developing an LCF is based on the risk factor of 0.0006 LCFs per rem.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.3.

#### 4.3.10.2.2 Radiological Impacts on Workers

Radiological exposure of workers would occur from activities at the waste processing facilities and from LLBG operations. Table 4–143 presents dose and risk estimates for an involved and a noninvolved worker receiving an average exposure from activities at the waste processing facilities. Radiation doses to workers from LLBG operations of different durations are addressed in the following sections. The three different durations reflect the amounts of time when disposal capabilities would be needed to support various Tank Closure alternatives. Doses resulting from waste processing facility operations would be the same, regardless of the disposal group selected.

**Table 4–143. Waste Management Alternative 2 Radiological Impacts on Workers**

| | Years[a] | Dose | Latent Cancer Fatality Risk[b] |
|---|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | | |
| Average annual impact | 2013–2051 | 200 millirem | $1\times10^{-4}$ |
| Impact over the life of project[c] | 2013–2051 | 7,800 millirem | $5\times10^{-3}$ |
| **Life-of-Project Worker Population** | 2013–2051 | 3,000 person-rem | 2 |
| **Noninvolved Worker–Years of Maximum Impact** | | | |
| 100-meter distance | 2013–2051 | 0.00039 millirem | $2\times10^{-10}$ |

a Years indicate the portion of the project during which a worker dose is expected under this alternative.

b For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

c Impact over the life of the project is the average impact a full-time-equivalent radiation worker would receive while working on this project. It is determined by multiplying the average annual impact by the smaller of the project duration (39 years) or 40 years (assuming a worker spends a 40-year career supporting this project).

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.3.

The average annual radiation worker dose would be 200 millirem, less than the Administrative Control Level of 500 millirem. A worker receiving the average annual radiation dose over the 39 years of this activity would receive a cumulative dose of 7,800 millirem, corresponding to a risk of $5 \times 10^{-3}$ (1 chance in 200) of developing an LCF.

The total effective dose equivalent to the worker population from 39 years of occupational exposure under this alternative was estimated to be 3,000 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, 2 LCFs could be expected in the worker population. This number should be viewed in the context of the duration of the project and the DOE administrative controls that limit worker dose. Due to the duration of this activity, the cumulative dose would be distributed over a few generations of workers. Even though the worker population dose implies a number of LCFs, the operational controls used by DOE and its contractors would limit the dose that individual workers would receive and, therefore, the risk of developing an LCF. A majority of the worker population dose under this alternative (2,800 person-rem, or 93 percent) is associated with operation of WRAP.

The potential dose to a noninvolved worker would result from exposure to and inhalation of radioactive contaminants released to the atmosphere from waste processing activities. The potential dose to a noninvolved worker would be 0.00039 millirem per year, well less than the DOE recommended Administrative Control Level of 500 millirem per year (DOE 2006a:2; Fluor Hanford 2006:2-1). The annual risk of an LCF as a result of this exposure would be essentially zero (less than 1 chance in 4 trillion).

#### 4.3.10.2.2.1 Disposal Group 1

Table 4–144 presents dose and risk estimates for a radiation worker involved in LLBG operations who would receive an average radiological exposure. LLBG operations would be conducted for 44 years under Disposal Group 1. The average annual dose would be 200 millirem, less than the Administrative Control Level of 500 millirem. A worker who received the average annual radiation dose over a 40-year career would receive a dose of 8,000 millirem, corresponding to a risk of $5 \times 10^{-3}$ (1 chance in 200) of developing an LCF.

**Table 4–144. Waste Management Alternative 2, Disposal Group 1, Radiological Impacts on Workers**

| | Years[a] | Dose | Latent Cancer Fatality Risk[b] |
|---|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | | |
| Average annual impact | 2007–2050 | 200 millirem | $1\times10^{-4}$ |
| Impact over the life of project[c] | 2007–2050 | 8,000 millirem | $5\times10^{-3}$ |
| **Life-of-Project Worker Population** | 2007–2050 | 360 person-rem | 0 ($2\times10^{-1}$) |

[a] Years indicate the portion of the project during which a worker dose is expected under this alternative and disposal group.

[b] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

[c] Impact over the life of the project is the average impact a full-time-equivalent radiation worker would receive while working on this project. It is determined by multiplying the average annual impact by the smaller of the project duration or 40 years (assuming a worker spends a 40-year career supporting this project).

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.3.

The total effective dose equivalent to the worker population from 44 years of occupational exposure during disposal operations was estimated to be 360 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, no LCFs due to occupational radiological exposure are expected in the worker population.

The total radiological impact on the worker population would be 3,360 person-rem, the combination of the doses from disposal operations (360 person-rem) and waste processing facility operations (3,000 person-rem) (see Section 4.3.10.2.2). Applying the risk factor of 0.0006 LCFs per person-rem, 2 LCFs could be expected in the worker population. This number should be viewed in the context of the duration of the project and the DOE administrative controls that limit worker dose. Due to the duration of this activity, the cumulative dose would be distributed over a few generations of workers. Even though the worker population dose implies a number of LCFs, the operational controls used by DOE and its contractors would limit the dose that individual workers would receive and, therefore, the risk of developing an LCF.

#### 4.3.10.2.2.2 Disposal Group 2

Table 4–145 presents dose and risk estimates for a radiation worker involved in LLBG operations who would receive an average radiological exposure. LLBG operations would be conducted for 94 years under Disposal Group 2. The average annual dose would be 200 millirem, less than the Administrative Control Level of 500 millirem. A worker who received the average annual radiation dose over a 40-year career would receive a cumulative dose of 8,000 millirem, corresponding to a risk of $5 \times 10^{-3}$ (1 chance in 200) of developing an LCF.

**Table 4–145. Waste Management Alternative 2, Disposal Group 2, Radiological Impacts on Workers**

| | Years[a] | Dose | Latent Cancer Fatality Risk[b] |
|---|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | | |
| Average annual impact | 2007–2100 | 200 millirem | $1\times10^{-4}$ |
| Impact over the life of project[c] | 2007–2100 | 8,000 millirem | $5\times10^{-3}$ |
| **Life-of-Project Worker Population** | 2007–2100 | 3,600 person-rem | 2 |

[a] Years indicate the portion of the project during which a worker dose is expected under this alternative.
[b] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).
[c] Impact over the life of the project is the average impact a full-time-equivalent radiation worker would receive while working on this project. It is determined by multiplying the average annual impact by the smaller of the project duration or 40 years (assuming a worker spends a 40-year career supporting this project).
**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.
**Source:** Appendix K, Section K.2.3.

The total effective dose equivalent to the worker population from 94 years of occupational exposure during disposal operations was estimated to be 3,600 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, 2 LCFs due to occupational radiological exposure could be expected in the worker population. A majority of the worker population dose under this alternative (3,400 person-rem, or 94 percent) is associated with operation of the RPPDF.

The total radiological impact on the worker population would be 6,600 person-rem, the combination of the doses from disposal operations (3,600 person-rem) and waste processing facility operations (3,000 person-rem) (see Section 4.3.10.2.2). Applying the risk factor of 0.0006 LCFs per person-rem, 4 LCFs could be expected in the worker population. This number should be viewed in the context of the duration of the project and the DOE administrative controls that limit worker dose. Due to the duration of

this activity, the cumulative dose would be distributed over several generations of workers. Even though the worker population dose implies a number of LCFs, the operational controls used by DOE and its contractors would limit the dose that individual workers would receive and, therefore, the risk of developing an LCF.

#### 4.3.10.2.2.3 Disposal Group 3

Table 4–146 presents dose and risk estimates for a radiation worker involved in LLBG operations who would receive an average radiological exposure. LLBG operations would be conducted for 159 years under Disposal Group 3. The radiological impact on an individual worker would be the same as that under Disposal Group 2—an average annual dose of 200 millirem and a cumulative dose from 40 years of exposure of 8,000 millirem. The risk of developing an LCF associated with a dose of 8,000 millirem would be $5 \times 10^{-3}$ (1 chance in 200).

The total effective dose equivalent to the worker population from 159 years of occupational exposure during Disposal Group 3 operations was estimated to be 6,400 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, 4 LCFs due to occupational radiological exposure could be expected in the worker population. A majority of the worker population dose under this alternative (6,200 person-rem, or 97 percent) would be associated with operation of the RPPDF.

**Table 4–146. Waste Management Alternative 2, Disposal Group 3, Radiological Impacts on Workers**

| | Years[a] | Dose | Latent Cancer Fatality Risk[b] |
|---|---|---|---|
| **Average Involved Full-Time-Equivalent Worker** | | | |
| Average annual impact | 2007–2165 | 200 millirem | $1\times10^{-4}$ |
| Impact over the life of project[c] | 2007–2165 | 8,000 millirem | $5\times10^{-3}$ |
| **Life-of-Project Worker Population** | 2007–2165 | 6,400 person-rem | 4 |

[a] Years indicate the portion of the project during which a worker dose is expected under this alternative.

[b] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number (see Appendix K, Section K.1.1.6).

[c] Impact over the life of the project is the average impact a full-time-equivalent radiation worker would receive while working on this project. It is determined by multiplying the average annual impact by the smaller of the project duration or 40 years (assuming a worker spends a 40-year career supporting this project).

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Appendix K, Section K.2.3.

The total radiological impact on the worker population would be 9,400 person-rem, the combination of the doses from disposal operations (6,400 person-rem) and waste processing facility operations (3,000 person-rem) (see Section 4.3.10.2.2). Applying the risk factor of 0.0006 LCFs per person-rem, 6 LCFs could be expected in the worker population. This number should be viewed in the context of the duration of the project and the DOE administrative controls employed that limit worker dose. Due to the duration of this activity, the cumulative dose would be distributed over several generations of workers. Even though the worker population dose implies a number of LCFs, the operational controls used by DOE and its contractors would limit the dose that individual workers would receive and, therefore, the risk of developing an LCF.

#### 4.3.10.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Radiological impacts under this alternative would be the same as those under Alternative 2. Doses to the public would result from radioactive air emissions associated with waste processing in new or expanded facilities constructed at the T Plant and the CWC. Worker doses would result from waste processing facility and waste disposal operations.

##### 4.3.10.3.1 Radiological Impacts on the Public

Radiological impacts on the public under this alternative would be the same as those under Alternative 2 (see Section 4.3.10.2.1).

##### 4.3.10.3.2 Radiological Impacts on Workers

Radiological impacts on workers under this alternative would be the same as those under Waste Management Alternative 2 (see Section 4.3.10.2.2). Radiological exposure to workers would occur from waste processing facility activities and LLBG operations. Doses resulting from waste processing facility operations would be the same, regardless of the disposal group selected.

###### 4.3.10.3.2.1 Disposal Group 1

Radiological impacts on workers from disposal operations under Waste Management Alternative 3, Disposal Group 1, would be the same as those under Alternative 2, Disposal Group 1 (see Section 4.3.10.2.2.1).

###### 4.3.10.3.2.2 Disposal Group 2

Radiological impacts on the worker population from disposal operations for the duration of the project under Waste Management Alternative 3, Disposal Group 2, were estimated to be slightly smaller than those under Alternative 2. The collective worker population dose from 94 years of disposal operations would be about 3,500 person-rem. This small reduction in worker population dose would not change the estimated 2 LCFs that could occur in the worker population. The average annual worker dose would be the same as that under Alternative 2, Disposal Group 2 (see Section 4.3.10.2.2.2).

###### 4.3.10.3.2.3 Disposal Group 3

Radiological impacts on workers from disposal operations under Waste Management Alternative 3, Disposal Group 3, would be the same as those under Alternative 2, Disposal Group 3 (see Section 4.3.10.2.2.3).

## 4.3.11 Public and Occupational Health and Safety—Facility Accidents

This section addresses impacts on workers and the public associated with potential accidents under the Waste Management alternatives and associated disposal groups. For each Waste Management alternative, the radiological impacts of postulated accident scenarios were quantified for an MEI living near Hanford, the offsite population as a whole, and a noninvolved worker. Hazardous chemical impacts were also evaluated. Accident consequences for an involved worker were not quantified. While involved workers are expected to be in or near waste treatment, storage, and disposal facilities analyzed under the Waste Management alternatives, the number and location of personnel relative to a postulated accident are unknown. In the event of an accident involving chemicals or radioactive materials, workers near an accident could be at risk of serious injury or fatality. Safety procedures, safety equipment, and protective barriers are typical features that would prevent or minimize worker impacts. Additionally, following initiation of accident/site emergency alarms, workers in adjacent areas of the facility would evacuate in accordance with the technical area and facility emergency operating procedures and training. Therefore, involved worker impacts are not discussed further relative to the Waste Management alternatives. The impacts of intentional destructive act scenarios would be comparable to those of scenarios Solid Waste Operations Complex (SWOC) FIR-4 (large fire of waste containers outside a facility) and SWOC EE-2 (aircraft crash).

There would be no radiological accidents associated with facility construction in support of Hanford waste treatment and storage activities or new disposal facility construction under the various disposal groups evaluated as part of Waste Management Alternatives 2 and 3. Any hazardous chemical accidents associated with facility construction (e.g., fuel spills) would be typical of those normally associated with industrial construction materials, hazards, and practices. The projected accident consequences under each Waste Management alternative are presented in the following sections. Details of the methodology for assessing the potential impacts on workers and the public associated with postulated accidents are presented in Appendix K, Section K.3.

### 4.3.11.1 Alternative 1: No Action

#### 4.3.11.1.1 Radiological Impacts of Airborne Releases

Under Waste Management Alternative 1, reasonably foreseeable accidents include fires involving stored waste, spills of waste containers, external events, and natural phenomena. Table 4–147 shows the consequences of the accidents associated with the No Action Alternative. Table 4–148 shows the annual cancer risks for the accidents.

**Table 4–147. Waste Management Alternative 1 Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[b] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[c] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Single-drum deflagration (SWOC FIR-1) | 0.00079 | $5\times10^{-7}$ | 4.7 | 0 ($3\times10^{-3}$) | 0.84 | $5\times10^{-4}$ |
| Medium fire inside facility (SWOC FIR-6) | 0.015 | $9\times10^{-6}$ | 87 | 0 ($5\times10^{-2}$) | 16 | $9\times10^{-3}$ |
| Glovebox or greenhouse fire (SWOC FIR-8) | 0.028 | $2\times10^{-5}$ | 170 | 0 ($1\times10^{-1}$) | 30 | $4\times10^{-2}$ |
| Large fire of waste containers outside facility (SWOC FIR-4) | 0.25 | $1\times10^{-4}$ | 1,500 | 1 | 260 | $3\times10^{-1}$ |
| Handling spill of single waste container (SWOC SP-2) | 0.00015 | $9\times10^{-8}$ | 0.87 | 0 ($5\times10^{-4}$) | 0.16 | $9\times10^{-5}$ |
| Large handling spill of boxes or multiple waste containers (SWOC SP-3A) | 0.00072 | $4\times10^{-7}$ | 4.3 | 0 ($3\times10^{-3}$) | 0.77 | $5\times10^{-4}$ |
| Spill of single large-diameter container (SWOC SP-4) | 0.0070 | $4\times10^{-6}$ | 42 | 0 ($3\times10^{-2}$) | 7.5 | $4\times10^{-3}$ |
| Design-basis seismic event (SWOC NPH-1) | 0.0068 | $4\times10^{-6}$ | 41 | 0 ($2\times10^{-2}$) | 7.3 | $4\times10^{-3}$ |
| Beyond-design-basis accident (SWOC NPH-2) | 0.026 | $2\times10^{-5}$ | 160 | 0 ($9\times10^{-2}$) | 28 | $3\times10^{-2}$ |
| Range fire (SWOC EE-1) | 0.12 | $7\times10^{-5}$ | 740 | 0 ($4\times10^{-1}$) | 130 | $2\times10^{-1}$ |
| Aircraft crash (SWOC EE-2) | 0.28 | $2\times10^{-4}$ | 1,700 | 1 | 300 | $4\times10^{-1}$ |

[a] The alphanumeric code following the accident's title (e.g., SWOC FIR-1) corresponds with the code in the accident's description in Appendix K, Section K.3.6.

[b] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.

[c] Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.

[d] The reported value is the projected number of LCFs among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** LCF=latent cancer fatality; SWOC=Solid Waste Operations Complex.

**Source:** Appendix K, Section K.3.7.3.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–148) is the large fire of waste containers outside a facility (SWOC FIR-4). For this accident, no LCFs are expected to occur in the offsite population; however, there would be an increased risk of an LCF of about $9 \times 10^{-3}$ per year (1 chance in 110 per year of a single LCF occurring among the population). For the MEI, the increase in the likelihood of an LCF would be about $1 \times 10^{-6}$ per year (1 chance in 680,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be about $3 \times 10^{-3}$ per year (1 chance in 320 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) from the accident's location, the risk of exposure to radioactivity resulting in eventual development of an LCF would depend on the distance and other factors, but would generally be higher. The accident that would have the highest consequences would be the aircraft crash (SWOC EE-2). The consequences would be about 1.2 times those shown for the large fire of waste containers outside a facility (SWOC FIR-4).

Under Waste Management Alternative 1, operations would continue for a project period of 29 years; during this time period, workers and the public would be at risk of exposure to radiation from an accident. For the highest-risk accident (accident SWOC FIR-4) in Table 4–148, the annual cancer risks to the offsite population and noninvolved workers during this 29-year project period would be a zero ($3 \times 10^{-1}$) increase in the number of LCFs in the offsite population, a $4 \times 10^{-5}$ increase in the likelihood of an LCF for the MEI, and a $9 \times 10^{-2}$ increase in the likelihood of an LCF for the noninvolved worker.

**Table 4–148. Waste Management Alternative 1 Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Single-drum deflagration (SWOC FIR-1) | $1\times10^{-2}$ | $5\times10^{-9}$ | 0 ($3\times10^{-5}$) | $5\times10^{-6}$ |
| Medium fire inside facility (SWOC FIR-6) | $1\times10^{-2}$ | $9\times10^{-8}$ | 0 ($5\times10^{-4}$) | $9\times10^{-5}$ |
| Glovebox or greenhouse fire (SWOC FIR-8) | $1\times10^{-2}$ | $2\times10^{-7}$ | 0 ($1\times10^{-3}$) | $4\times10^{-4}$ |
| Large fire of waste containers outside facility (SWOC FIR-4) | $1\times10^{-2}$ | $1\times10^{-6}$ | 0 ($9\times10^{-3}$) | $3\times10^{-3}$ |
| Handling spill of single waste container (SWOC SP-2) | $1\times10^{-2}$ | $9\times10^{-10}$ | 0 ($5\times10^{-6}$) | $9\times10^{-7}$ |
| Large handling spill of boxes or multiple waste containers (SWOC SP-3A) | $1\times10^{-2}$ | $4\times10^{-9}$ | 0 ($3\times10^{-5}$) | $5\times10^{-6}$ |
| Spill of single large-diameter container (SWOC SP-4) | $1\times10^{-2}$ | $4\times10^{-8}$ | 0 ($3\times10^{-4}$) | $4\times10^{-5}$ |
| Design-basis seismic event (SWOC NPH-1) | $1\times10^{-3}$ | $4\times10^{-9}$ | 0 ($2\times10^{-5}$) | $4\times10^{-6}$ |
| Beyond-design-basis accident (SWOC NPH-2) | $1\times10^{-3}$ | $2\times10^{-8}$ | 0 ($9\times10^{-5}$) | $3\times10^{-5}$ |
| Range fire (SWOC EE-1) | $1\times10^{-2}$ | $7\times10^{-7}$ | 0 ($4\times10^{-3}$) | $2\times10^{-3}$ |
| Aircraft crash (SWOC EE-2) | $3\times10^{-5}$ | $5\times10^{-9}$ | 0 ($3\times10^{-5}$) | $1\times10^{-5}$ |

[a] The alphanumeric code following the accident's title (e.g., SWOC FIR-1) corresponds with the code in the accident's description in Appendix K, Section K.3.6.
[b] Increased risk of a latent cancer fatality to the individual.
[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively.
[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** SWOC=Solid Waste Operations Complex.
**Source:** Appendix K, Section K.3.7.3.

