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. Impacts 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. Impact 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 are 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; a comparison of the environmental effects among alternatives is presented in Chapter 2, Section 2.6.

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 impacts analysis also considers different closure scenarios associated with the single-shell tank (SST) system.

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) has assumed for the purposes of analysis 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 involve the construction, subsequent operations, 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. With the exception of 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 involve the construction, subsequent operations, 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[e]								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	
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
Modified sluicing retrieval systems		X	X	X	X	X	X	X			X
Preprocessing Facility									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					

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**
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]		
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 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.

[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; 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.

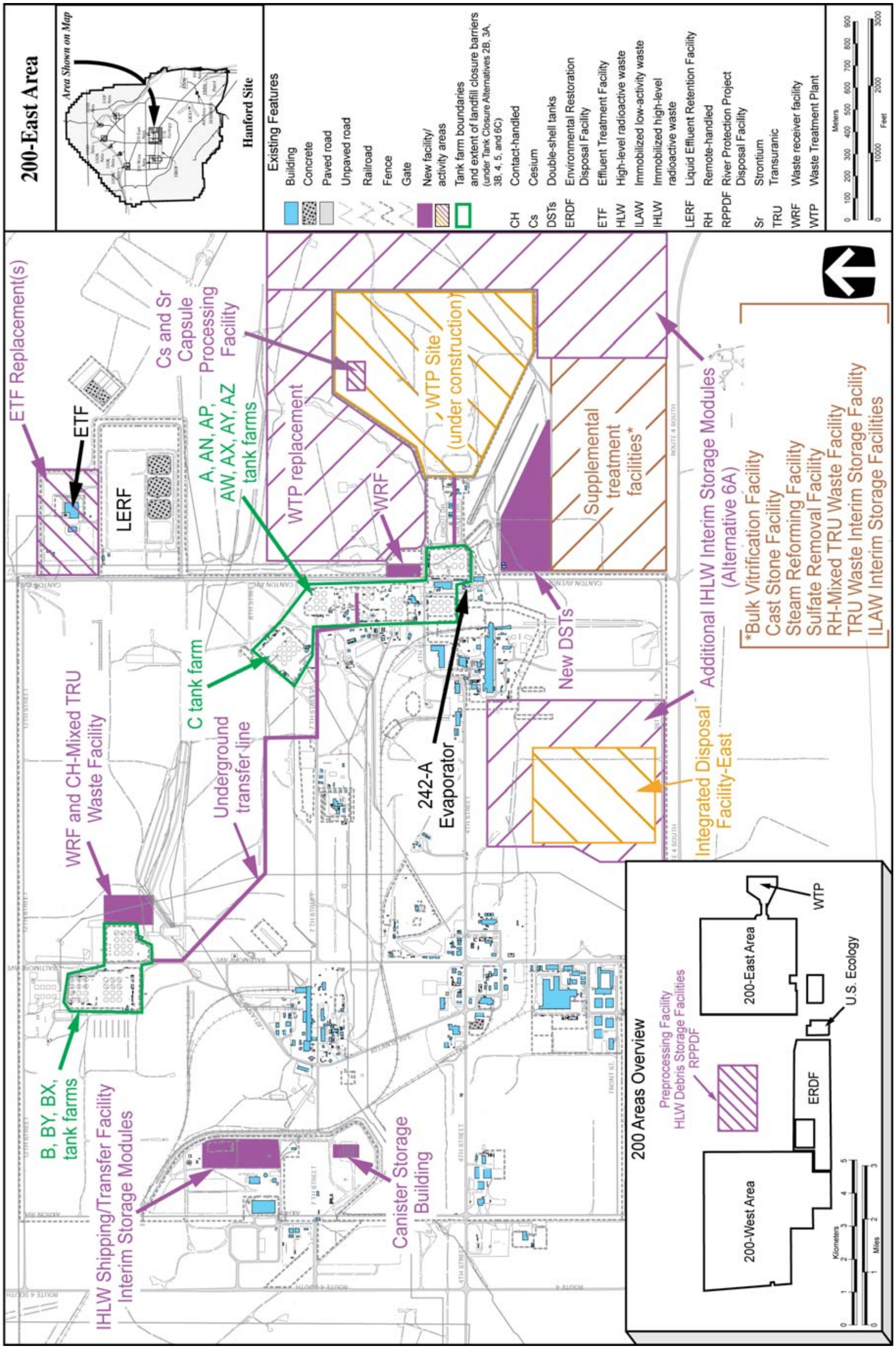


Figure 4–1. 200-East Area New Facility Locations and Affected Areas

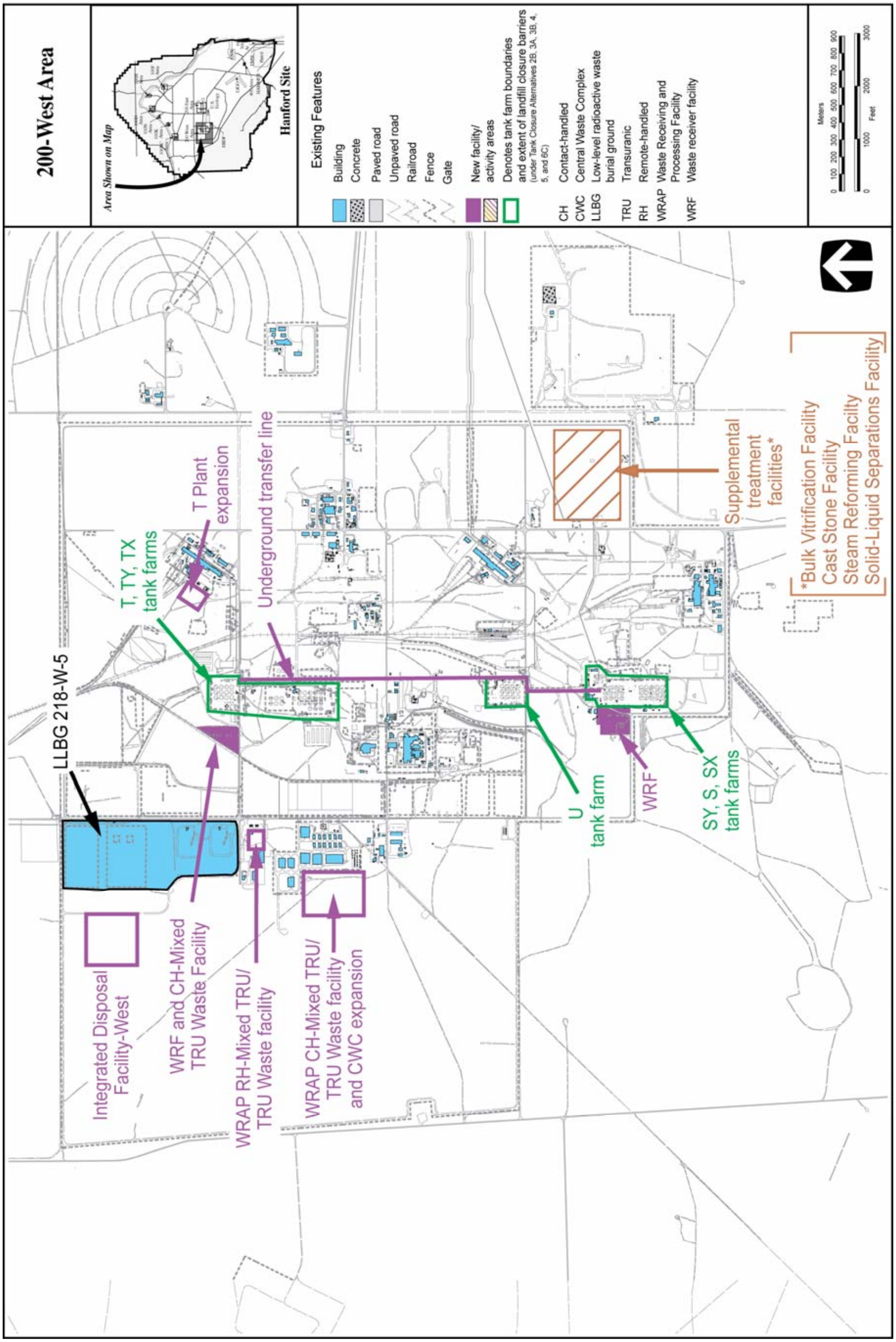


Figure 4–2. 200-West Area New Facility Locations and Affected Areas

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 commitment of land within the 200 Areas over the long term. 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 recent 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 in connection with 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 completing 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 32.3 hectares (79.9 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 0.6 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 Industrial-Exclusive land use zone over the long term. In addition to the 32.3 hectares (79.9 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 49.4 hectares (122 acres), or 1 percent of the area designated as Industrial-Exclusive.