#### 4.3.11.1.2 Hazardous Chemical Impacts

Hazardous waste exists in two major areas in the SWOC. The first is the toxic chemical contents of waste containers encountered during retrieval and handling of TRU waste containers and suspect TRU waste containers. The second toxic chemical within the SWOC is the sodium in storage modules at the CWC facility. The future disposition of the bulk sodium stored at the CWC is addressed in Section 4.2. The consequences of accidents involving the bulk sodium are addressed in Section 4.2.11.1.2.

To estimate the hazard significance and potential impacts of an accidental release of the hazardous chemicals within the SWOC waste containers, the containers were evaluated using the methodologies for identifying hazardous chemicals that should be subjected to quantitative analyses in both the DOE safety

analysis and emergency management programs. The results of this evaluation are discussed in Appendix K; the results indicate that, except for sodium metal mentioned above, none of the chemicals listed exist in a form or quantity that represents a sufficiently high health hazard that would require analysis and inclusion in a documented facility safety analysis or an emergency preparedness hazards assessment.

The hazardous chemicals in the waste management containers are generally mixed together with the hazardous radioactive materials. Radiological accident scenarios are expected to release both radioactive materials and hazardous (toxic) chemicals. The scenario most likely to release a substantial quantity of hazardous chemicals is a fire event involving multiple waste containers. From the results reported in Appendix K for this type of event, the dose consequence to the noninvolved worker at 100 meters (110 yards) would be 210 rem; doses from the other fire scenarios analyzed ranged from approximately 1 rem to a maximum of 300 rem.

The evaluation of chemical exposures shows that exposures to the noninvolved worker do not exceed the AEGLs (i.e., 60-minute AEGL-2 value) established by the U.S. Environmental Protection Agency (EPA) and implemented by DOE as the trigger point for planning protective measures for the public in the event of a large release of hazardous chemicals. The equivalent radiological threshold established by EPA for planning protective measures in the event of a large release of radioactive material is 1 rem. From the results of the radiological analysis and the chemical evaluations, it is clear that the potential health impacts of the radioactive components of the waste far outweigh those of the chemical components. Therefore, further quantitative analysis to determine the potential human health impacts of an accidental release of hazardous chemicals from within the mixed waste is not necessary.

#### 4.3.11.2 Alternative 2: Disposal in IDF, 200-East Area Only

##### 4.3.11.2.1 Radiological Impacts of Airborne Releases

Table 4–149 shows the consequences of the accidents associated with Alternative 2. Table 4–150 shows the annual cancer risks for the accidents. In addition to the accident scenarios evaluated under Alternative 1, two new accident scenarios involving ILAW containers disposed of in IDF-East are possible under Alternative 2.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–150) is the large fire of waste containers outside a facility (SWOC FIR-4). For this accident, no LCFs are expected in the offsite population; however, there would be an increased risk of an LCF of about $9 \times 10^{-3}$ per year (about 1 chance in 110 per year of a single LCF) occurring among the population. For the MEI, the increased likelihood of an LCF would be about $1 \times 10^{-6}$ per year (about 1 chance in 680,000 per year). For a noninvolved worker located 100 meters (110 yards) from the accident, the increased likelihood of an LCF would be about $3 \times 10^{-3}$ per year (about 1 chance in 320 per year). For any involved or noninvolved worker closer than 100 meters (110 yards) from the accident's location, the risk of exposure to radioactivity resulting in eventual development of an LCF would depend on the distance and other factors, but would generally be higher. The accident that would have the highest consequences would be the aircraft crash (SWOC EE-2). The consequences would be about 1.2 times those shown for the large fire of waste containers outside a facility.

**Table 4–149. Waste Management Alternatives 2 and 3 Radiological Consequences of Accidents**

| Accident[a] | Maximally Exposed Individual | | Offsite Population[b] | | Noninvolved Worker | |
|---|---|---|---|---|---|---|
| | Dose (rem) | LCF[c] | Dose (person-rem) | LCF[d] | Dose (rem) | LCF[b] |
| Single-drum deflagration (SWOC FIR-1) | 0.00079 | $5\times10^{-7}$ | 4.7 | 0 ($3\times10^{-3}$) | 0.84 | $5\times10^{-4}$ |
| Medium fire inside facility (SWOC FIR-6) | 0.015 | $9\times10^{-6}$ | 87 | 0 ($5\times10^{-2}$) | 16 | $9\times10^{-3}$ |
| Glovebox or greenhouse fire (SWOC FIR-8) | 0.028 | $2\times10^{-5}$ | 170 | 0 ($1\times10^{-1}$) | 30 | $4\times10^{-2}$ |
| Large fire of waste containers outside facility (SWOC FIR-4) | 0.25 | $1\times10^{-4}$ | 1,500 | 1 | 260 | $3\times10^{-1}$ |
| Handling spill of single waste container (SWOC SP-2) | 0.00015 | $9\times10^{-8}$ | 0.87 | 0 ($5\times10^{-4}$) | 0.16 | $9\times10^{-5}$ |
| Large handling spill of boxes or multiple waste containers (SWOC SP-3A) | 0.00072 | $4\times10^{-7}$ | 4.3 | 0 ($3\times10^{-3}$) | 0.77 | $5\times10^{-4}$ |
| Spill of single large-diameter container (SWOC SP-4) | 0.0070 | $4\times10^{-6}$ | 42 | 0 ($3\times10^{-2}$) | 7.5 | $4\times10^{-3}$ |
| Design-basis seismic event (SWOC NPH-1) | 0.0068 | $4\times10^{-6}$ | 41 | 0 ($2\times10^{-2}$) | 7.3 | $4\times10^{-3}$ |
| Beyond-design-basis accident (SWOC NPH-2) | 0.026 | $2\times10^{-5}$ | 160 | 0 ($9\times10^{-2}$) | 28 | $3\times10^{-2}$ |
| Range fire (SWOC EE-1) | 0.12 | $7\times10^{-5}$ | 740 | 0 ($4\times10^{-1}$) | 130 | $2\times10^{-1}$ |
| Aircraft crash (SWOC EE-2) | 0.28 | $2\times10^{-4}$ | 1,700 | 1 | 300 | $4\times10^{-1}$ |
| Earthmover shears tops off six ILAW containers (ILAW1) | 0.0000034 | $2\times10^{-9}$ | 0.020 | 0 ($1\times10^{-5}$) | 0.0036 | $2\times10^{-6}$ |
| Crushing of ILAW containers by falling crane boom (ILAW2) | 0.000031 | $2\times10^{-8}$ | 0.18 | 0 ($1\times10^{-4}$) | 0.033 | $2\times10^{-5}$ |

[a] The alphanumeric code following the accident's title (e.g., SWOC FIR-1) corresponds with the code in the accident's description in Appendix K, Section K.3.6.

[b] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively (see Appendix K, Section K.2.1.1.3.2).

[c] Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.

[d] The reported value is the projected number of LCFs among the population, assuming the accident occurs, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

**Key:** ILAW=immobilized low-activity waste; LCF=latent cancer fatality; SWOC=Solid Waste Operations Complex.

**Source:** Appendix K, Section K.3.7.3.

#### 4.3.11.2.1.1 Disposal Group 1

Under Disposal Group 1, disposal operations would continue for 44 years. For the highest-risk accident shown in Table 4–150 (SWOC FIR-4), there would be no ($4 \times 10^{-1}$) additional LCFs in the offsite population as a consequence of the 44-year project period. As a result of the 44-year duration of the project, there would be an increased risk of an LCF for an MEI of about $6 \times 10^{-5}$ (1 chance in 15,000) and an increased risk of an LCF for the noninvolved worker of about $1 \times 10^{-1}$ (1 chance in 7).

**Table 4–150. Waste Management Alternatives 2 and 3 Annual Cancer Risks from Accidents**

| Accident[a] | Frequency (per year) | Risk of Latent Cancer Fatality | | |
|---|---|---|---|---|
| | | Maximally Exposed Individual[b] | Offsite Population[c, d] | Noninvolved Worker[b] |
| Single-drum deflagration (SWOC FIR-1) | $1\times10^{-2}$ | $5\times10^{-9}$ | 0 ($3\times10^{-5}$) | $5\times10^{-6}$ |
| Medium fire inside facility (SWOC FIR-6) | $1\times10^{-2}$ | $9\times10^{-8}$ | 0 ($5\times10^{-4}$) | $9\times10^{-5}$ |
| Glovebox or greenhouse fire (SWOC FIR-8) | $1\times10^{-2}$ | $2\times10^{-7}$ | 0 ($1\times10^{-3}$) | $4\times10^{-4}$ |
| Large fire of waste containers outside facility (SWOC FIR-4) | $1\times10^{-2}$ | $1\times10^{-6}$ | 0 ($9\times10^{-3}$) | $3\times10^{-3}$ |
| Handling spill of single waste container (SWOC SP-2) | $1\times10^{-2}$ | $9\times10^{-10}$ | 0 ($5\times10^{-6}$) | $9\times10^{-7}$ |
| Large handling spill of boxes or multiple waste containers (SWOC SP-3A) | $1\times10^{-2}$ | $4\times10^{-9}$ | 0 ($3\times10^{-5}$) | $5\times10^{-6}$ |
| Spill of single large-diameter container (SWOC SP-4) | $1\times10^{-2}$ | $4\times10^{-8}$ | 0 ($3\times10^{-4}$) | $4\times10^{-5}$ |
| Design-basis seismic event (SWOC NPH-1) | $1\times10^{-3}$ | $4\times10^{-9}$ | 0 ($2\times10^{-5}$) | $4\times10^{-6}$ |
| Beyond-design-basis accident (SWOC NPH-2) | $1\times10^{-3}$ | $2\times10^{-8}$ | 0 ($9\times10^{-5}$) | $3\times10^{-5}$ |
| Range fire (SWOC EE-1) | $1\times10^{-2}$ | $7\times10^{-7}$ | 0 ($4\times10^{-3}$) | $2\times10^{-3}$ |
| Aircraft crash (SWOC EE-2) | $3\times10^{-5}$ | $5\times10^{-9}$ | 0 ($3\times10^{-5}$) | $1\times10^{-5}$ |
| Earthmover shears tops off six ILAW containers (ILAW1) | $1\times10^{-1}$ | $2\times10^{-10}$ | 0 ($1\times10^{-6}$) | $2\times10^{-7}$ |
| Crushing of ILAW containers by falling crane boom (ILAW2) | $1\times10^{-1}$ | $2\times10^{-9}$ | 0 ($1\times10^{-5}$) | $2\times10^{-6}$ |

[a] The alphanumeric code following the accident's title (e.g., SWOC FIR-1) corresponds with the code in the accident's description in Appendix K, Section K.3.6.
[b] Increased risk of a latent cancer fatality to the individual.
[c] Based on populations of 546,746 and 589,668 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively (see Appendix K, Section K.2.1.1.3.2).
[d] The reported value is the projected number of latent cancer fatalities (LCFs) among the population, based on the probability (frequency) of the accident occurring, and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).
**Key:** ILAW=immobilized low-activity waste; SWOC=Solid Waste Operations Complex.
**Source:** Appendix K, Section K.3.7.3.

#### 4.3.11.2.1.2 Disposal Group 2

Under Disposal Group 2, disposal operations would continue for 94 years. For the highest-risk accident shown in Table 4–150 (SWOC FIR-4), there would be a risk of about 1 ($8 \times 10^{-1}$) additional LCF in the offsite population as a consequence of the 94-year project period. As a result of the 94-year duration of the project, there would be an increased risk of an LCF for an MEI of about $1 \times 10^{-4}$ (1 chance in 7,000) and an increased risk of an LCF for the noninvolved worker of about $3 \times 10^{-1}$ (1 chance in 3). This risk to an MEI or noninvolved worker is theoretical because the same individual would not be present for the duration of the project.

#### 4.3.11.2.1.3 Disposal Group 3

Under Disposal Group 3, disposal operations would continue for 159 years. For the highest-risk accident shown in Table 4–150 (SWOC FIR-4), there would be a risk of 1 (1.4) additional LCF in the offsite population as a consequence of the 159-year project period. As a result of the 159-year duration of the project, there would be an increased risk of an LCF for an MEI of about $2 \times 10^{-4}$ (1 chance in 4,300) and an increased risk of an LCF for the noninvolved worker of about $5 \times 10^{-1}$ (1 chance in 2). This risk to an MEI or noninvolved worker is theoretical because the same individual would not be present for the duration of the project.

### 4.3.11.2.2 Hazardous Chemical Impacts

The hazardous chemical impacts of accidents under Alternative 2 (including Disposal Groups 1, 2, and 3) would be the same as those addressed under Alternative 1 (see Section 4.3.11.1.2).

## 4.3.11.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

### 4.3.11.3.1 Radiological Impacts of Airborne Releases

The accident scenarios under Alternative 3 are the same as those addressed under Alternative 2. The consequences and annual risks of the accidents are presented in Tables 4–149 and 4–150.

#### 4.3.11.3.1.1 Disposal Groups 1, 2, and 3

The radiological impacts of reasonably anticipated accidents under Alternative 3, Disposal Groups 1, 2, and 3, would be the same as those addressed under Alternative 2 (see Sections 4.3.11.2.1.1, 4.3.11.2.1.2, and 4.3.11.2.1.3).

### 4.3.11.3.2 Hazardous Chemical Impacts

The hazardous chemical impacts of accidents under Alternative 3 (including Disposal Groups 1, 2, and 3) would be the same as those addressed under Alternative 1 (see Section 4.3.11.1.2).

## 4.3.11.4 Intentional Destructive Acts

This section addresses potential impacts of intentional destructive acts at waste management facilities. Release scenarios and impacts resulting from intentional destructive acts may be similar to a number of the accidents scenarios analyzed in this EIS. An additional intentional destructive act scenario was also considered. This scenario would apply to all Waste Management alternatives.

**Large Aircraft Crash at Solid Waste Operations Complex Storage Building.** Impacts of the aircraft crash accident scenario (SWOC EE-2) were extrapolated to reflect the potential impacts of an intentional destructive act that could involve a large aircraft, substantial amounts of fuel, and damage to a large number of containers in a SWOC storage building. The radiological impacts would be about 18 times greater than those calculated for the accident scenario. The offsite population dose was estimated to be 31,000 person-rem, which would result in 19 additional LCFs. The MEI dose would be 5.0 rem, corresponding to an increased risk of an LCF of $3 \times 10^{-3}$. The noninvolved worker dose would be 5,400 rem, which could result in a near-term fatality.

The impacts and mitigation of intentional destructive acts are discussed in more detail in Appendix K, Section K.3.11.

### 4.3.12 Public and Occupational Health and Safety—Transportation

Impacts of transporting radioactive materials are predominantly categorized as radiological impacts or nonradiological impacts. Radiological impacts are those associated with the accidental release of radioactive materials and the effects of low levels of radiation emitted during incident-free transportation. Nonradiological impacts are those associated with transportation, regardless of the nature of the cargo, such as accidents resulting in death or injury when there is no release of radioactive material.

Transportation impacts include the impacts of incident-free transportation, as well as those of transportation accidents. The impacts of both incident-free transportation and transportation accidents can be radiological and nonradiological. Incident-free transportation impacts include radiological impacts on the public and workers from the radiation field surrounding the transportation package. Nonradiological impacts of potential transportation accidents include traffic accident fatalities. The impact of a specific radiological accident is expressed in terms of probabilistic risk, which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences. The overall risk is obtained by summing the individual risks from all accident severities, irrespective of their likelihood of occurrence. The analysis of accident risks takes into account a spectrum of accidents ranging from high-probability accidents of low severity (e.g., fender benders) to hypothetical high-severity accidents that have a low probability of occurrence. Additional information is provided in Section 4.1.12, and further details on modeling and parameter selections are provided in Appendix H.

Table 4–151 provides the estimated number of shipments of various wastes under each alternative by waste type. A shipment is defined as the amount of waste transported on a single truck or a single railcar. The values presented for offsite shipments in Table 4–151 are the estimated number of shipments required to transport about 75,500 cubic meters (99,000 cubic yards) of LLW and MLLW from DOE facilities. This activity is common to both Alternatives 2 and 3. The values presented for the offsite-waste shipments in Table 4–151 are estimated truck transports. Offsite rail shipments were assumed to be one-half of the values given.

**Table 4–151. Waste Management Alternatives – Estimated Number of Shipments**

| Alternative | Number of Shipments | | | |
|---|---|---|---|---|
| | Offsite Shipments[a] | | Onsite Shipments | |
| | LLW[b] | MLLW[b] | LLW[b] | MLLW[b] |
| Alternative 1 | 0 | 0 | 810 | 200 |
| Alternative 2 | 12,800 | 1,300 | 810 | 200 |
| Alternative 3 | 12,800 | 1,300 | 810 | 200 |

[a] These are estimates for truck transports. Rail transports would be one-half of the values given.
[b] These include both the contact- and remote-handled wastes.
**Key:** LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste.
**Source:** Appendix H, Section H.7.3.

Table 4–152 summarizes the transportation risks under each alternative and shows that the dose to the population along the routes (see column 6 of Table 4–152: offsite) would be between the lowest expected dose of about 140 person-rem, which is associated with rail transport of offsite waste to Hanford, and the highest expected dose of about 350 person-rem, which is associated with truck transport of offsite waste to Hanford. The additional LCFs expected from such exposures to the general population would be less than 1 for all alternatives, ranging from 0.08 to 0.21. Rail transport would lead to lower doses to the general population due to the smaller number of transports and lower exposure of the people in the vicinity of stations where the reclassification and inspections would take place. Almost half of the doses to the general population resulting from truck transports would result from exposures at rest areas, gas stations, and stops along the route.

The lowest expected dose to workers transporting wastes (see column 4 of Table 4–152: offsite) would be about 49 person-rem for offsite rail shipments, and the highest would be 2,500 person-rem for offsite truck shipments. The additional LCFs among the exposed crew would range from 0 (0.03) to 2 (1.5). Rail transport would result in lower doses to rail crews because they would be located farther away from the waste packages than the truck crews. Note that the maximum annual dose to a transportation crewmember would be 100 millirem per year, unless the individual is a trained radiation worker, in which case the maximum annual dose would be 2 rem (DOE Standard 1098-2008). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure of 2 rem is 0.0012 (about 1 chance in 833). Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

**Table 4–152. Waste Management Alternatives – Risks of Transporting Radioactive Waste**

| Alternative | Location (transport mode) | Number of Shipments | Incident-Free | | | | Accident | | One-Way Offsite Travel ($10^6$ km) |
|---|---|---|---|---|---|---|---|---|---|
| | | | Crew | | Population | | | | |
| | | | Dose (person-rem) | Risk[a] | Dose (person-rem) | Risk[a] | Rad. Risk[a, b] | Nonrad. Risk[a] | |
| Alternative 1 | Off site | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | On site | 1,000 | 2.6 | 0.002 | 0.08 | 0.00005 | $7.6\times10^{-11}$ | 0.0004 | N/A |
| Alternative 2 | Off site (T) | 14,200 | 2,500 | 1.5 | 350 | 0.21 | $1.2\times10^{-5}$ | 1.7 | 51.3 |
| | Off site (R) | 7,100 | 49 | 0.03 | 140 | 0.08 | $1.8\times10^{-6}$ | 4.1 | 26.1 |
| | On site | 1,000 | 4.3 | 0.003 | 0.14 | 0.00008 | $1.6\times10^{-10}$ | 0.0006 | N/A |
| Alternative 3 | Off site (T) | 14,200 | 2,500 | 1.5 | 350 | 0.21 | $1.2\times10^{-5}$ | 1.7 | 51.3 |
| | Off site (R) | 7,100 | 49 | 0.03 | 140 | 0.08 | $1.8\times10^{-6}$ | 4.1 | 26.1 |
| | On site | 1,000 | 2.6 | 0.002 | 0.08 | 0.00005 | $7.6\times10^{-11}$ | 0.0004 | N/A |

[a] Risk is expressed in terms of latent cancer fatalities, except for the nonradiological, where it refers to the number of accident fatalities.
[b] To calculate population dose (person-rem), divide the values in this column by 0.0006. For additional insight on how this dose is calculated, see the text in Section 4.1.12.
**Note:** To convert kilometers to miles, multiply by 0.6214.
**Key:** km=kilometers; N/A=not applicable—(no offsite waste would be accepted at the Hanford Site); nonrad.=nonradiological; R=rail transport; rad.=radiological; T=truck transport.
**Source**: Appendix H, Section H.7.3.

The risks to different receptors under incident-free transportation conditions were estimated on a per-trip or per-event basis. This basis was used because it is unlikely that the same person would be exposed to multiple events; for those that could have multiple exposures, the dose over the duration of transportation activities could be calculated by multiplying by the number of events or trips. The dose to a person stuck in traffic next to a shipment of RH-waste in a Type B cask for 30 minutes was calculated to be about 10 millirem. For a receptor who is a member of the public residing along a transportation route, the dose over the duration of transportation activities would depend on the number of truck or rail shipments passing a particular point and would be independent of the actual route being considered. The maximum dose to this resident, if all the materials are shipped along this route, would be less than 5 millirem under all of the action alternatives. Refer to Appendix H, Table H–17, for additional results.

The expected number of traffic fatalities from accidents involving radioactive material transport would range from 2 (1.7) for truck shipments and 4 (4.1) for rail shipments. Considering that the duration of acceptance of offsite waste would be about 30 years and the average number of traffic fatalities in the U.S. is about 40,000 per year, the expected risk of a traffic fatality under all of the alternatives is small.

Table 4–153 summarizes the impacts of transporting the nonradioactive support materials required to construct new facilities, materials required to support operational activities, and waste en route to storage or burial locations. The construction materials considered include concrete, cement, sand/gravel/dirt,

asphalt, steel, and piping, among others. The table shows the impacts in terms of the total numbers of kilometers, accidents, and fatalities for all alternatives. The results in Table 4–153 indicate that, under the Waste Management alternatives, the potential for traffic fatalities would be the largest under Disposal Group 3. However, the absolute risk would be small, considering that the operational period for this disposal group would be over 120 years.

**Table 4–153. Waste Management Alternatives – Estimated Impacts of Construction and Operational Material Transport**

| Alternatives/Disposal Groups | Total Distance Traveled (million kilometers) | Number of Accidents | Number of Fatalities |
|---|---|---|---|
| Alternative 1 | 0.42 | 0.09 | 0.006 |
| Alternative 2 | 4.2 | 0.84 | 0.05 |
| Disposal Group 1 | 8.2 | 1.7 | 0.11 |
| Disposal Group 2 | 29 | 5.9 | 0.38 |
| Disposal Group 3 | 37 | 7.5 | 0.49 |
| Alternative 3 | 4.2 | 0.84 | 0.05 |
| Disposal Group 1 | 7.4 | 1.5 | 0.10 |
| Disposal Group 2 | 29 | 5.9 | 0.38 |
| Disposal Group 3 | 37 | 7.6 | 0.49 |

**Note:** To convert kilometers to miles, multiply by 0.6214.
**Source:** Appendix H, Section H.8.

### 4.3.12.1 Alternative 1: No Action

Under this alternative, transportation activities would be limited to shipments of onsite waste to the active burial grounds in the 200-West Area. About 1,000 shipments would be transported from various facilities at Hanford to the 200-West Area of Hanford for disposal (see Table 4–151). These transports would mostly use onsite roads.

#### 4.3.12.1.1 Impacts of Incident-Free Transportation

The dose to transportation workers from all onsite transportation activities would be 2.6 person-rem, and the dose to the exposed population would be 0.08 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (0.002) LCFs among transportation workers and 0 (0.00005) LCFs among the exposed population (see Table 4–152).

#### 4.3.12.1.2 Impacts of Accidents During Transportation

As stated earlier, two sets of analyses were performed to evaluate the transportation accident impacts: analyses of the impacts of maximum reasonably foreseeable accidents and analyses of the impacts of all accidents, regardless of their severity or likelihood of occurrence.

The maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 chance in 10 million per year) would not lead to a release. The consequences of the most severe onsite accident that could release the content of the waste were estimated to have a likelihood of less than 1 chance in 1 billion per year.

Estimates of the total transportation accident risks under this alternative included a radiation dose risk to the population of $1.3 \times 10^{-7}$ person-rem, resulting in $7.6 \times 10^{-11}$ LCFs (1 chance in 13 billion), and traffic accidents resulting in 0 (0.0004) fatalities (see Table 4–152).

#### 4.3.12.1.3 Impacts of Construction and Operational Material Transports

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, canisters) were evaluated. The impacts of transport activities under this alternative would be 420,000 kilometers (261,000 miles) traveled, 0 (0.09) accidents, and 0 (0.006) fatalities over the entire period from construction through deactivation and closure (see Table 4–153). No disposal groups were analyzed under this alternative.

### 4.3.12.2 Alternative 2: Disposal in IDF, 200-East Area Only

Under this alternative, limited offsite waste would be accepted for disposal. This waste would require about 7,100 rail shipments or about 14,200 truck shipments. In addition, about 1,000 truck shipments would be made to transport onsite waste to storage locations and burial grounds. The total distance traveled carrying radioactive materials would be 26.1 million kilometers (16.2 million miles) on public rail or 51.3 million kilometers (20.8 million miles) on public roads.

#### 4.3.12.2.1 Impacts of Incident-Free Transportation

The dose to transportation workers from offsite transportation activities was estimated to be about 49 person-rem for rail shipments and 2,500 person-rem for truck shipments. The additional LCFs among the transportation workers would range from 0 (0.03) to 2 (1.5). The dose to transportation workers from onsite transport activity was estimated to be 4.3 person-rem, resulting in 0 (0.003) additional LCFs (see Table 4–152). As stated under Alternative 2, the maximum annual dose to a transportation worker would be 100 millirem, unless the individual is a trained radiation worker, in which case the maximum annual dose would be 2 rem (DOE Standard 1098-2008). Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

The expected cumulative dose to the general population during offsite transportation of waste by truck would be about 350 person-rem, resulting in 0 (0.21) additional LCFs. The expected doses to the general population during offsite transportation of waste by rail would be about 140 person-rem, resulting in 0 (0.08) additional LCFs. Rail transport would lead to lower doses to the general population due to the smaller number of transports and lower exposure of the people in the vicinity of stations where the reclassification and inspections would take place. Almost half of the doses to the general population resulting from truck transports would result from exposures at rest areas, gas stations, and stops along the route.

##### 4.3.12.2.1.1 Disposal Group 1

The estimates of the incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1.

##### 4.3.12.2.1.2 Disposal Group 2

The estimates of the incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1.

##### 4.3.12.2.1.3 Disposal Group 3

The estimates of the incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1.

#### 4.3.12.2.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident under this alternative (with a probability of occurrence of more than 1 chance in 10 million per year) is a severe-impact, high-temperature-fire rail accident involving a shipment of RH-LLW. The consequences of such an accident in terms of population dose in the rural, suburban, and urban zones are 1.6, 25, and 120 person-rem, respectively. The likelihood of occurrence of such consequences per shipment is less than $2.5 \times 10^{-7}$, $2.8 \times 10^{-8}$, and $5.3 \times 10^{-9}$ in rural, suburban, and urban zones, respectively. This accident could result in a dose of 0.00031 rem to an individual hypothetically exposed to the accident plume for 2 hours at a distance of 100 meters (330 feet), with a corresponding LCF risk of $1.9 \times 10^{-7}$.

Estimates of the total transportation accident risks (both on and off site) under this alternative are a radiation dose risk to the population ranging from 0.003 to 0.02 person-rem, resulting in $1.8 \times 10^{-6}$ to $1.2 \times 10^{-5}$ LCFs, and traffic accidents resulting in 2 (1.7) to 4 (4.1) fatalities for rail or truck shipments, respectively (see Table 4–152). All of the risks would result from offsite shipment of wastes to Hanford. These results indicate that the annual accident risks would be small, considering that the duration of these activities would be 35 years.

##### 4.3.12.2.2.1 Disposal Group 1

The estimates of the accident risks during transport of waste materials for this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1.

##### 4.3.12.2.2.2 Disposal Group 2

The estimates of the accident risks during transport of waste materials for this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1.

##### 4.3.12.2.2.3 Disposal Group 3

The estimates of the accident risks during transport of waste materials for this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1.

#### 4.3.12.2.3 Impacts of Construction and Operational Material Transports

The impacts of transporting construction materials (e.g., concrete, gravel/sand/soil, asphalt, steel, piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, canisters) were evaluated. In addition, under this alternative, three different combinations of waste capacities (disposal groups) that would be allocated to IDF-East and the RPPDF over varying operational timeframes to accommodate the waste generated under the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives were evaluated. The transportation impacts under this alternative would consist of two parts: (1) transports in support of construction and operation of the disposal group IDF, and (2) transports in support of activities within the alternative (see Table 4–153). The impacts of transportation activities under the disposal groups would range from 8.2 to 37 million kilometers (5.1 to 23 million miles) traveled and 2 (1.7) to 8 (7.6) accidents, and would result in 0 (0.11 to 0.49) fatalities over the entire period, from IDF construction through deactivation and closure. The impacts of transport activities under this alternative would be 4.2 million kilometers (2.6 million miles) traveled, 1 (0.84) accident, and 0 (0.05) fatalities over the entire period from IDF construction through deactivation and closure (see Table 4–153).

#### 4.3.12.2.3.1 Disposal Group 1

The impacts of transportation activities under this disposal group would be 8.2 million kilometers (5.1 million miles) traveled, 2 (1.7) accidents, and 0 (0.11) fatalities over the entire period from IDF construction through deactivation and closure.

#### 4.3.12.2.3.2 Disposal Group 2

The impacts of transportation activities under this disposal group would be 29 million kilometers (18 million miles) traveled, 6 (5.9) accidents, and 0 (0.38) fatalities over the entire period from IDF construction through deactivation and closure.

#### 4.3.12.2.3.3 Disposal Group 3

The impacts of transportation activities under this disposal group would be 37 million kilometers (23 million miles) traveled, 8 (7.5) accidents, and 0 (0.49) fatalities over the entire period from IDF construction through deactivation and closure.

### 4.3.12.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Under this alternative, as explained under Alternative 2, limited offsite waste would be accepted for disposal. This waste would require about 7,100 rail shipments or 14,200 truck shipments. In addition, about 1,000 truck shipments would be made to transport onsite waste to storage locations and burial grounds (see Table 4–152). The total distance traveled carrying radioactive materials would be 26.1 million kilometers (16.2 million miles) on public rail or 51.3 million kilometers (31.9 million miles) on public roads.

#### 4.3.12.3.1 Impacts of Incident-Free Transportation

The doses to transportation workers and the population from offsite transportation activities would be similar to those described under Alternative 2. The dose to transportation workers and the exposed population from onsite transport activity was estimated to be 2.6 and 0.08 person-rem, respectively, resulting in 0 (0.002) additional LCFs among the transportation workers and 0 (0.0005) additional LCFs among the exposed population. These doses would be slightly lower than those under Alternative 2 because of the shorter distance between the generator and disposal location.

#### 4.3.12.3.1.1 Disposal Group 1

The estimates of the incident-free operational risks during transport of waste materials under this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1.

#### 4.3.12.3.1.2 Disposal Group 2

The estimates of the incident-free operational risks during transport of waste materials under this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1.

#### 4.3.12.3.1.3 Disposal Group 3

The estimates of the incident-free operational risks during transport of waste materials under this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1.

#### 4.3.12.3.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident and the corresponding consequences under this alternative would be similar to those described under Alternative 2.

The estimated total transportation accident risks (both on and off site) under this alternative would be similar to those described under Alternative 2.

##### 4.3.12.3.2.1 Disposal Group 1

The estimates of the accident risks during transport of waste materials under this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1.

##### 4.3.12.3.2.2 Disposal Group 2

The estimates of the accident risks during transport of waste materials under this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1.

##### 4.3.12.3.2.3 Disposal Group 3

The estimates of the accident risks during transport of waste materials under this disposal group have already been accounted for, as discussed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1.

#### 4.3.12.3.3 Impacts of Construction and Operational Material Transports

The impacts of transporting construction and operational materials under this alternative would be similar to those described under Alternative 2 (see Table 4–153). In addition, similar to Alternative 2, under this alternative, three different combinations of waste capacities (disposal groups) that would be allocated to IDF-East, IDF-West, and the RPPDF over varying operational timeframes to accommodate the waste generated under the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives were evaluated. The impacts of transportation activities under the disposal groups would range from 7.4 to 37 million kilometers (4.6 to 23 million miles) traveled and 2 (1.5) to 8 (7.6) accidents, and would result in 0 (0.10 to 0.49) fatalities over the entire period from facility construction through deactivation and closure.

##### 4.3.12.3.3.1 Disposal Group 1

The impacts of transportation activities under this disposal group would be 7.4 million kilometers (4.6 million miles) traveled, 2 (1.5) accidents, and 0 (0.10) fatalities over the entire period from facility construction through deactivation and closure.

##### 4.3.12.3.3.2 Disposal Group 2

The impacts of transportation activities under this disposal group would be 29 million kilometers (18 million miles) traveled, 6 (5.9) accidents, and 0 (0.38) fatalities over the entire period from facility construction through deactivation and closure.

##### 4.3.12.3.3.3 Disposal Group 3

The impacts of transportation activities under this disposal group would be 37 million kilometers (23 million miles) traveled, 8 (7.6) accidents, and 0 (0.49) fatalities over the entire period from facility construction through deactivation and closure.

## 4.3.13 Environmental Justice

### 4.3.13.1 Alternative 1: No Action

This section addresses potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations under Waste Management Alternative 1. Because public access to Hanford is restricted, the majority of impacts under this Waste Management alternative would be associated with onsite activities and would not affect populations residing off site; thus, the potential for environmental justice concerns would be small. Resource areas that could be impacted and that may affect populations residing off site include public and occupational health and safety due to normal operations and facility accidents, as well as air quality and transportation.

Section 4.3.10.1.1 discusses short-term impacts on the public resulting from normal operations under Waste Management Alternative 1. Radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

Under this alternative, there would be no incremental radiological impacts on the public or the offsite MEI due to normal operations. Therefore, Waste Management Alternative 1 would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations.

Section 4.3.11.1.1 discusses the radiological impacts of airborne releases for facility accidents under Waste Management Alternative 1. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, activities under the No Action Alternative would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents.

Section 4.3.11.1.2 discusses the hazardous chemical impacts of facility accidents under Waste Management Alternative 1. The potential risks of hazardous chemical impacts of reasonably foreseeable accidents would be encompassed by those discussed in Section 4.2.11.1.2 under the FFTF Decommissioning No Action Alternative.

Air quality impacts are discussed in Section 4.3.4.1. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.3.12.1 discusses the potential human health risks of transporting radioactive waste on site at Hanford and transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs for the offsite population (which includes minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The impact of transporting construction materials to Hanford under this Waste Management alternative would be very small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.3.13.2 Alternative 2: Disposal in IDF, 200-East Area Only

This section addresses potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations under Waste Management Alternative 2. Because public access to Hanford is restricted, the majority of impacts under this Waste Management alternative would be associated with onsite activities and would not affect populations residing off site; thus, the potential for environmental justice concerns would be small. Resource areas that could be impacted and that may affect populations residing off site include public and occupational health and safety due to normal operations and facility accidents, as well as air quality and transportation.

Section 4.3.10.2.1 discusses short-term impacts on the public resulting from normal operations under Waste Management Alternative 2. The radiological impacts of normal operations on minority, American Indian, Hispanic or Latino, and low-income populations were determined by applying the same methodology used to determine the public (total population) impacts of normal operations. The exposure scenario used to model minority, American Indian, Hispanic or Latino, and low-income population exposures assumes that these groups would be exposed in the same manner as the general population—by external exposure to radioactive materials and by internal exposure from inhalation and ingestion of radioactively contaminated produce and animal products.

For the purpose of evaluating the potential for disproportionately high and adverse impacts caused by radioactive emissions from normal operations, the total doses to average individuals of the minority, American Indian, Hispanic or Latino, and low-income populations were compared with the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–154 summarizes the average individual total doses over the life of the project under this Waste Management alternative. There were no appreciable differences between average individual total doses. Therefore, Waste Management Alternative 2 would not pose disproportionately high and adverse impacts on minority or low-income populations due to normal operations. The radiological impacts on the offsite population would be the same, regardless of the disposal group.

**Table 4–154. Waste Management Alternative 2 Average Individual Total Dose from Radioactive Air Emissions over the Life of the Project**

| Subset Population | Average Individual Dose (millirem) | |
|---|---|---|
| | Subset Population | Remainder of Population |
| Minority | $1.1\times10^{-7}$ | $1.5\times10^{-7}$ |
| American Indian | $7.0\times10^{-8}$ | $1.3\times10^{-7}$ |
| Hispanic or Latino | $1.0\times10^{-7}$ | $1.5\times10^{-7}$ |
| Low-income | $1.1\times10^{-7}$ | $1.4\times10^{-7}$ |

**Source:** Appendix J, Section J.5.7.1.3.

Section 4.3.10.2.1 discusses radiological impacts on the offsite MEI at the far side of the Columbia River opposite Hanford as a result of normal operations under Alternative 2. To explore potential American Indian environmental justice concerns associated with normal operations, impacts on a hypothetical individual residing at the boundary of the Yakama Reservation and an individual subsisting on fish and wildlife were evaluated. These results are tabulated in Appendix J. Under Waste Management Alternative 2, the total dose received by an individual residing at the point of greatest impact along the reservation boundary would be less than approximately one-fourth of the total dose received by the MEI from the general population. Therefore, Alternative 2 would not pose disproportionately high and adverse impacts on the American Indian population due to normal operations. These impacts would be the same, regardless of the disposal group.