Alternative 2A would require that geologic material be excavated 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 27.5 hectares (68 acres), or 3 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 recent 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, 27.5 hectares (68 acres) of Borrow Area C would be excavated in connection with 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 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 completing 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 16.2 hectares (40 acres)—12.5 hectares (30.9 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 16.2 hectares (40 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.

Alternative 2B would require that geologic material be excavated 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 94.7 hectares (234 acres), or about 10 percent of the area. Although development of Borrow Area C would represent a change in the current land use, it 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 recent 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, 94.7 hectares (234 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 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 completing the WTP, a number of new facilities would be constructed under this alternative as listed in Table 4–1. Also, a modified RCRA Subtitle C landfill barrier 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 17.4 hectares (43 acres)—13.2 hectares (32.7 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, 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 17.4 hectares (43 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 102 hectares (251 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, 101 hectares (249 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 recent 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 6.1 hectares (15 acres) of land would be disturbed within Borrow Area C 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 that 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 18.3 hectares (45.2 acres)—13.7 hectares (33.8 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 0.4 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 18.3 hectares (45.2 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 (253 acres), or 2 percent of the area designated Industrial-Exclusive.

Under Alternative 3B, 93.5 hectares (231 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, it has been designated as Conservation (Mining); thus, 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 recent 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 slightly less (e.g., 1.2 hectares

[3 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 that 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 18.2 hectares (45 acres)—13.9 hectares (34.3 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 0.4 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 18.2 hectares (45 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 (253 acres), or 2 percent of the area designated as Industrial-Exclusive.

Alternative 3C would require that geologic material be excavated 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 93.9 hectares (232 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 recent 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. Since nearly the same amount of geologic material would be required under Alternative 3C (93.9 hectares [232 acres]) as under Alternative 2B (94.7 hectares [234 acres]), visual impacts would be similar to those described for Alternative 2B.

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 six sets of cribs and trenches (ditches) (see Chapter 2, Section 2.5.2.4). 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 17.8 hectares (44.1 acres)—13.7 hectares (33.8 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 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 recent 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 17.8 hectares (44.1 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 78.5 hectares (194 acres), or about 1.6 percent of the area designated as Industrial-Exclusive.

Alternative 4 would require that geologic material be excavated 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, it 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 recent 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 7.3 hectares (18 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 completing 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 that geologic material be excavated 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 118 hectares (291 acres), or about 13 percent of the area. Borrow Area C has been designated Conservation (Mining) and its use for this purpose would be in consistent with the Hanford land use plan established in accordance with the *Hanford Comprehensive Land-Use Plan EIS* and recent 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, 118 hectares (291 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 IV. Upon completion of work under this alternative, excavations in the 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 completing the WTP with expanded high-level radioactive waste (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. Although 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 210 hectares (519 acres)—207 hectares (511 acres) within or adjacent to the 200-East Area (both to the east and west) and 3.2 hectares (8 acres) in the 200-West Area (see Figures 4–1 and 4–2). Not including 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), or about 4.7 percent of the area 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.