Section 4.3.11.2.1 discusses the radiological impacts of airborne releases from facility accidents under Waste Management Alternative 2. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, facility disposition under Waste Management Alternative 2 would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents. The accident scenarios analyzed in Section 4.3.11.2.1 encompass the range of waste management storage and disposal activities. The radiological impacts of accidents would be the same, regardless of the disposal group.

Section 4.3.11.2.2 discusses the hazardous chemical impacts of facility accidents under Waste Management Alternative 2. The potential risks of hazardous chemical impacts of reasonably foreseeable accidents would be the same as those addressed under Alternative 1. The hazardous chemical impacts of accidents would be the same, regardless of the disposal group.

Air quality impacts are discussed in Section 4.3.4.2. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.3.12.2 discusses the potential human health risks of transporting offsite waste for disposal at Hanford and transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. Examination of the risks shows that there would be essentially no LCFs among the offsite population (including minority, American Indian, Hispanic or Latino, and low-income individuals) residing along the transportation routes. The radiological impacts of offsite waste transportation would be the same, regardless of the disposal group. The impacts of transporting construction materials to Hanford under all disposal groups would be small. Therefore, this alternative would not pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

#### 4.3.13.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

This section addresses the potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations under Waste Management Alternative 3. Because public access to Hanford is restricted, the majority of impacts under this alternative would be associated with onsite activities and would not affect populations residing off site; thus, the potential for environmental justice concerns is small. Resource areas that could be impacted include public and occupational health and safety due to normal operations and facility accidents, as well as air quality. These impacts could affect populations residing off site.

Section 4.3.10.3 discusses short-term radiological impacts on the public resulting from normal operations under Waste Management Alternative 3. Under this alternative, radiological impacts on the general public, minority and low-income populations, the offsite MEI, and an MEI residing at the boundary of the Yakama Reservation would be the same as those described under Waste Management Alternative 2 in Section 4.3.13.2, regardless of the disposal group (see Table 4–154).

Section 4.3.11.3.1 discusses the radiological impacts of airborne releases for facility accidents under Waste Management Alternative 3. Examination of the risks shows that there would be essentially no LCFs per year among the offsite population, including minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, Waste Management Alternative 3 would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to the radiological impacts of facility accidents. The accident scenarios analyzed in Section 4.3.11.3.1 encompass the range of waste management storage and disposal activities. The radiological impacts of accidents would be the same, regardless of the disposal group.

Section 4.3.11.3.2 discusses the hazardous chemical impacts of facility accidents under Waste Management Alternative 3. The potential risks of hazardous chemical impacts of reasonably foreseeable accidents would be the same as those addressed under Alternative 2. The hazardous chemical impacts of accidents would be the same, regardless of the disposal group.

Air quality impacts are discussed in Section 4.3.4.3. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high and adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.3.12.3 discusses the potential human health risks of transporting offsite waste for disposal at Hanford, transporting radioactive waste on site at Hanford, and transporting construction materials from onsite and/or offsite (local and regional) locations to Hanford. The radiological risks would be the same as those described under Waste Management Alternative 2. Similar to Waste Management Alternative 2, the risks of transporting construction and operational materials to Hanford under all disposal groups would be small. Therefore, this Waste Management alternative would not pose disproportionately high and adverse impacts on minority, American Indian, Hispanic or Latino, and low-income populations residing along the transportation routes.

### 4.3.14 Waste Management

This section evaluates the impacts of waste generation associated with implementation of each of the various Waste Management alternatives and disposal groups, as applicable, on the waste management infrastructure at Hanford. As summarized in Section 4.3 and detailed in Chapter 2, these Waste Management alternatives and disposal groups were developed to manage the various waste volumes projected to be generated under the alternatives for Tank Closure, FFTF Decommissioning, and Waste Management. In general, the disposal groups vary primarily in direct relation to the required size, number, and lifespan of the disposal facilities (i.e., IDF-East, IDF-West, and the RPPDF) that would be constructed, operated, and ultimately closed under each disposal scenario. This section also evaluates the impacts of waste generation associated with the construction, operations, deactivation, and closure of the expanded waste treatment and storage facilities and new waste disposal, in addition to the existing waste management activities analyzed under Waste Management Alternative 1: No Action. Under both Waste Management Alternatives 2 and 3, Hanford waste treatment and storage activities would be expanded at the CWC, T Plant, and WRAP to provide greater capacity and throughput. In addition, under all three Waste Management alternatives, trenches 31 and 34 would continue operations to dispose of LLW/MLLW until filled. The remaining space in the two trenches is 17,200 cubic meters (approximately 22,500 cubic yards), and the fiscal year 2007 projected emplacement rate in the two trenches is approximately 476 cubic meters (approximately 623 cubic yards). Given this emplacement rate, the remaining time the trenches will operate is approximately 36 years, or through 2043. For analysis purposes, this EIS assumes the trenches will operate through 2050.

The following analysis is consistent with DOE policy and DOE Manual 435.1-1, which requires that DOE radioactive waste shall be treated, stored, and, in the case of LLW, disposed of at the site where the waste is generated, if practical, or at another DOE facility. The analysis of these Waste Management alternatives and options is based on disposal of LLW and MLLW at Hanford. However, if DOE determines that use of Hanford's or another DOE site's waste management facilities is not practical or cost-effective, DOE may approve the use of non-DOE (commercial) facilities to store, treat, and dispose of such waste.

Included in this section is a discussion of the waste inventories projected to be generated under each of the Waste Management alternatives, as summarized in Table 4–155 for each of the Waste Management alternatives and disposal groups. These inventories would include secondary LLW, MLLW, and hazardous waste. WRAP and T Plant operations would produce small amounts of LLW and MLLW. No TRU waste or liquid LLW is expected to be generated by facility construction, operations, deactivation, or closure.

**LOW-LEVEL RADIOACTIVE WASTE**

LLW would be generated during routine operations at the two MLLW trenches (trenches 31 and 34) in LLBG 218 W-5 and during operations of WRAP and the T Plant. LLW is typically not treated or only minimally treated (e.g., via compaction) before disposal. Therefore, this waste treatment would cause no impacts on the Hanford waste management system. The LLW would be sent directly to disposal. Therefore, long-term storage facilities would not be required. All LLW would be disposed of in an IDF.

**MIXED LOW-LEVEL RADIOACTIVE WASTE**

MLLW would be generated during routine operations at WRAP and the T Plant. Through a combination of on- and offsite capabilities, MLLW would be treated to meet all RCRA land-disposal-restriction treatment standards prior to disposal. All MLLW would be disposed of in an IDF.

**HAZARDOUS WASTE**

Hazardous waste is dangerous waste as defined in the *Washington Administrative Code* (WAC 173-303). Hazardous waste generated during operations at the two MLLW trenches (trenches 31 and 34) in LLBG 218-W-5 and during postclosure care of the IDF(s) would be packaged in DOT-approved containers and shipped off site to permitted commercial recycling, treatment, and disposal facilities. Hanford shipped 182,177 kilograms (402,000 pounds) of hazardous waste off site in 2005 (Poston et al. 2006). Management of the additional waste generated under the Waste Management alternatives would require little, if any, additional planning. The waste would be treated and disposed of at offsite commercial facilities.

### 4.3.14.1 Alternative 1: No Action

#### 4.3.14.1.1 Waste Inventories

Under Waste Management Alternative 1: No Action, no new facility construction would be initiated. Storage and treatment of LLW, MLLW, and TRU waste at the CWC, WRAP, and T Plant complex would continue. Disposal actions would continue at the lined disposal trenches, trenches 31 and 34, in LLBG 218-W-5 through 2035. No offsite shipments of TRU waste or LLW/MLLW would be received. Administrative controls would be implemented for a period of 100 years following disposal operations (2036 through 2135). Table 4–155 presents the estimated waste volumes that would be generated under Waste Management Alternative 1.

**Table 4–155. Waste Management Alternatives – Summary of Waste Generation Volumes**

| Waste Type | Project Phase | | | | | Peak Annual Generation | |
|---|---|---|---|---|---|---|---|
| | Construction | Operations | Deactivation | Closure | Total | Year(s) of Peak | Annual Waste Volume |
| **Alternative 1: No Action** | | | | | | | |
| Low-level radioactive waste | N/A | 38 | N/A | N/A | 38 | 2007–2035 | 1 |
| Hazardous waste[a] | N/A | 38 | N/A | N/A | 38 | 2007–2035 | 1 |
| **Alternatives 2 and 3: Treatment and Storage** | | | | | | | |
| Low-level radioactive waste | N/A | 1,460 | N/A | N/A | 1,460 | 2019–2050 | 40 |
| Mixed low-level radioactive waste | N/A | 98 | N/A | N/A | 98 | 2019–2050 | 3 |
| **Alternative 2: Disposal Group 1** | | | | | | | |
| Low-level radioactive waste | N/A | 58 | N/A | N/A | 58 | 2007–2050 | 1 |
| Hazardous waste[a] | N/A | 58 | N/A | 89 | 147 | 2007–2050 | 1 |
| **Alternative 2: Disposal Group 2** | | | | | | | |
| Low-level radioactive waste | N/A | 58 | N/A | N/A | 58 | 2007–2050 | 1 |
| Hazardous waste[a] | N/A | 58 | N/A | 343 | 401 | 2103–2202 | 3 |
| **Alternative 2: Disposal Group 3** | | | | | | | |
| Low-level radioactive waste | N/A | 58 | N/A | N/A | 58 | 2007–2050 | 1 |
| Hazardous waste[a] | N/A | 58 | N/A | 343 | 401 | 2168–2267 | 3 |
| **Alternative 3: Disposal Group 1** | | | | | | | |
| Low-level radioactive waste | N/A | 58 | N/A | N/A | 58 | 2007–2050 | 1 |
| Hazardous waste[a] | N/A | 58 | N/A | 90 | 147 | 2007–2050 | 1 |
| **Alternative 3: Disposal Group 2** | | | | | | | |
| Low-level radioactive waste | N/A | 58 | N/A | N/A | 58 | 2007–2050 | 1 |
| Hazardous waste[a] | N/A | 58 | N/A | 344 | 402 | 2103–2202 | 3 |
| **Alternative 3: Disposal Group 3** | | | | | | | |
| Low-level radioactive waste | N/A | 58 | N/A | N/A | 58 | 2007–2050 | 1 |
| Hazardous waste[a] | N/A | 58 | N/A | 344 | 402 | 2168–2267 | 3 |

[a] Hazardous waste would be accumulated on site for less than 90 days and then shipped to offsite commercial facilities for treatment and/or disposal.
**Note:** All values are in cubic meters. To convert cubic meters to cubic yards, multiply by 1.308.
**Key:** N/A=not applicable.
**Source:** SAIC 2010c.

#### 4.3.14.2 Alternative 2: Disposal in IDF, 200-East Area Only

Waste Management Alternative 2 includes continued storage and treatment of LLW, MLLW, and TRU waste. Existing waste management facilities at the CWC, T Plant, and WRAP would be expanded, as summarized above. Waste management operations at the expanded facilities would produce a small amount of waste, as shown in Table 4–155.

Under this alternative, no additional offsite TRU waste would be received. Offsite shipments of waste to Hanford would be limited to 82,000 cubic meters (2.9 million cubic feet) of LLW and MLLW. Construction, operations, deactivation, and closure of two disposal facilities would provide for disposal of tank waste, onsite non-CERCLA waste, FFTF decommissioning waste, waste management waste streams, and LLW/MLLW received from other DOE sites. Disposal facilities would include a single IDF in the 200-East Area and an RPPDF. The RPPDF would be used to dispose of equipment and soils resulting from clean closure of the tank farm that are not highly contaminated. The IDF would be used for disposal of all other waste streams.

As mentioned in Section 4.3.14 and under Alternative 2, three disposal groups were developed to accommodate the different waste volumes generated by Tank Closure, FFTF Decommissioning, and Waste Management alternative activities. Within each disposal group, the largest waste volume was utilized to size the disposal facilities (IDF and RPPDF). These three disposal groups are described further in Chapter 2, Section 2.5, of this EIS.

Closure actions would include construction of a modified RCRA Subtitle C barrier over IDF-East and the RPPDF. Closure actions at the CWC, WRAP, T Plant, and LLBG (trenches 31 and 34) are not included under this alternative.

##### 4.3.14.2.1 Waste Inventories

Table 4–155 presents the estimated waste volumes that would be generated under Waste Management Alternative 2.

##### 4.3.14.2.2 Disposal Groups 1, 2, and 3

Under all disposal groups, MLLW and LLW would be generated from operations of WRAP and the T Plant, and LLW would be generated from operations of the LLBG (trenches 31 and 34). All waste would be disposed of in IDF-East.

#### 4.3.14.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Waste Management Alternative 3 includes continued storage and treatment of LLW, MLLW, and TRU waste. Existing waste management facilities at the CWC, WRAP, and T Plant would be expanded, as under Alternative 2. Waste management operations at the expanded facilities would produce a small amount of waste, as shown in Table 4–155.

Under this alternative, no additional offsite TRU waste would be received. Offsite shipments of waste to Hanford would be limited to 82,000 cubic meters (2.9 million cubic feet) of LLW and MLLW. Construction, operations, deactivation, and closure of two IDFs and one RPPDF would provide for disposal of tank waste, onsite non-CERCLA waste, FFTF decommissioning waste, waste management waste streams, and offsite LLW/MLLW received from other DOE sites. Disposal facilities would consist of one IDF in the 200-East Area, which would be used for tank waste only; one IDF in the 200-West Area, which would be used for onsite non-CERCLA waste, offsite LLW/MLLW received from other DOE sites, FFTF decommissioning waste, and waste management waste streams; and an RPPDF. The RPPDF would be used for disposal of equipment and soils associated with clean closure of the tank

farms, as under Waste Management Alternative 2. The IDFs would be used for disposal of all other waste streams. As mentioned in Section 4.3.14 and under Alternative 2, three disposal groups were developed to accommodate the different waste volumes generated by Tank Closure, FFTF Decommissioning, and Waste Management alternative activities. Within each disposal group, the largest waste volume was utilized to size the disposal facilities (IDF-East, IDF-West, and the RPPDF). These three disposal groups are described further in Chapter 2, Section 2.5, of this EIS.

Closure actions would include construction of a modified RCRA Subtitle C barrier over each IDF and RPPDF. Closure actions at the CWC, WRAP, T Plant, and LLBG (trenches 31 and 34) are not included under this alternative.

#### 4.3.14.3.1 Waste Inventories

Table 4–155 presents the estimated waste volume generated under Waste Management Alternative 3.

#### 4.3.14.3.2 Disposal Groups 1, 2, and 3

Under all disposal groups, LLW and MLLW would be generated from operations of WRAP and the T Plant; LLW also would be generated from operations of the LLBG. All waste would be disposed of in an IDF.

### 4.3.15 Industrial Safety

Illness, injury, and death are possible outcomes of any industrial accident. The accepted standard for measuring the outcome of an industrial accident is the number of TRCs of illness, injury, and death. This section addresses the potential impacts on workers that could result from implementation of each of the Waste Management alternatives and disposal groups. The key underlying assumptions and industrial safety incident rates used in support of this analysis are the same as those described in Section 4.1.15 for the Tank Closure alternatives.

Using these incident rates and the projected labor hours, industrial safety impacts associated with each of the alternatives were determined (see Table 4–156). There are inherent uncertainties in estimating the number of TRCs and fatalities associated with future activities. Currently, there are no weighting factors assigned to the phases of an alternative that allow for normalizing the risks under each alternative. Therefore, when averaging the rate over all phases, this approach can result in slightly higher values for project operation and closure phases and lower values for activities that have higher risk of injury and illness.

As shown in Figure 4–39, higher numbers of TRCs are associated with those alternatives that would require higher numbers of labor hours.

#### 4.3.15.1 Alternative 1: No Action

About 1 million total labor hours were identified under this alternative. Using the selected TRC rate of 2.0 and total labor hours, it is anticipated that there will be 10 reportable cases of illness or injury and no fatalities.

#### 4.3.15.2 Alternative 2: Disposal in IDF, 200-East Area Only

Under Alternative 2, three separate disposal groups are associated with disposal activities, and construction, operations, and deactivation of several new and expanded facilities would be required to support ongoing Hanford waste treatment and storage activities. Consequently, the construction, operations, deactivation, and closure of IDF-East and the RPPDF, in addition to ongoing LLBG 218-W-5

activities, were evaluated. Given the total labor hours (37.9 million) and the incident rate (2.0), it is anticipated that approximately 379 TRCs would occur. Fatalities are not expected based on the number of workers and total labor hours.

**Table 4–156. Waste Management Alternatives – Industrial Safety Impacts**

| Alternative | Labor Category | Million Labor Hours | Total Recordable Case Rate per 200,000 Labor Hours | Projected Total Recordable Cases | Fatality Rate per 200 Million Labor Hours | Projected Fatalities |
|---|---|---|---|---|---|---|
| Alternative 1: No Action | Construction | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Operations | 0.69 | 2.0 | 6.9 | 0.26 | 0.0009 |
| | Deactivation | 0.31 | 2.0 | 3.1 | 0.26 | 0.0004 |
| | Closure | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | **Total** | **1.01** | | **10.1** | | **0.001** |
| Alternatives 2 and 3: Treatment and Storage | Construction | 3.51 | 2.0 | 35.1 | 0.26 | 0.005 |
| | Operations | 33.9 | 2.0 | 339 | 0.26 | 0.04 |
| | Deactivation | 0.47 | 2.0 | 4.70 | 0.26 | 0.0006 |
| | Closure | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | **Total** | **37.9** | | **379** | | **0.05** |
| Alternative 2: Disposal Group 1 | Construction | 2.05 | 2.0 | 20.5 | 0.26 | 0.003 |
| | Operations | 11.7 | 2.0 | 117 | 0.26 | 0.015 |
| | Deactivation | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Closure | 6.12 | 2.0 | 61.2 | 0.26 | 0.008 |
| | **Total** | **19.9** | | **199** | | **0.026** |
| Alternative 2: Disposal Group 2 | Construction | 8.89 | 2.0 | 88.9 | 0.26 | 0.012 |
| | Operations | 95.1 | 2.0 | 951 | 0.26 | 0.12 |
| | Deactivation | 0.0 | 2.0 | 0.00 | 0.26 | 0.0 |
| | Closure | 23.7 | 2.0 | 237 | 0.26 | 0.03 |
| | **Total** | **128** | | **1,280** | | **0.17** |
| Alternative 2: Disposal Group 3 | Construction | 8.89 | 2.0 | 88.9 | 0.26 | 0.012 |
| | Operations | 171 | 2.0 | 1,710 | 0.26 | 0.22 |
| | Deactivation | 0.0 | 2.0 | 0.00 | 0.26 | 0.0 |
| | Closure | 23.7 | 2.0 | 237 | 0.26 | 0.03 |
| | **Total** | **204** | | **2,040** | | **0.27** |
| Alternative 3: Disposal Group 1 | Construction | 3.68 | 2.0 | 36.8 | 0.26 | 0.005 |
| | Operations | 11.6 | 2.0 | 116 | 0.26 | 0.015 |
| | Deactivation | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Closure | 6.11 | 2.0 | 61.1 | 0.26 | 0.008 |
| | **Total** | **21.4** | | **214** | | **0.03** |
| Alternative 3: Disposal Group 2 | Construction | 10.5 | 2.0 | 105 | 0.26 | 0.014 |
| | Operations | 94.6 | 2.0 | 946 | 0.26 | 0.123 |
| | Deactivation | 0.0 | 2.0 | 0.00 | 0.26 | 0.0 |
| | Closure | 23.7 | 2.0 | 237 | 0.26 | 0.03 |
| | **Total** | **129** | | **1,290** | | **0.17** |

**Table 4–156. Waste Management Alternatives – Industrial Safety Impacts *(continued)***

| Alternative | Labor Category | Million Labor Hours | Total Recordable Case Rate per 200,000 Labor Hours | Projected Total Recordable Cases | Fatality Rate per 200 Million Labor Hours | Projected Fatalities |
|---|---|---|---|---|---|---|
| Alternative 3: Disposal Group 3 | Construction | 10.5 | 2.0 | 105 | 0.26 | 0.01 |
| | Operations | 171 | 2.0 | 1,710 | 0.26 | 0.22 |
| | Deactivation | 0.0 | 2.0 | 0.0 | 0.26 | 0.0 |
| | Closure | 23.7 | 2.0 | 237 | 0.26 | 0.03 |
| | **Total** | **205** | | **2,050** | | **0.27** |

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate. Totals may not equal the sum of the contributions due to rounding.
**Source:** Labor hours compiled from Appendix I.

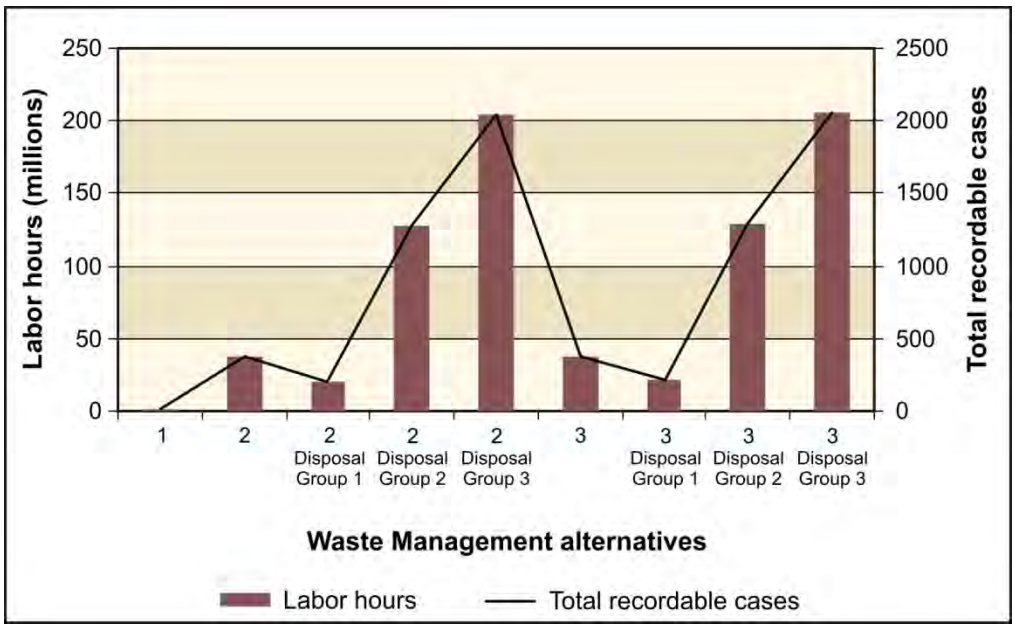


**Figure 4–39. Total Recordable Cases and Labor Hours by Alternative**

#### 4.3.15.2.1 Disposal Group 1

The work specified in this group would require 19.9 million labor hours to complete. Applying the TRC rate of 2.0, 199 TRCs can be expected. No fatalities are anticipated.

#### 4.3.15.2.2 Disposal Group 2

Work under this disposal group would require approximately 128 million total labor hours, generating 1,280 TRCs. Based on the projected labor hours and incident rate, no fatalities are anticipated.

#### 4.3.15.2.3 Disposal Group 3

Under this disposal group, about 204 million total labor hours would be required, generating 2,040 TRCs. No fatalities are anticipated.

#### 4.3.15.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Waste Management Alternative 3 would require construction of IDFs in the 200-East and 200-West Areas of Hanford, in addition to use of the RPPDF and continued LLBG 218-W-5 activities. As under Alternative 2, several Hanford waste treatment and storage facilities would also be expanded. Construction, operations, and deactivation of these waste treatment and storage facilities would require roughly 38 million labor hours. Applying the 2.0 TRC rate per 200,000 labor hours results in a projected 379 TRCs over the life of the project. Applying the fatality (0.26) rate per 200 million labor hours returns a value of 0.05. A fatality is not projected to occur over the period of this project. The following paragraphs evaluate the impacts of the three disposal groups associated with the closure of waste tanks and decommissioning of FFTF.

##### 4.3.15.3.1 Disposal Group 1

This disposal group would require about 21 million hours to complete and would generate 214 TRCs. No fatalities are expected.

##### 4.3.15.3.2 Disposal Group 2

This disposal group would require a total of about 129 million labor hours. Approximately 1,290 TRCs are anticipated. No fatalities are expected.

##### 4.3.15.3.3 Disposal Group 3

This disposal group would require about 205 million hours and would generate 2,050 TRCs. No fatalities are expected.

## 4.4 COMBINATION OF ALTERNATIVES

The potential short-term environmental and human health impacts associated with implementation of the alternatives and options for (1) tank waste retrieval, treatment, and disposal and SST system closure at Hanford; (2) decommissioning of FFTF and auxiliary facilities (i.e., FFTF decommissioning); and (3) management of waste resulting from other Hanford activities and limited volumes from other DOE sites (i.e., waste management) are presented separately in Sections 4.1, 4.2, and 4.3, respectively. The individual Tank Closure, FFTF Decommissioning, and Waste Management alternatives and options, as applicable, are described in detail in Chapter 2. This section presents the potential short-term, combined impacts on key air and groundwater resource indicators of implementing selected alternatives and options associated with the three sets of proposed actions.

To focus on those measures that provide the most meaningful and useful assessment of potential impacts, key resource indicators were selected from the total range of impact measures presented for each resource area or discipline (analyzed elsewhere in this chapter). Combined-impact analyses were not performed for the following resource areas or disciplines: noise and the facility accident component of public and occupational health and safety. As presented in this section, the combined-impact analyses provide a basis for determining the potential peak and/or total impact on an environmental resource area or human health indicator associated with implementation of the alternatives and options from each set of proposed actions analyzed in this EIS. For purposes of these combined-impact analyses, the impacts of disposition of RH-SCs at INL were counted in the combination total for Hanford, even though the work would not occur at Hanford.

Several hundred impact scenarios could result from the potential combinations of the 11 Tank Closure, 3 FFTF Decommissioning, and 3 Waste Management alternatives when factored with their associated option cases and waste disposal groups. For analysis purposes, the following combinations of alternatives were chosen to represent key points along the range of actions and associated overall impacts that could result from full implementation of the three sets of proposed actions:

- **Alternative Combination 1:** all No Action Alternatives
- **Alternative Combination 2:** Tank Closure Alternative 2B (Expanded WTP Vitrification; Landfill Closure); FFTF Decommissioning Alternative 2 (Entombment) with the Idaho Option for disposition of RH-SCs and the Hanford Reuse Option for disposition of bulk sodium; and Waste Management Alternative 2 (Disposal in IDF, 200-East Area Only) with Disposal Group 1, Subgroup 1-A
- **Alternative Combination 3:** Tank Closure Alternative 6B (All Vitrification with Separations; Clean Closure), Base Case; FFTF Decommissioning Alternative 3 (Removal) with the Idaho Option for disposition of RH-SCs and the Hanford Reuse Option for disposition of bulk sodium; and Waste Management Alternative 2 (Disposal in IDF, 200-East Area Only) with Disposal Group 2, Subgroup 2-B

Alternative Combination 1 represents the potential short-term impacts resulting from minimal DOE action and the greatest long-term impact with respect to groundwater. Alternative Combination 2 is a midrange case representative of DOE's Preferred Alternative(s), as addressed in Chapter 2, Section 2.12. Alternative Combination 3 reflects the most conservative estimate of impacts for most resource areas in terms of the intensity of the potential impact; therefore, on the whole, it represents a combination that would result in maximum potential short-term impacts, but would likely have the lowest long-term impacts on groundwater. For some resource areas, an alternative combination that included Alternative 6A, Option Case, would result in maximum short-term impacts. Selection of these three alternative combinations for detailed analysis in this EIS was done only to establish overall impact-level reference cases for stakeholders and decisionmakers to consider and does not preclude the selection and implementation of different combinations of the various alternatives in support of final agency decisions.

## 4.4.1 Land Resources

### 4.4.1.1 Land Use

The land use impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.1, 4.2.1, and 4.3.1. Those analyses evaluated the land requirements of each alternative and the compatibility of the proposed facilities and actions with the guidelines established by the *Hanford Comprehensive Land-Use Plan EIS* and the 2008 supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615, 73 FR 55824). Although previously undisturbed land would be developed in some cases, the analyses established that, with one exception (see Section 4.1.1.9.1.1), proposed facilities and actions would be compatible with site land-use guidelines; thus, this issue is not addressed further in this section. However, because the land needed for facility construction would be additive, the total land requirement for each of the three alternative combinations is addressed below.

To determine the combined land requirement at Hanford, the area needed for each component within each alternative combination was added together (see Table 4–157). As not all facilities would be constructed and not all activities would occur within previously disturbed areas, the table also presents the area of undeveloped land that would be required. No new land would be disturbed at INL under any of the alternative combinations.

As noted in Table 4–157, Alternative Combination 1 would require the least amount of land (2 hectares [5 acres]), all of which would be undisturbed land within Borrow Area C. Alternative Combination 2 would require a total of 308 hectares (761 acres), 67 percent of which is undeveloped. The total land area needed under Alternative Combination 3 would be 797 hectares (1,970 acres), 94 percent of which is undeveloped. Under Alternative Combination 2, about two-thirds of the undeveloped land would be within Borrow Area C; under Alternative Combination 3, about one-half.

**Table 4–157. Combined Hanford Site Land Use Requirements**

| Alternative Combination and Components | Alternative | Land Area Required (hectares) | |
|---|---|---|---|
| | | Total Land | Undeveloped Land |
| **Alternative Combination 1** | | | |
| Tank Closure | No Action | 2.0 | 2.0 |
| FFTF Decommissioning | No Action | 0 | 0 |
| Waste Management | No Action | 0 | 0 |
| **Total** | | **2.0** | **2.0** |
| **Alternative Combination 2** | | | |
| Tank Closure | 2B | 196 | 98.3 |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 3.6 | 2.8 |
| Waste Management | 2, DG 1 | 108 | 106 |
| **Total** | | **308** | **207** |
| **Alternative Combination 3** | | | |
| Tank Closure | 6B, Base Case | 384 | 342 |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 3.3 | 3.2 |
| Waste Management | 2, DG 2 | 409 | 406 |
| **Total** | | **797** | **753** |

**Note:** To convert hectares to acres, multiply by 2.471. Totals may not equal the sum of the contributions due to rounding.
**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory.
**Source:** Compiled from Sections 4.1.1.1.1–4.1.1.12.1, 4.2.1.1.1–4.2.1.3.1, 4.3.1.1.1–4.3.1.3.1.

Although not addressed in Table 4–157, the greatest land area would be required under an alternative combination that included Tank Closure Alternative 6A, Option Case; FFTF Decommissioning Alternative 3 (with all facilities to be built at Hanford); and Waste Management Alternative 3 (with waste Disposal Group 2 or 3). Under this alternative combination, a total of 1,110 hectares (2,740 acres) would be needed, 95 percent of which is currently undeveloped.

#### 4.4.1.2 Visual Resources

The impact on visual resources under these *TC & WM EIS* alternative combinations would depend on a number of factors. Among these would be the area of undeveloped land disturbed by new facilities, as analyzed in Section 4.4.1.1 above. Thus, the values for undeveloped land found in Table 4–157 provide a guide to the range of visual impacts that could be expected under the various alternative combinations. Additionally, the size of the area to be disturbed, the location of new facilities relative to public points of observation (i.e., public roadways or nearby higher elevations), and the proximity of new development to present industrial development must also be considered when evaluating combined visual impacts.

The least amount of undeveloped land (2 hectares [5 acres]) would be required under Alternative Combination 1. In this case, all development would occur within Borrow Area C, an area that, except for an access road, is undisturbed grassland at present. This alternative combination would disturb about 0.2 percent of Borrow Area C. Alternative Combination 2 would require 207 hectares (512 acres) of undeveloped land, and Alternative Combination 3 would require 753 hectares (1,860 acres) of undeveloped land. Under Alternative Combination 2, about two-thirds of this land would be within Borrow Area C; under Alternative Combination 3, about one-half.

The facilities and actions likely to have the greatest overall impact on visual resources are those that would require larger areas (e.g., over 20 hectares [50 acres]). Facilities needing less land would generally be located within built-up areas and, thus, would tend to blend in with existing development. None of the facilities that would be constructed under Alternative Combination 1 would require more than 20 hectares (50 acres) of land. Under Alternative Combination 2, expansion of IDF-East, construction of the RPPDF, and mining activities within Borrow Area C would each require over 20 hectares (50 acres). While IDF-East and the RPPDF could be visible from nearby higher elevations, they would be either minimally or not at all visible from Route 240. The disturbance to Borrow Area C would be readily visible from State Route 240, as well as Rattlesnake Mountain, an area important to American Indians (see Chapter 3, Section 3.2.8.3). In addition to the facilities noted for Alternative Combination 2, Alternative Combination 3 would require construction of the ILAW Interim Storage Facilities and the HLW Debris Storage Facilities. Alternative Combination 3 would require 401 hectares (992 acres) within Borrow Area C, nearly triple the land requirement of Alternative Combination 2 (140 hectares [345 acres]).

As is the case for land use (see Section 4.4.1.1), the greatest impact on visual resources would result from a combination of *TC & WM EIS* alternatives that is not represented in Table 4–157: Tank Closure Alternative 6A, Option Case; FFTF Decommissioning Alternative 3 (with all facilities to be built at Hanford); and Waste Management Alternative 3 (with waste Disposal Group 2 or 3). This alternative combination would require a total of 1,110 hectares (2,740 acres) of undeveloped land, including 619 hectares (1,530 acres) within Borrow Area C, as well as large areas between the 200-East and 200-West Areas and adjacent to the 200-East Area.

Regardless of the alternative combination being evaluated, construction within the 200 Areas would not change the BLM Visual Resource Management Class IV rating. However, the BLM rating for Borrow Area C would be lowered to Class III under Alternative Combination 1 and Class IV under Alternative Combinations 2 and 3.

### 4.4.2 Infrastructure

The utility infrastructure impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.2, 4.2.2, and 4.3.2. This section summarizes the overall demands on utility infrastructure and resource requirements of the three alternative combinations. Table 4–158 presents the projected peak annual and total demands for electricity, liquid fuels, and water under each alternative combination. Under each alternative combination, the peaks for each component could potentially occur during different time periods without overlap. To determine the potential maximum impact of each alternative combination, the peaks of each component were totaled together, even when the peak impacts are projected to occur in different timeframes. The resulting total projections are overly conservative and represent the upper limits for utility resource requirements.

As shown in Table 4–158, the tank closure component would be the most significant contributor to combined peak and combined total utility demands under all alternative combinations, although surveillance and monitoring activities associated with the FFTF Decommissioning No Action Alternative would incur higher total demands for electricity than those associated with the Tank Closure No Action Alternative during the 100-year administrative control period. For electricity, gasoline, and water, both the highest combined peak and combined total demands would occur under Alternative Combination 3 due to the requirements associated with Tank Closure Alternative 6B, Base Case, combined with those of Waste Management Alternative 2, Disposal Group 2. Combined peak demands would be highest under Alternative Combination 3 despite the fact that Tank Closure Alternative 2B under Alternative Combination 2 would have higher peak annual demands for diesel fuel, gasoline, and water than Alternative 6B, Base Case.

Overall, combined peak annual electrical energy demands could range from 0.04 million megawatt-hours under Alternative Combination 1 to as high as 1.27 million megawatt-hours under Alternative Combination 3, with the total combined energy requirements ranging from 0.72 to 21.7 million megawatt-hours over the entire duration of alternatives. The peak electrical energy demand of 1.27 million megawatt-hours (approximating an electric load of 145 megawatts) under Alternative Combination 3 would be about 73 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system.

For liquid fuels (diesel fuel and gasoline), combined peak annual requirements could range from about 16.3 million liters (4.3 million gallons) under Alternative Combination 1 to as high as 432 million liters (114 million gallons) under Alternative Combination 3, with the total combined liquid fuel requirements ranging from 55.8 million liters (14.7 million gallons) to 6,120 million liters (1,620 million gallons) over the entire duration of alternatives. It was assumed for analysis purposes that liquid fuels are not capacity-limiting resources because supplies would be replenished from offsite sources to support each alternative and provided at the point of use on an as-needed basis.

**Table 4–158. Combined Utility Infrastructure Requirements**

| Alternative Combination and Components | Alternative | Electricity Use (M megawatt-hours) | Diesel Fuel Use (M liters) | Gasoline Use (M liters) | Water Use (M liters) |
|---|---|---|---|---|---|
| | | Peak Use [Peak Year(s)][a] *Total Use* | Peak Use [Peak Year(s)][a] *Total Use* | Peak Use [Peak Year(s)][a] *Total Use* | Peak Use [Peak Year(s)][a] *Total Use* |
| **Alternative Combination 1** | | | | | |
| Tank Closure | No Action | 0.035 [2008] *0.12* | 11.8 [2008] *35.9* | 1.0 [2008] *4.61* | 1,090 [2008] *3,300* |
| FFTF Decommissioning | No Action | 0.006 [2008–2107] *0.60* | 0 *0* | 0.0011 [2008–2107] *0.11* | 7.95 [2008–2107] *795* |
| Waste Management | No Action | 0.00019 [2007–2035] *0.0056* | 3.46 [2009] *13.9* | 0.012 [2036–2135] *1.23* | 25.5 [2009] *35.7* |
| **Combined Peak[b]** | | **0.04** | **15.3** | **1.02** | **1,120** |
| **Combined Total[b]** | | **0.72** | **49.8** | **5.96** | **4,130** |
| **Alternative Combination 2** | | | | | |
| Tank Closure | 2B | 1.18 [2040] *17.9* | 271 [2040] *4,040* | 8.23 [2040] *156* | 3,590 [2040] *86,300* |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 0.0039 [2017] *0.0045* | 2.21 [2015–2021] *5.12* | 0.28 [2015–2021] *0.78* | 12.8 [2017–2021] *23.6* |
| Waste Management | 2, DG 1 | 0.018 [2007–2050] *0.56* | 41.6 [2011–2052] *257* | 4.69 [2011–2052] *21.7* | 90.8 [2011–2052] *3,050* |
| **Combined Peak[b]** | | **1.20** | **315** | **13.2** | **3,690** |
| **Combined Total[b]** | | **18.5** | **4,300** | **179** | **89,400** |
| **Alternative Combination 3** | | | | | |
| Tank Closure | 6B, Base Case | 1.25 [2040] *21.1* | 255 [2040] *4,360* | 6.61 [2040] *216* | 3,530 [2040] *92,600* |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 0.0039 [2013–2017] *0.0077* | 1.59 [2015–2021] *4.85* | 0.23 [2013–2016] *0.79* | 11.9 [2017–2021] *22.9* |
| Waste Management | 2, DG 2 | 0.018 [2007–2050] *0.56* | 154 [2011–2102] *1,460* | 15.2 [2011–2102] *83.1* | 283 [2011–2102] *21,200* |
| **Combined Peak[b]** | | **1.27** | **410** | **22.1** | **3,830** |
| **Combined Total[b]** | | **21.7** | **5,820** | **300** | **114,000** |

[a] Year(s) in brackets denotes the timeframe over which the listed peak value could theoretically occur based on projected timeframes for contributing activities associated with each component.