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, it would be necessary to excavate 494 hectares (1,220 acres) of Borrow Area C. This level of development would represent about 53 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 recent 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 those described for Alternative 6A, Base Case. 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) since they would be removed and their deep plumes remediated. Thus, compared to the Base Case, an additional 25.4 hectares (62.7 acres) of land would become available for alternative uses in the future within the 200 Areas, or a total land commitment of 210 hectares (519 acres) under the option case (i.e., 41 percent of the area designated as Industrial-Exclusive). However, 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, 571 hectares (1,410 acres), or about 62 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 this alternative, with all but 3.2 hectares (8 acres) in or adjacent to the 200-East Area. Thus, although the overall appearance of the 200-West Area would not noticeably change, that of the 200-East Area and vicinity 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 just to the west and 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 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, 494 hectares (1,220 acres) of Borrow Area C would be excavated in connection with 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 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. 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; 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 result in the excavation of an additional 76.5 hectares (189 acres) of Borrow Area C compared with the Base Case. This excavation would further impact the view of the area from State Route 240 and nearby higher elevations, resulting in a BLM visual resource management rating change from Class II to Class IV (as is 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 completing the WTP with expanded LAW vitrification capacity, a number of new facilities would be constructed under this alternative, as listed in Table 4–1. As is the case under Alternative 5 (see Section 4.1.1.8.1), 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 117 hectares (288 acres)—113 hectares (279 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 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 142 hectares (351 acres), or 2.8 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 that geologic material be excavated 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 239 hectares (591 acres), or about 26 percent of the area. Although development of Borrow Area C would represent a change in the current land use, it 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 recent 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 would generally be similar to those described above for Alternative 6B, Base Case (see Section 4.1.1.10.1.1). 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) since 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 within the 200 Areas would become available for alternative uses in the future, or a total land commitment of 117 hectares (288 acres) under the option case (i.e., 2.3 percent of the area designated as Industrial-Exclusive). 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 (780 acres), or about 34 percent of the area, as compared to 239 hectares (591 acres) under the Base Case.

4.1.1.10.2 Visual Resources

4.1.1.10.2.1 Base Case

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

As noted above, 239 hectares (591 acres) of Borrow Area C would be excavated in connection with 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 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 the 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; 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 result in the excavation of an additional 76.5 hectares (189 acres) within Borrow Area C compared with the Base Case. This excavation would further impact the view of the area from State Route 240 and nearby higher elevations, resulting in a BLM visual resource management rating change from Class II to Class IV (as is the situation for 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 completing 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, facilities would be located within area designated as Industrial-Exclusive. In total, new facilities would occupy 61.1 hectares (151 acres)—57.5 hectares (142 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 61.1 hectares (151 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 145 hectares (359 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 that geologic material be excavated 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 (257 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 recent supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615, 73 FR 55824).

4.1.1.11.2 Visual Resources

As noted above, 61.1 hectares (151 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 (257 acres) of Borrow Area C would be excavated in connection with 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 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 the purposes of analysis, project timeframes for each alternative include the active project phase (during which construction, operations, deactivation, and closure activities are 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 are projected for each Tank Closure alternative as well as for component project phases (e.g., 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, electrical 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 has been assumed for the purposes of analysis 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 for 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, but this requirement would be relatively small compared to 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)
2A	Construction	0.90	338	45.8	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	4,950	218	208,000
	Peak (Year)	0.56 (2078–2079)	112 (2078–2079)	5.33 (2023–2025)	3,720 (2065–2067)
2B	Construction	0.55	177	30.3	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)	1.16 (2040)	271 (2040)	8.18 (2040)	3,560 (2040)
3A	Construction	0.48	174	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)	0.78 (2040)	80.8 (2035–2036)	5.03 (2035–2036)	2,180 (2035–2036)

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)
3B	Construction	0.48	170	28.7	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	1,860	116	77,000
	Peak (Year)	0.47 (2035–2038)	81.2 (2035–2036)	5.03 (2035–2036)	2,180 (2035–2036)
3C	Construction	0.49	175	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)	0.83 (2035–2038)	86.1 (2035–2036)	5.03 (2035–2036)	2,190 (2035–2036)
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)
5	Construction	0.50	174	29.1	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)	0.62 (2024–2025)	229 (2029–2032)	5.89 (2029–2032)	3,800 (2029–2032)
6A, Base Case	Construction	1.80	671	77.6	28,600
	Operations	175	21,300	598	597,000
	Deactivation	6.0	718	22.2	17,300
	Closure	3.28	400	25.6	1,150
	Total[c]	186	23,100	723	644,000
	Peak (Year)	1.94 (2138)	234 (2138)	8.95 (2149–2150)	6,580 (2138)
6A, Option Case	Construction	1.80	671	77.6	28,600
	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	23,200	720	644,000
	Peak (Year)	1.97 (2078)	237 (2078)	7.54 (2163)	6,580 (2138)
6B, Base Case	Construction	0.58	206	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)	1.24 (2040)	255 (2040)	6.56 (2040)	3,500 (2040)

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)
6B, Option Case	Construction	0.58	206	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)	1.28 (2040)	259 (2040)	6.58 (2040)	3,500 (2040)
6C	Construction	0.55	179	30.3	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)	1.16 (2040)	271 (2040)	8.18 (2040)	3,560 (2040)

[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 2007a.

4.1.2.1 Alternative 1: No Action

Under Alternative 1, peak utility infrastructure demands would occur over the first 3 years of the project period (assumed as 2006–2008) while 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 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 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 involves the 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 is 90 years, from 2006 through completion of WTP deactivation activities in 2095, excluding the subsequent 100-year administrative control period. Table 4–2 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 through 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 2023–2025, 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 is 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 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 1.16 million megawatt-hours (approximating an electric load of 132 megawatts) in 2040 would be about 67 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, with demands 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 3,560 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).

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

Alternative 3A involves 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 active project phase under Alternative 3A is 37 years, from 2006 through completion of WTP deactivation, landfill closure, and most other activities in 2041, excluding the subsequent 100-year postclosure (landfill) care period. Table 4–2 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 0.78 million megawatt-hours (approximating an electric load of 89 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) in the 2035 through 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 also occur in 2035–2036 under Alternative 3A, with demands dominated by facility operations and Borrow Area C operations and surface barrier construction. The projected peak water demand of 2,180 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).

4.1.2.5 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 is 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 summarizes the projected infrastructure resource requirements under Alternative 3B.

4.1.2.5.1 Electricity

Total electrical energy requirements for implementation of Alternative 3B are 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 operation of 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 2035–2038 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 0.47 million megawatt-hours (approximating an electric load of 54 megawatts) would be about 27 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 operations of Borrow Area C and surface barrier construction activities.

4.1.2.5.3 Water

Peak water requirements would also occur in 2035–2036 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 2,180 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).

4.1.2.6 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 is 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 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-Liquids 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 Alternatives 3A or 3B by virtue 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

0.83 million megawatt-hours (approximating an electric load of 95 megawatts) over the 2035–2038 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 2035–2036 timeframe, driven by facility operations, with construction of landfill closure surface barrier lobes as a large contributor. The projected peak water demand of 2,190 million liters (579 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 is 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 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 Preprocessing Facility (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 is 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 electrical energy demand peak occurring in 2024–2025 would coincide with the projected startup of SST grouting operations, coinciding with WTP and supplemental treatment facility operations. The peak electrical energy demand of 0.62 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, with the addition of Hanford surface barrier construction activities.

4.1.2.8.3 Water

Peak water requirements would also occur over the 2029–2032 timeframe, driven by facility operations, led by the WTP, along with Hanford surface barrier construction activities. The projected peak water demand of 3,800 million liters (1,000 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 activity overlaps would compound utility infrastructure resource demands, along with clean closure activities, and peak activities would occur over a much longer timeframe, compared with the previously discussed alternatives. The active project phase under Alternative 6A is 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 different cases (Base and Option Cases) considered under Alternative 6A relate to landfill closure of six sets of cribs and trenches (ditches) in the B and T Areas under the Base Case versus their removal and clean closure under the Option Case. Table 4–2 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 1.94 million megawatt-hours (approximating an electric load of 221 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 234 million liters (61.8 million gallons) in 2138, corresponding with ongoing WTP operations and WTP replacement construction 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 the Base Case liquid fuel consumption, with peak diesel fuel demands also occurring in 2078 at 237 million liters (62.6 million gallons). Gasoline consumption would also 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 6,580 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 that 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 accomplishes waste processing in a shorter timeframe using an expanded WTP and requiring no 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 is 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 relate to landfill closure of six sets of cribs and trenches (ditches) in the B and T Areas under the Base Case versus their removal and clean closure under the Option Case. Table 4–2 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 1.24 million megawatt-hours (approximating an electric load of 142 megawatts) in 2040 would be about 71 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 occurs due to the higher electricity demand 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 1.28 million megawatt-hours (approximating an electric load of 146 megawatts) would be about 74 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 also occur in 2040, with the timing of the peak based on the activities discussed above. The projected peak water demand of up to 3,500 million liters (925 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 that 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 the most demand on utility infrastructure. Infrastructure requirements under this alternative would mirror those under Alternative 2B, except that additional immobilized low-activity waste (ILAW) storage facilities would be needed under this alternative. The active project phase under Alternative 6C is 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 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 1.16 million megawatt-hours (approximating an electric load of 132 megawatts) in 2040 would be about 67 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 also occur in 2040, dominated by peak operations coinciding with landfill closure activities. The projected peak water demand of 3,560 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 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 15.2 meters (50 feet), the contribution to the sound level at the nearest site boundary would be 18 dBA (SAIC 2007a). If the equipment operates 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 limitation of 60 dBA for industrial sources impacting residential receptors (WAC 173-60).