[b] The combined peaks and combined totals may not equal the sum of the contributions due to rounding.

**Note:** To convert liters to gallons, multiply by 0.26417.

**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; M=million.

**Source:** Compiled from Tables 4–2, 4–99, and 4–134.

Water requirements could entail a combined peak annual demand ranging from about 1,120 million liters (296 million gallons) under Alternative Combination 1 to 3,830 million liters (1,000 million gallons) under Alternative Combination 3, with total combined water requirements ranging from 4,130 million liters (1,090 million gallons) to 114,000 million liters (30,115 million gallons) over the duration of the alternatives. The projected peak annual water demand of 3,830 million liters (1,000 million gallons) under Alternative Combination 3 would be about 21 percent of the 18,500-million-liter (4,890-million-gallon) annual capacity of the Hanford Export Water System and about 17 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

As discussed above, none of the three alternative combinations would exceed the capacity of a Hanford utility system. While Alternative Combination 3 reflects the upper end of the three combinations, it would not represent the limit for infrastructure resource demands. An alternative combination that would include Tank Closure Alternative 6A, Option Case, instead of Alternative 6B, Base Case, along with FFTF Decommissioning Alternative 2 (with all facilities to be built at Hanford) and Waste Management Alternative 2 (with waste Disposal Group 3), would have the greatest combined impact on utility infrastructure.

Under such an alternative combination, the combined peak annual electrical energy demand could be 1.99 million megawatt-hours, with a total combined energy requirement of 188 million megawatt-hours over the entire duration of the alternatives. The peak electrical energy demand of 1.99 million megawatt-hours (approximating an electric load of 227 megawatts) would be about 114 percent of the 1.74-million-megawatt-hour annual capacity (199-megawatt load capacity) of the Hanford electric power distribution system, exceeding its capacity. For water, the combined peak annual water demand could be about 6,880 million liters (1,820 million gallons), with a total combined water requirement of approximately 681,000 million liters (180,000 million gallons). The projected peak annual water demand of 6,880 million liters (1,820 million gallons) under this alternative combination would be about 37 percent of the 18,500 million liter (4,890 million gallon) annual capacity of the Hanford Export Water System and about 30 percent of the 200 Areas' historical average annual water use of more than 22,700 million liters (6,000 million gallons).

### 4.4.3 Air Quality

The nonradioactive air pollutant impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.4, 4.2.4, and 4.3.4. This section summarizes the overall impacts of the three alternative combinations. Table 4–159 provides the peak incremental concentrations for selected pollutants and averaging periods under the three alternative combinations.

Under each alternative combination, the peaks for each pollutant and component could potentially occur during different time periods. For analysis purposes, the incremental concentrations during the peak year for each component and averaging period were totaled together. The resulting conservative total estimates represent the upper limit of the concentrations that could be realized.

Under Alternative Combination 1, the projected air pollutant concentrations would be dominated by the Tank Closure alternative. Under Alternative Combination 2, the Waste Management alternative would dominate for carbon monoxide, and the Tank Closure and Waste Management alternatives would have similar contributions for the other pollutants. Under Alternative Combination 3, the Waste Management alternative would dominate for all pollutants.

**Table 4–159. Combined Criteria Air Pollutant Concentrations**

| Alternative Combination and Components | Alternative | Maximum Average Concentration (micrograms per cubic meter) | | | |
|---|---|---|---|---|---|
| | | Carbon Monoxide (8 hours) | Nitrogen Dioxide (annual) | $PM_{10}$ (24 hours) | Sulfur Dioxide (1 hour) |
| **Alternative Combination 1** | | | | | |
| Tank Closure | No Action | 3,410 | 8.19 | **546** | 24.0 |
| FFTF Decommissioning | No Action | 4.35 | 0.00066 | 0.00272 | 0.0419 |
| Waste Management | No Action | 72.6 | 1.35 | **507** | 0.723 |
| **Total** | | 3,490 | 9.5 | 1,050 | 24.8 |
| **Alternative Combination 2** | | | | | |
| Tank Closure | 2B | 6,330 | 20.5 | **4,910** | 105 |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 780 | 2.91 | 53.8 | 37.6 |
| Waste Management | 2, DG 1 | **10,100** | 23.2 | **4,080** | 84.9 |
| **Total** | | 17,200 | 46.6 | 9,040 | 228 |
| **Alternative Combination 3** | | | | | |
| Tank Closure | 6B, Base Case | 5,770 | 14.2 | **5,510** | 71.5 |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 772 | 2.09 | 94.5 | 50.4 |
| Waste Management | 2, DG 2 | **43,400** | 92.8 | **17,900** | **370** |
| **Total** | | 49,900 | 109 | 23,500 | 492 |
| Most stringent standard or guideline | | 10,000 | 100 | 150 | 197 |

**Note:** Exceedances are shown in **bold** text. Totals may not equal the sum of the contributions due to rounding.

**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; $PM_{10}$=particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

**Source:** Compiled from Tables 4–3, 4–100, and 4–135.

When added this way, the total incremental concentrations would not exceed the ambient standards, except for PM, which would exceed ambient standards under all three alternative combinations; carbon monoxide and sulfur dioxide, which would exceed ambient standards under Alternative Combinations 2 and 3; and nitrogen dioxide, which would exceed ambient standards under Alternative Combination 3. As discussed previously, the PM emissions for all activities were conservatively estimated, and no controls were assumed in the estimates, but the methodology was consistently applied so that alternatives could be compared. Actual concentrations from tank closure, FFTF decommissioning, and waste management activities would be appropriately controlled such that the ambient standards would not be exceeded.

### 4.4.4 Geology and Soils

The geologic and soil resource requirements for implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.5, 4.2.5, and 4.3.5. This section summarizes the overall demands for, and projected consumption of, geologic and soil resources under the three alternative combinations. Table 4–160 provides the volumes of selected geologic and soil materials and total material requirements under the three alternative combinations. Representative geologic resources were selected from certain categories (e.g., construction, borrow/backfill, closure) to facilitate meaningful comparison of demands for alternative components within each alternative combination. As previously described in Section 4.1.5 and elsewhere, it is expected that these materials would be excavated from Borrow Area C. The volumes in Table 4–160 conservatively reflect the combined impact of obtaining required materials from onsite reserves.

**Table 4–160. Combined Geologic and Soil Resource Requirements**

| Alternative Combination and Components | Alternative | Representative Resource Demands (cubic meters) | | | Total Requirements[a] (cubic meters) |
|---|---|---|---|---|---|
| | | Construction Gravel | Borrow-Soil | Closure-Barrier Materials | |
| **Alternative Combination 1** | | | | | |
| Tank Closure | No Action | 21,100 | 55,100 | 0 | 92,800 |
| FFTF Decommissioning | No Action | 0 | 0 | 0 | 0 |
| Waste Management | No Action | 3,510 | 0 | 0 | 6,230 |
| **Total** | | **24,600** | **55,100** | **0** | **99,000** |
| **Alternative Combination 2** | | | | | |
| Tank Closure | 2B | 268,000 | 782,000 | 2,300,000[b] | 4,360,000 |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 50 | 80,400 | 19,300 | 122,000 |
| Waste Management | 2, DG 1 | 11,500 | 0 | 1,760,000[c] | 1,990,000 |
| **Total** | | **281,000** | **863,000** | **4,080,000** | **6,470,000** |
| **Alternative Combination 3** | | | | | |
| Tank Closure | 6B, Base Case | 889,000 | 8,550,000 | 689,000[d] | 10,900,000 |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 50 | 121,000 | 0 | 143,000 |
| Waste Management | 2, DG 2 | 11,500 | 0 | 6,800,000[c] | 7,620,000 |
| **Total** | | **902,000** | **8,670,000** | **7,490,000** | **18,700,000** |

[a] Reflects total requirements for all resources for all component activities in addition to and including the representative resources included in the table.

[b] Volume includes soil, sand, gravel, rock, and asphalt for construction of modified Resource Conservation and Recovery Act Subtitle C barriers for landfill closure of all tank farms and six sets of cribs and trenches (ditches).

[c] Volume includes soil, sand, gravel, rock, and asphalt for construction of modified Resource Conservation and Recovery Act Subtitle C barriers for landfill closure of IDF-East and the RPPDF.

[d] Volume includes soil, sand, gravel, rock, and asphalt for construction of modified Resource Conservation and Recovery Act Subtitle C barriers for landfill closure of the six sets of cribs and trenches (ditches) in the B and T Areas.

**Note:** To convert cubic meters to cubic yards, multiply by 1.308. Totals may not equal the sum of the contributions due to rounding.

**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; IDF-East=200-East Area Integrated Disposal Facility; RPPDF=River Protection Project Disposal Facility.

**Source:** Compiled from Tables 4–7, 4–106, and 4–139.

Total geologic resource requirements could range from approximately 99,000 cubic meters (130,000 cubic yards) of material under Alternative Combination 1 to as much as 18.7 million cubic meters (24.5 million cubic yards) under Alternative Combination 3 (see Table 4–160). While the tank closure component generally would have the highest geologic resource demands and associated potential for indirect impacts on geology and soils, the waste management component would have roughly comparable total demands, driven by the requirements for disposal facility construction, operations, and closure. In contrast to tank closure and waste management activities, FFTF decommissioning activities would have relatively insignificant geologic resource requirements under any of the alternative combinations.

As discussed above, it is expected that required materials would be excavated from Borrow Area C at Hanford. Further, it was estimated that Borrow Area C could yield 42.6 million cubic meters (55.7 million cubic yards) of borrow material. In addition, gravel pit No. 30, located between the 200-East and 200-West Areas, is an approximately 54-hectare (134-acre) borrow site that is currently in operation. Aggregate reserves at pit No. 30 are estimated at 15.3 million cubic meters (20 million cubic yards) of material (see Section 4.1.5).

Based on the estimates above, the geologic resources demands associated with all of the alternative combinations considered could be supplied via Hanford's onsite resource reserves; gravel pit No. 30 alone would be able to supply the demands of Alternative Combinations 1 and 2 without the need to develop Borrow Area C to a significant degree.

However, a more conservative alternative combination that would include Tank Closure Alternative 6A, Option Case, instead of Alternative 6B, Base Case, along with FFTF Decommissioning Alternative 3 (with all facilities to be built at Hanford) and Waste Management Alternative 2 or 3 (with waste Disposal Group 3), would have the greatest combined geologic resource requirements. In this case, the combined geologic resource requirements could be as high as 33.8 million cubic meters (44.2 million cubic yards). Assuming that this material would be exclusively obtained from Borrow Area C, the demand to support such an alternative combination would require excavation of approximately 79 percent, on a volumetric basis, of Borrow Area C.

### 4.4.5 Water Resources

The water resource impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.6, 4.2.6, and 4.3.6. The analysis of water resources in the aforementioned sections focuses on direct, short-term impacts on surface water, the vadose zone, and groundwater from activities such as new facility construction and closure, which could impact stormwater runoff, surface water, or groundwater hydrology or quality. This section summarizes the impacts on water resources of the three alternative combinations. In general, potential impacts are expected to vary proportionally with the total amount of land that would be disturbed and, more importantly, in relation to the land that would be disturbed in the same general timeframe.

Overall, component activities under the three alternative combinations are not expected to have any direct impact on major surface-water features, including the Columbia River, because there are no natural, perennial surface-water drainages on the Central Plateau of Hanford. All construction- and closure-related land disturbance, especially for new facility construction, would expose soils and sediments to possible erosion by infrequent, heavy rainfall or wind. Stormwater runoff would be unlikely to reach surface-water features, as discussed above, because it would be controlled via application of best management practices and other measures. Stormwater runoff from exposed areas, however, could convey soil, sediments, and other pollutants (e.g., construction waste materials and spilled materials, such as petroleum, oils, and lubricants from construction equipment) from the construction footprint and laydown areas. As described in Section 4.4.1.1, Alternative Combination 2 would have a total land

requirement of about 308 hectares (761 acres). The total land area needed under Alternative Combination 3 would be about 797 hectares (1,970 acres). Further, the only component activity with the potential to directly impact surface-water hydrology would be excavation work in Borrow Area C, which could impact the areas surrounding Cold Creek, but would be conducted to minimize any direct impacts. Excavation activities, and thus potential impacts on this surface-water feature, would be greatest under Alternative Combination 3, as indicated above. The relative intensity of the excavation impacts associated with meeting the geologic resources demands are further described in Section 4.4.4.

Any component activity that would contribute to the disturbance of a larger land area would have a greater potential for short-term impacts on water resources than the three alternative combinations discussed herein.

## 4.4.6 Ecological Resources

### 4.4.6.1 Terrestrial Resources

The ecological resource impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.7, 4.2.7, and 4.3.7. The analysis of terrestrial resources focused on those projects and activities that would result in a loss of habitat within undeveloped areas of Hanford, with special attention to the loss of sagebrush habitat. To determine the area of terrestrial habitat that would be affected under each alternative combination, the total area of undeveloped land for each component was added together. Similarly, the area of sagebrush habitat affected was also summed. The results are presented in Table 4–161. As no new facilities would be built at INL under any alternative combination, there would be no impacts on terrestrial habitat at the site.

**Table 4–161. Combined Hanford Ecological Resource Disturbance**

| Alternative Combination and Components | Alternative | Land Area (hectares) | |
|---|---|---|---|
| | | Terrestrial Habitat | Sagebrush Habitat |
| **Alternative Combination 1** | | | |
| Tank Closure | No Action | 2.0 | 0 |
| FFTF Decommissioning | No Action | 0 | 0 |
| Waste Management | No Action | 0 | 0 |
| **Total** | | **2.0** | **0** |
| **Alternative Combination 2** | | | |
| Tank Closure | 2B | 98.3 | 1.2 |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 2.8 | 0 |
| Waste Management | 2, DG 1 | 106 | 64.3 |
| **Total** | | **207** | **65.5** |
| **Alternative Combination 3** | | | |
| Tank Closure | 6B, Base Case | 342 | 100 |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 3.2 | 0 |
| Waste Management | 2, DG 2 | 406 | 248 |
| **Total** | | **753** | **348** |

**Note:** To convert hectares to acres, multiply by 2.471. Totals may not equal the sum of the contributions due to rounding.
**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory.
**Source:** Compiled from Sections 4.1.7.3.1, 4.1.7.10.1, 4.2.7.1, 4.2.7.2.1, 4.2.7.3.1, 4.3.7.1, 4.3.7.2.1, and 4.3.7.3.1.

Under Alternative Combination 1, a total of 2 hectares (5 acres) of terrestrial habitat would be disturbed. All of this habitat is classified as grassland and is found within Borrow Area C; no sagebrush habitat would be affected under this alternative combination. Alternative Combination 2 would involve disturbance of 207 hectares (512 acres), 32 percent of which is sagebrush habitat. In the case of Alternative Combination 3, a total of 753 hectares (1,860 acres) of terrestrial habitat would be impacted by project facilities and activities. Of this total, 46 percent would be sagebrush habitat. Mitigation measures relative to the disturbance of sagebrush habitat are addressed earlier in this chapter under each alternative.

Although not addressed in Table 4–161, the greatest impact on terrestrial habitat would occur under an alternative combination that includes Tank Closure Alternative 6A, Option Case; FFTF Decommissioning Alternative 3 (with all facilities to be built at Hanford); and Waste Management Alternative 3 (with waste Disposal Group 2 or 3). Such an alternative combination would disturb a total of up to 1,060 hectares (2,610 acres) of terrestrial habitat, 41 percent of which would be sagebrush.

#### 4.4.6.2 Wetlands and Aquatic Resources

As there are no wetlands or aquatic resources within any of the areas potentially disturbed by alternatives proposed under any of the three *TC & WM EIS* components, there would be no impacts on these resources from any of the alternative combinations.

#### 4.4.6.3 Threatened and Endangered Species

The impacts of the Tank Closure, FFTF Decommissioning, and Waste Management alternatives analyzed in this EIS on threatened and endangered species, including other federally or state-listed special status species, are evaluated in Sections 4.1.7, 4.2.7, and 4.3.7. The analyses in those sections that focused on listed species potentially affected by the proposed projects and actions were based on those species' observed presence, as well as the amounts of undeveloped land, especially sagebrush habitat, that potentially would be disturbed.

For the combined impacts analyses, the numbers of special status species observed or potentially present within those areas affected by the three *TC & WM EIS* alternative combinations were determined. While none of the alternative combinations would impact federally or state-listed threatened or endangered species or designated critical habitat for the bull trout, each could affect a number of state-listed species with other special status designations. Under Alternative Combination 1, three state-listed species (all of which occur within Borrow Area C) could be impacted. These include Piper's daisy (state sensitive), stalked-pod milkvetch (state watch), and long-billed curlew (state monitor). In addition to the three special status species, black-tailed jackrabbit (state candidate) could also be affected under Alternative Combination 2. Under Alternative Combination 3, as many as seven special status species could be impacted, including the loggerhead shrike (Federal species of concern and state candidate); sage sparrow (state candidate); and black-tailed jackrabbit, long-billed curlew, Piper's daisy, stalked-pod milkvetch, and crouching milkvetch (state watch). As the potential to cause disturbance to these species would be greater as habitat disturbance increased, especially sagebrush habitat, the overall potential to impact special status species would increase from Alternative Combination 1 to Alternative Combination 3.

Although not among the identified alternative combinations evaluated, a combination that included Tank Closure Alternative 6A, Option Case; FFTF Decommissioning Alternative 3 (with all facilities to be built at Hanford); and Waste Management Alternative 2 or 3 (with waste Disposal Group 2 or 3) would have the greatest potential to impact special status species. This alternative combination could affect the same seven species affected under Alternative Combination 3. However, the overall potential to impact these species would be greater under this alternative combination due to the greater area of terrestrial habitat, including sagebrush habitat, that would be impacted (see Section 4.4.6.1).

## 4.4.7 Cultural and Paleontological Resources

### 4.4.7.1 Prehistoric Resources

The cultural and paleontological resource impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.8, 4.2.8, and 4.3.8. This section summarizes the overall impacts on cultural and paleontological resources of the three alternative combinations. Potential impacts on cultural and paleontological resources would be directly related to the acreage and location of land disturbed (see Table 4–155), as well as the visual impacts expected from these alternative combinations.

Alternative Combination 1 would require the least acreage of undeveloped land and would involve the least land disturbance. Geologic material would be excavated from Borrow Area C to support construction, operations, deactivation, decommissioning, and closure activities for tank closure, FFTF decommissioning, and waste management activities. Alternative Combination 1 would disturb about 2 hectares (5 acres) of Borrow Area C. Cultural deposits have a zero-to-low potential of being present in Borrow Area C. Prehistoric resources located in the 200-East and 200-West Areas would not be disturbed under this alternative combination.