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

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.

The number of employee vehicles and trucks delivering materials for various phases of tank closure activities will 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 the Tank Closure alternatives that involve excavation, earthmoving, transporting 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 that have been identified to have impacts on this facility are activities in which heavy vehicles or large construction equipment is used. It is expected that blasting would also have an impact on this facility if it is required for mining. Although DOE will coordinate vibration-producing activities with LIGO, impacts of this type of activity associated with these Tank Closure alternatives are expected to result in some interference 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 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 disturbance of wildlife near the 200 Areas is expected to occur as a result of noise 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 operation 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 will vary over the duration of the project. The highest number of employee trips is expected to occur from 2078–2079, during WTP operations and deactivation (SAIC 2007a). The increase in the number of employee vehicles and truck trips is expected to result in a minor increase in traffic noise levels along routes to the site. The increase in employee and truck traffic from the discussion of local traffic (see Section 4.1.9) was compared to the existing average traffic volume (see Chapter 3, Section 3.2.9.4). For the purpose of comparison among 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 operation 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 will 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 2007a). 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. This assessment and conclusion is similar to that previously described for 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 operation 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 will 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 2007a). 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. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will 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 2007a). 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. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will 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 2007a). The increase in number of employee vehicle and truck trips is expected to result in a minor increase in traffic noise levels along routes to the site. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will 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 2007a). 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. This assessment and conclusion is similar to that previously described for 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 operation 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 will vary over the duration of the project. The highest number of employee trips is expected to occur from 2029–2032 during WTP and VBR system operations (SAIC 2007a). 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. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will vary over the duration of the project. The highest number of employee trips is expected to occur in 2138 during WTP operations and deactivation and HLW Interim Storage Facility operations (SAIC 2007a). 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. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will 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 2007a). 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. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will vary over the duration of the project. The highest number of employee trips is expected to occur from 2021–2022 during construction of the PPF, MRS, and WTP operations (SAIC 2007a). 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. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will vary over the duration of the project. The highest number of employee trips is expected to occur from 2021–2022 during construction of the PPF, MRS, and WTP operations (SAIC 2007a). 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. This assessment and conclusion is similar to that previously described for 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 result in minor noise impacts of employee vehicles, trucks, construction equipment and activity, generators, and process equipment operation 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 will 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 operations, and modified RCRA Subtitle C barrier construction (SAIC 2007a). 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. This assessment and conclusion is similar to that previously described for 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 of 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). These concentrations are presented in Table 4–3 and compared with the ambient standards. The maximum concentrations that would result from these activities for each Tank Closure alternative would be below the ambient standards for the most part; exceptions include the 24-hour concentrations of particulate matter (PM) under most Tank Closure alternatives, the annual concentrations of PM with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) under Alternative 6A, the annual concentrations of PM with an aerodynamic diameter less than or equal to 2.5 micrometers ($PM_{2.5}$) under most Tank Closure 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 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).