Alternative Combination 2 would require 207 hectares (512 acres), and Alternative Combination 3 would require 753 hectares (1,860 acres) of previously undisturbed land. Although a larger area of land would be disturbed compared with Alternative Combination 1, cultural deposits have a zero-to-low potential of being present in the areas that would be impacted under these alternative combinations. Known prehistoric resources located in the 200-East and 200-West Areas would not be disturbed.

### 4.4.7.2 Historic Resources

The acreage of undeveloped land required under Alternative Combination 1 would have no impact on historic resources located within the 200-East and 200-West Areas, including buildings associated with the Manhattan Project and Cold War era.

Alternative Combinations 2 and 3, which would disturb more land than Alternative Combination 1, also would not affect historic resources in the 200-East Area. Historic resources located in the 200-West Area would not be affected by construction or excavation.

### 4.4.7.3 American Indian Interests

The impacts of the Tank Closure, FFTF Decommissioning, and Waste Management alternatives analyzed in this EIS on American Indian areas of interest are evaluated in Sections 4.1.8, 4.2.8, and 4.3.8.

Construction of new facilities and disturbance of previously undeveloped land would have the greatest impacts. The size of the area to be disturbed and the location of new facilities need to be considered in evaluating the impacts. The view from State Route 240 and Rattlesnake Mountain, an area of noted cultural and religious significance to the American Indians, would be impacted. Under Alternative Combination 1, the industrial appearance of the 200-East and 200-West Areas would remain largely unchanged. Alternative Combination 2 would entail expansion of IDF-East and construction of the RPPDF. Disposal facility expansion/construction, along with mining activities in Borrow Area C, would require over 20 hectares (50 acres) of land. Expansion of IDF-East and construction of the RPPDF would be minimally visible. The disturbance to Borrow Area C would be readily visible from Rattlesnake Mountain. Alternative Combination 3 would require construction of the ILAW Interim Storage Facilities and HLW Debris Storage Facilities in addition to other facilities related to Alternative Combination 2. The land requirement within Borrow Area C, which would increase to 401 hectares (992 acres), nearly

triple the land requirement under Alternative Combination 2 (140 hectares [345 acres]), would have the greatest visual impact on Rattlesnake Mountain.

#### 4.4.7.4 Paleontological Resources

The impacts of the Tank Closure, FFTF Decommissioning, and Waste Management alternatives analyzed in this EIS on paleontological resources are evaluated in Sections 4.1.8, 4.2.8, and 4.3.8. As no paleontological resources have been discovered within any of the areas that would potentially be disturbed by the alternatives proposed under any of the alternative combinations, there would be no impacts on these resources under any of the alternative combinations.

### 4.4.8 Socioeconomics

The socioeconomic impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.9, 4.2.9, and 4.3.9. This section summarizes the overall socioeconomic effects of the three alternative combinations. Table 4–162 provides the projected peak workforce, commuter traffic, and truck activity under the three alternative combinations.

Under each alternative combination, the peaks for each component could potentially occur during different time spans. To determine the potential impact of each alternative combination, the peak amounts of each component were totaled. The resulting conservative total estimates represent the upper limit of workforce requirements. As shown in Table 4–162, the projected total workforce under all three alternative combinations would be dominated by the requirements of the Tank Closure alternatives. Total workforce requirements would range from 1,840 to 12,500 FTEs over the entire duration of activities. The lower end of the range would represent approximately 1.5 percent of the projected labor force (123,000) in 2008 in the ROI. The higher workforce requirement would range from approximately 8.4 percent of the projected labor force in the ROI (150,000) in 2021 to 4 percent of that labor force (314,000) in 2101. For comparison, in 2006, the employment of approximately 10,000 people at Hanford made up about 10 percent of the labor force employed in the ROI.

The number of daily commuter vehicles would correlate with the number of employees. Assuming that employees would commute to work at a rate averaging 1.25 people per vehicle (Malley 2007), up to 10,000 vehicles per day could impact commuter traffic under Alternative Combination 3. In addition to commuter traffic, Alternative Combination 3 would require a larger number of trucks moving equipment and resources off site (around 102 trips per day) and moving material on site (approximately 1,760 trips per day). Based on this predicted truck and commuter traffic, the LOS on offsite roads in the Hanford area is expected to be impacted.

**Table 4–162. Combined Socioeconomic Impact Measures**

| Alternative Combination and Components | Alternative | Peak Annual Workforce[a] (Peak Year) | Peak Daily Commuter Traffic | Peak Daily Truck Loads (Peak Year) | |
|---|---|---|---|---|---|
| | | | | Off Site | On Site |
| **Alternative Combination 1** | | | | | |
| Tank Closure | No Action | 1,730 (2008) | | 4 (2008) | 23 (2006–2008) |
| FFTF Decommissioning | No Action | 1 (2008–2107) | | Less than 1 (2008–2107) | 0 |
| Waste Management | No Action | 109 (2009) | | Less than 1 (2009) | 6 (2009) |
| **Total** | | **1,840** | **1,470** | **4** | **29** |
| **Alternative Combination 2** | | | | | |
| Tank Closure | 2B | 6,860 (2040) | | 48 (2040) | 217 (2039–2043) |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 151 (2017) | | 3 (2017) | 52 (2021) |
| Waste Management | 2, DG 1 | 1,180 (2051–2052) | | 28 (2051) | 428 (2051–2052) |
| **Total** | | **8,190** | **6,550** | **79** | **697** |
| **Alternative Combination 3** | | | | | |
| Tank Closure | 6B, Base Case | 7,860 (2021–2022) | | 66 (2040) | 188 (2100) |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 139 (2017) | | 2 (2013–2014) | 63 (2021) |
| Waste Management | 2, DG 2 | 4,540 (2101–2102) | | 34 (2101–2102) | 1,500 (2101–2102) |
| **Total** | | **12,500** | **10,000** | **102** | **1,760** |

[a] The workforce is rounded into full-time-equivalent quantities.

**Note:** Values presented in the table have been rounded to no more than three significant digits, where appropriate. Totals may not equal the sum of the contributions due to rounding.

**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory.

**Source:** Compiled from Sections 4.1.9.1–4.1.9.11, 4.2.9.1–4.2.9.3, and 4.3.9.1–4.3.9.3.

### 4.4.9 Public and Occupational Health and Safety—Normal Operations

The public and worker health impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.10, 4.2.10, and 4.3.10. This section summarizes the health impacts of selected alternative combinations on the public and workers. Table 4–163 presents the projected peak annual and total impacts on the general population and an MEI under each alternative combination. Combined impacts on the general population were estimated by adding the impacts on the population living within 80 kilometers (50 miles) of the site (Hanford or INL) under each alternative combination. Under each alternative combination, the peaks for each alternative could potentially occur during different time periods without overlap. To determine the potential maximum impact of each alternative combination, the peaks of each alternative were totaled, even when the peak impacts were projected to occur in different timeframes. Similarly, impacts on an MEI were added, even though the MEI may be in different locations along the perimeter of Hanford or INL. This approach provided a conservative estimate of the potential impacts.

**Table 4–163. Combined Public Health Impacts—Normal Operations**

| Alternative Combination and Components | Alternative | Time Period | General Population | | Maximally Exposed Individual | |
|---|---|---|---|---|---|---|
| | | | Dose (person-rem) | Risk (LCFs)[a] | Dose (millirem) | Risk (LCFs)[b] |
| **Alternative Combination 1** | | | | | | |
| Tank Closure | No Action | Peak annual | 0.78 | 0 ($5\times10^{-4}$) | 0.041 | $2\times10^{-8}$ |
| | | Project total | 74 | 0 ($4\times10^{-2}$) | 3.6 | $2\times10^{-6}$ |
| FFTF Decommissioning | No Action | Peak annual | 0.00027 | 0 ($2\times10^{-7}$) | 0.000017 | $1\times10^{-11}$ |
| | | Project total | 0.027 | 0 ($2\times10^{-5}$) | 0.0012 | $7\times10^{-10}$ |
| Waste Management | No Action | Peak annual | 0 | 0 | 0 | 0 |
| | | Project total | 0 | 0 | 0 | 0 |
| **Combined Impacts** | | **Peak annual** | **0.78** | **0 ($5\times10^{-4}$)** | **0.041** | **$2\times10^{-8}$** |
| | | **Project total** | **74** | **0 ($4\times10^{-2}$)** | **3.6** | **$2\times10^{-6}$** |
| **Alternative Combination 2** | | | | | | |
| Tank Closure | 2B | Peak annual | 330 | 0 ($2\times10^{-1}$) | 10 | $6\times10^{-6}$ |
| | | Project total | 1,600 | 1 (1) | 43 | $3\times10^{-5}$ |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | Peak annual | 0.010 | 0 ($6\times10^{-6}$) | 0.00047 | $3\times10^{-10}$ |
| | | Project total | 0.022 | 0 ($1\times10^{-5}$) | 0.0010 | $6\times10^{-10}$ |
| Waste Management | 2, DG 1 | Peak annual | 0.0000020 | 0 ($1\times10^{-9}$) | 0.00000015 | $9\times10^{-14}$ |
| | | Project total | 0.000077 | 0 ($5\times10^{-8}$) | 0.0000056 | $3\times10^{-12}$ |
| **Combined Impacts** | | **Peak annual** | **330** | **0 ($2\times10^{-1}$)** | **10** | **$6\times10^{-6}$** |
| | | **Project total** | **1,600** | **1 (1)** | **43** | **$3\times10^{-5}$** |

**Table 4–163. Combined Public Health Impacts—Normal Operations *(continued)***

| Alternative Combination and Components | Alternative | Time Period | General Population | | Maximally Exposed Individual | |
|---|---|---|---|---|---|---|
| | | | Dose (person-rem) | Risk (LCFs)[a] | Dose (millirem) | Risk (LCFs)[b] |
| **Alternative Combination 3** | | | | | | |
| Tank Closure | 6B, Base Case | Peak annual | 320 | 0 ($2\times10^{-1}$) | 9.8 | $6\times10^{-6}$ |
| | | Project total | 1,700 | 1 (1) | 49 | $3\times10^{-5}$ |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | Peak annual | 0.0099 | 0 ($6\times10^{-6}$) | 0.00047 | $3\times10^{-10}$ |
| | | Project total | 0.022 | 0 ($1\times10^{-5}$) | 0.0010 | $6\times10^{-10}$ |
| Waste Management | 2, DG 2 | Peak annual | 0.0000020 | 0 ($1\times10^{-9}$) | 0.00000015 | $9\times10^{-14}$ |
| | | Project total | 0.000077 | 0 ($5\times10^{-8}$) | 0.0000056 | $3\times10^{-12}$ |
| **Combined Impacts** | | **Peak annual** | **320** | **0 ($2\times10^{-1}$)** | **9.8** | **$6\times10^{-6}$** |
| | | **Project total** | **1,700** | **1 (1)** | **49** | **$3\times10^{-5}$** |

[a] The reported value is the projected number of LCFs among the population and is therefore presented as a whole number. The result calculated by multiplying the collective dose to the population by the risk factor (0.0006 per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6).

[b] Probability of an LCF in the maximally exposed individual is calculated by converting the dose in millirem to rem (divide by 1,000), then multiplying the dose by the risk factor of 0.0006 LCFs per rem.

**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; LCFs=latent cancer fatalities.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Compiled from Tables 4–19, 4–23, 4–39, 4–109, 4–111, and 4–142.

Table 4–164 presents the combined impacts of normal operations on the worker population. The total impact on the worker population was calculated as the sum of the impacts of each alternative, regardless of the duration or the time of occurrence. In some cases, the periods in which doses would occur would overlap; however, because of the varying durations of activities, there would be times when only one or two of the activities would be under way. The average annual impacts on an FTE are not additive. The average dose across all three alternatives would be lower than the highest dose of any single alternative.

**Table 4–164. Combined Worker Health Impacts—Normal Operations**

| Alternative Combination and Components | Alternative | Project Total Impact—Worker Population | | Duration of Radiation Work (years) | Average Annual Impact—Full-Time-Equivalent Worker[b] | |
|---|---|---|---|---|---|---|
| | | Dose (person-rem) | Risk (LCFs)[a] | | Dose (millirem/year) | Risk (LCFs)[a] |
| **Alternative Combination 1** | | | | | | |
| Tank Closure | No Action | 280 | 0 ($2\times10^{-1}$) | 102 | 140 | $9\times10^{-5}$ |
| FFTF Decommissioning | No Action | 1 | 0 ($6\times10^{-4}$) | 100 | 50 | $3\times10^{-5}$ |
| Waste Management | No Action | 37 | 0 ($2\times10^{-2}$) | 29 | 200 | $1\times10^{-4}$ |
| **Combined Impacts** | | **320** | **0 ($2\times10^{-1}$)** | | **<200** | **$<1\times10^{-4}$** |
| **Alternative Combination 2** | | | | | | |
| Tank Closure | 2B | 11,000 | 7 | 41 | 160 | $1\times10^{-4}$ |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 5.3 | 0 ($3\times10^{-3}$) | 3 | 33 | $2\times10^{-5}$ |
| Waste Management | 2, DG 1 | 3,400 | 2 | 45 | 200 | $1\times10^{-4}$ |
| **Combined Impacts** | | **14,000** | **9** | | **<200** | **$<1\times10^{-4}$** |
| **Alternative Combination 3** | | | | | | |
| Tank Closure | 6B, Base Case | 82,000 | 49 | 96 | 890 | $5\times10^{-4}$ |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 11 | 0 ($7\times10^{-3}$) | 3 | 51 | $3\times10^{-5}$ |
| Waste Management | 2, DG 2 | 6,600 | 4 | 94 | 200 | $1\times10^{-4}$ |
| **Combined Impacts** | | **89,000** | **53** | | **<890** | **$<5\times10^{-4}$** |

[a] For an individual, the lifetime risk of developing a latent cancer fatality (LCF) is based on the risk factor of 0.0006 LCFs per rem. For the worker population, the reported value is the projected number of LCFs and is therefore presented as a whole number. When the reported value is zero, the result calculated by multiplying the collective dose to the population by the risk factor (0.0006 LCFs per person-rem) is shown in parentheses (see Appendix K, Section K.1.1.6). The LCF risk in the worker population should be viewed in light of the number of years in which the worker dose occurs (spanning multiple generations of workers) and the controls implemented by the U.S. Department of Energy and its contractors to limit individual worker dose.

[b] Average annual dose and risk are not additive. On average, the dose or risk would be lower than the highest dose or risk of any single alternative.

**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory; LCFs=latent cancer fatalities.

**Note:** Sums and products presented in the table may differ from those calculated from table entries due to rounding.

**Source:** Compiled from Tables 4–20, 4–24, 4–41, 4–108, 4–110, 4–112, 4–141, 4–143, 4–144, and 4–145.

Under each of the three alternative combinations, the selected Tank Closure alternative would dominate the impacts on the public and workers. The Tank Closure alternatives would account for an especially high proportion of the impacts on the public—up to more than 99 percent of the doses to the general population and the MEI under each alternative combination. As shown in Table 4–163, the dose to the general population over the operational life of the project under Alternative Combination 1, about 77 person-rem, would result from a comparatively low annual offsite impact occurring at a fairly constant rate for approximately 100 years. The dose to the general population over the life of the project would be of the same order of magnitude under Alternative Combinations 2 and 3 (1,600 person-rem and 1,700 person-rem, respectively); the peak annual doses under the two alternatives are also comparable (330 person-rem and 320 person-rem, respectively).

Table 4–164 shows that the cumulative worker dose would increase as the level of activity increases among the alternative combinations. Alternative Combination 1, comprising the No Action Alternatives, would result in worker doses from continued operations and maintenance activities under each alternative. Alternative Combination 2 would result in higher cumulative worker doses: the Tank Closure alternative worker dose would increase due to retrieval and processing of tank waste; the FFTF Decommissioning alternative dose would increase due to processing of sodium and RH-SCs and entombing of the buildings; and the Waste Management alternative dose would increase due to the longer period required for disposal operations and increased waste processing activities. Alternative Combination 3 would result in the largest cumulative worker doses: the Tank Closure alternative worker dose would increase due to tank and soil removal and processing; the FFTF Decommissioning alternative dose would increase due to removal of the RCB vessels, piping, and components for disposal at IDF-East; and the Waste Management alternative dose would increase due to receipt of offsite waste and the longer period required for disposal operations.

The worker risks shown in Table 4–164 should be viewed in the context of the duration of the alternatives and the DOE administrative controls employed to limit worker dose, as discussed in Section 4.1.10. Some of the alternatives would occur over multiple generations of workers (e.g., Alternative Combinations 2 and 3, Tank Closure and Waste Management alternatives), so a large number of workers would be exposed. Individual worker exposure would be controlled in accordance with DOE requirements and contractor procedures. Individual annual doses must be less than 2 rem (2,000 millirem) per year unless a higher dose is explicitly approved. An Administrative Control Level of 500 millirem per year is applied to projects to ensure the dose limit is not exceeded (DOE 2006a:2, Fluor Hanford 2006:2-1). The number of LCFs is calculated by multiplying individual FTE doses that are less than the regulatory limit by a large number of FTEs. For example, Alternative Combination 3 would require about 112,000 FTE radiation worker years; however, the actual number of workers could be greater than 112,000 to comply with the administrative control level.

Note that the FTE worker average annual dose, shown in Table 4–164, would not occur in practice. Work would be divided among a larger number of workers so that the dose received by each individual was maintained within the Administrative Control Level of 500 millirem per year.

### 4.4.10 Public and Occupational Health and Safety—Transportation

The risks from transportation of radioactive and nonradioactive materials resulting from implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.12, 4.2.12, and 4.3.12. This section summarizes the overall transportation risks of the three alternative combinations. Table 4–165 provides the impacts on transportation workers and the general population from transportation activities under the three selected alternative combinations.

**Table 4–165. Combined Transportation Risks**

| Alternative Combination and Components | Alternative | Worker | | General Population | | Nonradiological Traffic Fatalities[a] |
|---|---|---|---|---|---|---|
| | | Collective Dose (person-rem) | Risk (Latent Cancer Fatalities) | Collective Dose (person-rem) | Risk (Latent Cancer Fatalities) | |
| **Alternative Combination 1** | | | | | | |
| Tank Closure | No Action | 0 | 0 | 0 | 0 | 0 |
| FFTF Decommissioning | No Action | 0 | 0 | 0 | 0 | 0 |
| Waste Management | No Action[b] | 2.6 | 0.0 | 0.08 | 0.0 | 0.006 |
| **Total** | | **2.6** | **0 (0.0)** | **0.08** | **0 (0.0)** | **0 (0.006)** |
| **Alternative Combination 2** | | | | | | |
| Tank Closure | 2B | 260 | 0.16 | 73 | 0.044 | 0.89 |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option[c] | 0.96 | 0.0 | 0.34 | 0.0 | 0.035 |
| Waste Management | 2, DG 1[d] | 2,500 | 1.5 | 350 | 0.21 | 1.86 |
| **Total** | | **2,800** | **2 (1.7)** | **420** | **0 (0.25)** | **3 (2.79)** |
| **Alternative Combination 3** | | | | | | |
| Tank Closure | 6B, Base Case | 560 | 0.34 | 89 | 0.053 | 1.96 |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option[b] | 0.99 | 0.0 | 0.34 | 0.0 | 0.035 |
| Waste Management | 2, DG 2[e] | 2,500 | 1.5 | 350 | 0.21 | 2.1 |
| **Total** | | **3,100** | **2 (1.8)** | **440** | **0 (0.26)** | **4 (4.1)** |

[a] Traffic fatalities include those associated with the transport of both radioactive and nonradioactive materials.
[b] The values provided are for onsite transport of waste to a disposal site in the 200-East Area.
[c] This includes disposition of remote-handled special components at Idaho National Laboratory and disposition of bulk sodium at Hanford.
[d] The values presented are for truck transport of radioactive materials as well as construction and operational materials under Disposal Group 1. Note that Disposal Group 1 material transport needs are based on the disposal area that meets the needs of Tank Closure Alternative 4; no attempt was made to adjust the burial size under Alternative 2B. In addition, traffic fatalities using rail would be higher by a factor of 3 than the value presented here (see Section 4.3.12).
[e] The values presented are for truck transport of radioactive materials as well as construction and operational materials under Disposal Group 2. Note that Disposal Group 2 material transport needs are based on the disposal area that meets the needs of Tank Closure Alternative 6B, Option Case; no attempt was made to adjust the burial size under Alternative 6B, Base Case. In addition, traffic fatalities using rail would be higher by a factor of 3 than the value presented here (see Section 4.3.12).

**Note:** Totals may not equal the sum of the contributions due to rounding.

**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory.

**Source:** Compiled from Tables 4–69, 4–70, 4–124, 4–125, 4–152, and 4–153.

As indicated in Table 4–165, no combination of transports is expected to result in an LCF among the exposed population. There could be two additional fatalities among the exposed workers under Alternative Combinations 2 and 3. The maximum annual dose to a transportation crew would be limited to 100 millirem per year, unless the individual is a trained radiation worker, in which case the administrative limit would be an annual dose of 2 rem (DOE Standard 1098-2008). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure of 2 rem is 0.0012 per year. Therefore, an individual transportation worker is not expected to develop a latent fatal cancer from exposures during these activities during his or her lifetime.

The expected traffic fatalities range from 0 to 4 over the entire duration of activities. Considering that the duration of activities ranges from 30 to over 100 years, and that traffic fatalities in the United States average about 40,000 per year, the expected risk of traffic fatalities is small.

### 4.4.11 Environmental Justice

The potential for high and adverse impacts on minority and low-income populations resulting from implementation of the Tank Closure, FFTF Decommissioning, and Waste Management alternatives is discussed in Sections 4.1.13, 4.2.13, and 4.3.13. This section presents the impacts that would result under the selected alternative combinations. Resource areas that could be impacted, and thus affect the general population, including minority and low-income populations, include public and occupational health and safety due to normal operations, accidents, and transportation, as well as air quality.

Section 4.4.9 discusses the short-term radiological impacts on the public resulting from normal operations. As shown in Table 4–163, the majority of the dose received by the public and the MEI under all alternative combinations would be dominated by the Tank Closure alternatives. As presented in Appendix J and Section 4.1.13, there is no appreciable difference between the average total dose to an individual of the minority, American Indian, Hispanic or Latino, or low-income populations and an individual of the remainder of the population in both the peak year of exposure and across the lifetime of the project under all Tank Closure alternatives. Similarly, the dose to the Yakama Reservation MEI is less than one-sixth of that to the offsite MEI for both the peak year of exposure and across the lifetime of the project under all Tank Closure alternatives. Therefore, none of the selected alternative combinations would pose disproportionately high and adverse impacts on minority or low-income populations.

The radiological and chemical impacts of facility accidents under the selected alternative combinations would be the same as those identified in Sections 4.1.11, 4.2.11, and 4.3.11. Potential impacts on minority and low-income populations due to facility accidents would be the same as those described in Sections 4.1.13, 4.2.13, and 4.3.13. As no disproportionately high and adverse impacts were identified under the individual alternatives, none of the combined alternatives would pose disproportionately high and adverse impacts on minority or low-income populations due to facility accidents.

Air quality impacts under the alternative combinations are discussed in Section 4.4.3. Air quality impacts were not analyzed separately for each minority population because the results would be similar to those for radiological impacts; as there would be no disproportionately high or adverse health or environmental impacts on minority, American Indian, Hispanic or Latino, or low-income populations due to normal operations, the same would be true for nonradioactive air emissions.

Section 4.4.10 discusses the risks to the general population of transporting radioactive and nonradioactive materials to implement the three selected alternative combinations. None of the selected alternative combinations are expected to result in an LCF to the exposed population, including minority, American Indian, Hispanic or Latino, and low-income populations. The risks associated with nonradiological transportation would also be small. Therefore, none of the alternative combinations would pose disproportionately high and adverse impacts on minority or low-income populations residing along the transportation routes.

### 4.4.12 Waste Management

Waste generation impacts associated with the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives and options, including those associated with the construction, operations, deactivation, and closure of the waste management facilities, are presented in Sections 4.1.14, 4.2.14, and 4.3.14. The various alternatives would generate several types of waste: HLW, mixed TRU waste, LLW, MLLW, hazardous waste, and nonhazardous waste. In all cases, the waste management capacity either would be sufficient or new infrastructure would be constructed as part of the alternative. This section describes the combined impacts of managing these wastes. Projected waste generation rates for the proposed alternative were compared with Hanford's capacity to manage the waste, including the additional waste disposal capacity that is proposed to be constructed. Specifically, projected waste generation rates were compared with site processing rates and the capacities of the treatment, storage, and disposal facilities likely to be involved in managing the additional waste. The potential impacts of waste generated as a result of site environmental restoration activities that are unrelated to tank closure, FFTF decommissioning, or waste management are not within the scope of this analysis.

Table 4–166 presents projected volumes of waste that would be generated under the three alternative combinations considered. All three alternative combinations would generate onsite, non-CERCLA waste. Waste generation under Alternative Combinations 2 and 3 would also include the projected receipt of offsite-waste shipments. Under Alternative Combination 1, no offsite waste would be received. The estimated volume of the onsite, non-CERCLA waste that would be generated at Hanford would not be regulated as CERCLA waste and would be generated in facilities and during operations that are not related to tank waste. Examples of facilities and operations that are expected to generate such non-CERCLA waste include the Plutonium Finishing Plant, T Plant complex, WESF, WRAP, Waste Sampling and Characterization Facility, groundwater sampling activities, Pacific Northwest National Laboratory, Cold Vacuum Drying Facility, Canister Storage Building, and the Liquid Waste Processing Facilities, which include the LERF, ETF, SALDS, and TEDF. Estimates of these volumes were developed from the Hanford Site Solid Waste Integrated Forecast Technical (SWIFT) database (Barcot 2005) for LLW, MLLW, and TRU waste and from the SWIFT 2007.0 database (Barcot 2006) for hazardous waste. From the SWIFT source, the volume of LLW and MLLW for the period from 2006 through 2035 was estimated to be approximately 5,300 cubic meters (187,000 cubic feet). For TRU waste, the estimated volume was estimated to be 22,500 cubic meters (795,000 cubic feet). The estimated volume of hazardous waste generated was 870 cubic meters (30,700 cubic feet). However, because hazardous waste is often shipped directly off site for disposal, complete estimates are difficult to calculate. Therefore, it is expected that this is only a subset of the total hazardous waste that would be generated at Hanford. Likewise, because nonhazardous waste is also shipped directly off site for disposal, no estimates are provided other than those projected from the tank closure activities.

## Table 4–166. Combined Waste Generation Volumes

| Alternative Combination and Components | Alternative | Waste Type | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | HLW[a] | Mixed TRU Waste | LLW[b] | MLLW[c] | Hazardous Waste[d] | Nonradioactive/ Nonhazardous Waste[d] | Liquid LLW (liters) |
| **Alternative Combination 1** | | | | | | | | |
| Tank Closure | No Action | N/A | N/A | 35 | 21 | 12 | 307 | N/A |
| FFTF Decommissioning | No Action | N/A | N/A | 1,700 | 57 | 396 | NR | 623,000 |
| Waste Management | No Action | N/A | N/A | 38 | N/A | 38 | NR | N/A |
| Onsite, non-CERCLA waste[e] | | N/A | 22,500 | 3,740 | 1,520 | 870 | NR | N/A |
| Offsite waste[f] | | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Total** | | **N/A** | **22,500** | **5,510** | **1,600** | **1,320** | **307** | **623,000** |
| **Alternative Combination 2** | | | | | | | | |
| Tank Closure | 2B | 16,000 | 206 | 38,300 | 726,000 | 79,600 | 1,900 | 9,690 |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | N/A | N/A | 85 | 407 | N/A | 458 | 182,000 |
| Waste Management | 2, Disposal Group 1 | N/A | N/A | 1,520 | N/A | 96 | N/A | N/A |
| Onsite, non-CERCLA waste[e] | | N/A | 22,500 | 3,740 | 1,520 | 870 | NR | N/A |
| Offsite waste | | N/A | N/A | 62,000 | 20,000 | N/A | N/A | N/A |
| **Total** | | **16,000** | **22,700** | **106,000** | **748,000** | **80,500** | **2,360** | **192,000** |
| **Alternative Combination 3** | | | | | | | | |
| Tank Closure | 6B, Base Case | 576,000 | 412 | 104,000 | 2,960,000 | 80,900 | 2,480,000 | 9,690 |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | N/A | N/A | 770 | 415 | 73 | 458 | 324,000 |
| Waste Management | 2, Disposal Group 2 | N/A | N/A | 1,520 | N/A | 96 | N/A | N/A |
| Onsite, non-CERCLA waste[e] | | N/A | 22,500 | 3,740 | 1,520 | 870 | NR | N/A |
| Offsite waste | | N/A | N/A | 62,000 | 20,000 | N/A | N/A | N/A |
| **Total** | | **576,000** | **22,900** | **172,000** | **2,980,000** | **81,900** | **2,480,000** | **334,000** |

[a] Includes cesium and strontium canisters, HLW melters, and other HLW. Includes ILAW and LAW melters under Alternative 6B, Base Case.

[b] Includes secondary LLW and closure LLW.

[c] Includes secondary MLLW, closure MLLW, LAW melters, and ILAW under Alternative 2B. Includes secondary MLLW, closure MLLW, and Preprocessing Facility melters and glass under Alternative 6B, Base Case.

[d] Hazardous and nonhazardous waste is directly shipped off site; therefore, it is generally not forecast.

[e] Data for LLW, MLLW, and TRU waste are from the Hanford Site Solid Waste Integrated Forecast Technical database fiscal year (FY) 2006–2035 report, while data for hazardous waste are from the FY 2007–2035 report. The FY 2007 report was used for hazardous waste because the forecast shows a 630-cubic-meter increase over the FY 2006 forecast due to changes in the site infrastructure forecast, based on historical generation rates and process knowledge regarding infrastructure support/operations.

[f] No offsite waste would be received under the Waste Management No Action Alternative.

**Note:** All values are in cubic meters except as noted. To convert cubic meters to cubic feet, multiply by 35.315; liters to gallons, by 0.26417.

**Key:** CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; HLW=high-level radioactive waste; Idaho=Idaho National Laboratory; ILAW=immobilized low-activity waste; LAW=low-activity waste; LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste; N/A=not applicable; NR=not reported; TRU=transuranic.

**Source:** Compiled from Tables 4–84, 4–86, 4–94, 4–126, and 4–155.

Estimated volumes of the LLW and MLLW that would be received from other DOE sites were established in the "Record of Decision for the Solid Waste Program, Hanford Site, Richland, WA: Storage and Treatment of Low-Level Waste and Mixed Low-Level Waste; Disposal of Low-Level Waste and Mixed Low-Level Waste, and Storage, Processing, and Certification of Transuranic Waste for Shipment to the Waste Isolation Pilot Plant" (69 FR 39449). The volumes are limited to 62,000 cubic meters (81,100 cubic yards) of LLW and 20,000 cubic meters (26,200 cubic yards) of MLLW. Thus, this *TC & WM EIS* evaluated the upper limits of the volumes of offsite wastes that may be disposed of at Hanford. These upper-limit volumes were used for analysis purposes only.

**Disposal and Capacity**

For waste disposal, the range of actions includes onsite and offsite disposal. Waste disposed of on site would be influenced by the volume of waste produced and the ability of the waste to meet onsite disposal criteria. Use of current disposal facilities (e.g., lined trenches) and construction of new facilities (IDF and RPPDF) were analyzed under the Waste Management alternatives. All three Waste Management alternatives include continued disposal of LLW and MLLW in lined trenches, with the timeframe for disposal completion varying from 2035 to 2050. Waste Management Alternatives 2 and 3 include construction of the RPPDF for disposal of equipment and soils resulting from clean closure activities that are not highly contaminated, as well as one or two IDFs for disposal of tank waste, onsite non-CERCLA waste, FFTF decommissioning waste, waste management waste streams, and, as applicable, LLW and MLLW received from offsite locations. The difference between the action alternatives is that Waste Management Alternative 2 includes one IDF, while Waste Management Alternative 3 includes two IDFs, one in the 200-East Area (IDF-East, for tank waste only) and one in the 200-West Area (IDF-West). The Waste Management No Action Alternative discontinues the construction of IDF-East.

Both Waste Management action alternatives analyze three disposal group options. These options were developed based on the amounts and types of waste generated under the various alternatives (within each of the three sets of alternatives that this *TC & WM EIS* analyzes, i.e., tank closure, FFTF decommissioning, and waste management). Facility operational timeframes also vary between the disposal group options. Disposal details for each of the Waste Management alternatives and disposal groups are discussed in Chapter 2.

For HLW, combined generation rates would range from 16,000 cubic meters (563,000 cubic feet) under Alternative Combination 2 to 576,000 cubic meters (20.3 million cubic feet) under Alternative Combination 3 (see Table 4–166). All HLW would be treated, packaged, and stored on site. Under Tank Closure Alternative 1, the cesium and strontium capsules would be stored indefinitely in the WESF, in a manner similar to that currently used.

For mixed TRU waste, combined generation rates would range from 22,500 cubic meters (796,000 cubic feet) under Alternative Combination 1 to 22,900 cubic meters (810,000 cubic feet) under Alternative Combination 3. It is anticipated that TRU waste would be disposed of at WIPP.

For LLW, combined generation rates would range from 5,510 cubic meters (194,000 cubic feet) under Alternative Combination 1 to 172,000 cubic meters (6.07 million cubic feet) under Alternative Combination 3. All LLW would be disposed of on site.

For MLLW, combined generation rates would range from 1,600 cubic meters (56,300 cubic feet) under Alternative Combination 1 to 2.98 million cubic meters (105 million cubic feet) under Alternative Combination 3. Through a combination of on- and offsite capabilities, MLLW would be treated to meet RCRA land-disposal-restriction treatment standards and then disposed of on site.

Hazardous waste volumes are often not forecast, but for those volumes that have been forecast, combined generation rates would range from 1,320 cubic meters (46,600 cubic feet) under Alternative Combination 1 to 81,900 cubic meters (2.89 million cubic feet) under Alternative Combination 3. All hazardous waste generated at Hanford is shipped off site for disposal or recycling.

Nonhazardous waste volumes are also often not forecast, but for those volumes that have been forecast, combined generation rates would range from 307 cubic meters (10,800 cubic feet) under Alternative Combination 1 to 2.48 million cubic meters (87.6 million cubic feet) under Alternative Combination 3. All nonhazardous waste generated at Hanford is shipped off site for disposal or recycling.

As discussed above, none of the three alternative combinations would exceed the capacity of the current or planned Hanford waste management infrastructure. While Alternative Combination 3 reflects the upper end of the three alternative combinations, it does not represent the limit for waste management infrastructure demands. An alternative combination that would substitute Tank Closure Alternative 6A, Base or Option Case, for Alternative 6B, Base Case, and include FFTF Decommissioning Alternative 2 (with all facilities to be built at Hanford) and Waste Management Alternative 2 or 3 (with Disposal Group 3), would have the greatest combined impacts on the waste management infrastructure for HLW, MLLW, hazardous waste, and liquid LLW.

An alternative combination that would substitute Tank Closure Alternative 6B, Option Case, for Alternative 6B, Base Case, and include FFTF Decommissioning Alternative 2 (with all facilities to be built at Hanford) and Waste Management Alternative 2 or 3 (with Disposal Group 3), would have the greatest combined impacts on the waste management infrastructure for LLW.

An alternative combination that would substitute Tank Closure Alternative 4 for Alternative 6B, Base Case, and include FFTF Decommissioning Alternative 2 (with all facilities to be built at Hanford) and Waste Management Alternative 2 or 3 (with Disposal Group 3), would have the greatest combined impacts on the waste management infrastructure for mixed TRU waste.

However, generation of these wastes is not likely to have major impacts on the waste management infrastructure at Hanford because sufficient capacity exists or would be constructed under the corresponding Waste Management alternatives.

### 4.4.13 Industrial Safety

The industrial safety risks and impacts of implementing the various Tank Closure, FFTF Decommissioning, and Waste Management alternatives are presented in Sections 4.1.15, 4.2.15, and 4.3.15. This section summarizes the overall industrial safety impacts of the three alternative combinations. For each alternative combination, the number of TRCs and fatalities was projected over the duration of the alternatives under that combination (see Table 4–167). The resulting total number of TRCs and fatalities represents the potential impacts on worker safety.

As indicated in Table 4–167, the number of projected TRCs and fatalities would be greatly influenced by the requirements of the Tank Closure alternatives. The numbers of TRCs would range from 173 under Alternative Combination 1 to 6,830 under Alternative Combination 3. The greater number of TRCs would be directly related to the amount of work required and the duration of time that work was performed.

**Table 4–167. Combined Industrial Safety Impacts**

| Alternative Combination and Components | Alternative | Number of Total Recordable Cases | Number of Fatalities |
|---|---|---|---|
| **Alternative Combination 1** | | | |
| Tank Closure | No Action | 163 | 0.02 |
| FFTF Decommissioning | No Action | 0.42 | 0.00005 |
| Waste Management | No Action | 10.0 | 0.001 |
| **Total** | | **173** | **0.02** |
| **Alternative Combination 2** | | | |
| Tank Closure | 2B | 3,880 | 0.50 |
| FFTF Decommissioning | 2, Idaho Option, Hanford Reuse Option | 14.8 | 0.001 |
| Waste Management | 2, DG 1, Subgroup 1-A | 578 | 0.076 |
| **Total** | | **4,470** | **0.58** |
| **Alternative Combination 3** | | | |
| Tank Closure | 6B, Base Case | 5,150 | 0.67 |
| FFTF Decommissioning | 3, Idaho Option, Hanford Reuse Option | 16.2 | 0.003 |
| Waste Management | 2, DG 2, Subgroup 2-B | 1,660 | 0.21 |
| **Total** | | **6,830** | **0.88** |

**Note:** Totals may not equal the sum of the contributions due to rounding.
**Key:** DG=Disposal Group; FFTF=Fast Flux Test Facility; Hanford=Hanford Site; Idaho=Idaho National Laboratory.
**Source:** Compiled from Tables 4–98, 4–132 , and 4–156.

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