Table 4–3. Tank Closure Alternatives – 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	6,010	5,840	8,880	9,160	9,120	5,550	7,620	5,330	3,800	5,290	5,290	5,640
1-hour	40,000[b]	23,300	**40,600**	36,300	**56,600**	**57,700**	**57,600**	35,700	**47,300**	31,900	22,400	34,200	34,200	33,600
Nitrogen Dioxide														
Annual	100[b]	8.56	18.4	20.4	17.9	18.1	18.1	13.1	21.1	19.3	14.9	14.2	14.7	20.4
PM_{10}[c]														
Annual	50[d]	5.32	15.5	34.8	34.8	34.8	34.7	23.3	35.8	39.1	38.7	37.2	15.3	35.4
24-hour	150[b]	**546**	**1,600**	**4,510**	**4,510**	**4,510**	**4,510**	**2,960**	**4,920**	**5,040**	**3,650**	**5,110**	**1,690**	**4,570**
Sulfur Dioxide														
Annual	50[d]	0.0134	0.0827	0.308	0.151	0.0952	0.0946	0.0939	0.152	0.0785	0.076	0.291	0.297	0.308
24-hour	260[d]	1.37	4.40	9.05	10.7	5.96	5.90	6.89	9.92	4.23	3.15	6.69	7.10	9.05
3-hour	1,300[b]	8.00	25.1	50.6	48.3	31.5	31.3	29.8	44.3	21.7	17.6	39.1	40.8	50.6
1-hour	660[d]	24.0	64.6	99.4	126	82.1	81.6	71.8	106	53.3	41.6	65.4	70.3	99.5

[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.

[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.

Note: The National Ambient Air Quality Standards 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: 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 and windblown particulate 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 more detailed engineering of a construction activity that would allow for a more refined estimate is 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.

Effects of Criteria Air Pollutants

Criteria air pollutants can harm health and the environment, and cause property damage. Below are the chief causes of concern by pollutant.

Carbon Monoxide – Can reduce oxygen delivered to the body. Poisonous to healthy people at high levels, and can affect people with heart disease. Affects the nervous system.

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

Ozone – Can result in lung irritation, reduced lung capacity, or permanent lung damage; breathing difficulties; aggravated asthma; and increased susceptibility to respiratory illnesses. Can make sensitive plants more susceptible to damage and damage the appearance of other plants. Can reduce crop yields and forest growth.

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 can contribute to acidification of streams and lakes, changes in 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 – Contributes to the formation of acid rain which damages trees, crops, and buildings and makes soils, lakes, and streams acidic. Contributes to reduced visibility.

Lead – Damages organs, including the kidneys, liver, brain, and nerves, especially in infants and young children; harms animals and fish.

Source: EPA 2007.

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, 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 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-sized projects in nonattainment areas. Hanford is within an area currently designated as 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 51.850–51.860).

Both carcinogenic and noncarcinogenic toxic pollutant concentrations were evaluated. The exposure of members of the public to airborne pollutants would be from process emissions released during operations and from equipment used during construction, operations, deactivation, and closure. Selected air toxics were modeled because they are representative of 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 to other toxic constituents in the tank vapor spaces. Ammonia's concentration, combined with its toxicity, made it a good indicator constituent for the analysis; i.e., if ammonia was found to be within the acceptable source impact level, other toxics should be also. 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. 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).

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 1.0 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 nonradiological toxic pollutant emissions under each Tank Closure alternative are summarized in Table 4–6.

Table 4–4. Tank Closure Alternative – 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	100	26.1	19.6	11.7	11.9	11.9	12.0	11.8	12.0	10.2	9.91	11.9	11.9	11.4
Benzene	Annual	0.12	0.00264	0.00592	0.00456	0.00602	0.00627	0.00602	0.00344	0.00594	0.00479	0.00278	0.00460	0.00355	0.00458
1,3-Butadiene	Annual	0.0036	0.0000732	0.000160	0.000126	0.000146	0.000150	0.000146	0.000101	0.000149	0.000140	0.0000759	0.000132	0.0000938	0.000126
Formaldehyde	Annual	0.077	0.00238	0.00522	0.00406	0.00487	0.00503	0.00487	0.00317	0.00492	0.00447	0.00245	0.00426	0.00306	0.00406
Mercury	24-hour	0.17	0.0	0.00590	0.117	0.0169	0.00787	0.0129	0.0130	0.0182	0.00237	0.00236	0.117	0.117	0.117
Toluene	24-hour	400	1.69	4.07	3.40	5.78	6.03	5.78	2.77	5.19	3.50	2.34	3.73	2.58	3.40
Xylene	24-hour	1,500	0.506	1.22	1.03	1.71	1.78	1.71	0.825	1.55	1.07	0.676	1.13	0.769	1.03

a WAC 173-460.

Note: To convert cubic meters to cubic feet, multiply by 35.315.

Source: Appendix G, Section G.3.

Table 4–5. Tank Closure Alternatives – Nonradiological 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	9.11×10^{-2}	1.13×10^{-1}	6.72×10^{-2}	6.90×10^{-2}	6.93×10^{-2}	6.97×10^{-2}	6.25×10^{-2}	7.20×10^{-2}	7.84×10^{-2}	7.35×10^{-2}	7.56×10^{-2}	7.31×10^{-2}	6.43×10^{-2}
Mercury	0.00	4.67×10^{-3}	7.15×10^{-2}	3.92×10^{-2}	7.15×10^{-3}	2.12×10^{-2}	1.63×10^{-2}	1.91×10^{-2}	2.14×10^{-3}	2.13×10^{-3}	7.15×10^{-2}	7.15×10^{-2}	7.15×10^{-2}
Toluene	5.95×10^{-5}	7.98×10^{-4}	5.66×10^{-4}	6.70×10^{-4}	6.97×10^{-4}	7.13×10^{-4}	6.30×10^{-4}	7.86×10^{-4}	1.99×10^{-3}	1.54×10^{-3}	1.02×10^{-3}	9.28×10^{-4}	5.00×10^{-4}
Xylene(s)	8.94×10^{-4}	1.16×10^{-2}	8.30×10^{-3}	9.79×10^{-3}	1.02×10^{-2}	1.04×10^{-2}	9.26×10^{-3}	1.15×10^{-2}	2.89×10^{-2}	2.24×10^{-2}	1.50×10^{-2}	1.37×10^{-2}	7.70×10^{-3}
Hazard Index	9.20×10^{-2}	1.30×10^{-1}	1.48×10^{-1}	1.19×10^{-1}	8.73×10^{-2}	1.02×10^{-1}	8.87×10^{-2}	1.03×10^{-1}	1.11×10^{-1}	9.96×10^{-2}	1.63×10^{-1}	1.59×10^{-1}	1.44×10^{-1}

Source: Appendix G, Section G.3.

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

Chemical	Cancer Risk												
	Alternatives												
	1	2A	2B	3A	3B	3C	4	5	6A Base Case	6A Option Case	6B Base Case	6B Option Case	6C
Benzene	3.71×10^{-7}	3.22×10^{-6}	2.76×10^{-6}	3.06×10^{-6}	3.17×10^{-6}	3.21×10^{-6}	2.90×10^{-6}	3.50×10^{-6}	8.34×10^{-6}	6.77×10^{-6}	5.33×10^{-6}	4.86×10^{-6}	2.63×10^{-6}
1,3-Butadiene	3.96×10^{-8}	2.41×10^{-7}	2.48×10^{-7}	2.61×10^{-7}	2.68×10^{-7}	2.69×10^{-7}	2.87×10^{-7}	2.89×10^{-7}	6.50×10^{-7}	5.57×10^{-7}	5.07×10^{-7}	4.63×10^{-7}	2.43×10^{-7}
Formaldehyde	5.59×10^{-7}	3.70×10^{-6}	3.64×10^{-6}	3.87×10^{-6}	3.98×10^{-6}	4.00×10^{-6}	4.18×10^{-6}	4.33×10^{-6}	9.88×10^{-6}	8.35×10^{-6}	7.33×10^{-6}	6.69×10^{-6}	3.54×10^{-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. The peak concentrations occur in 2008 for carbon monoxide and nitrogen dioxide and from 2006–2008 for PM and sulfur dioxide. The peak period concentration would result primarily from WTP construction activities and tank upgrade construction. Maximum air quality impacts of PM_{10} 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.

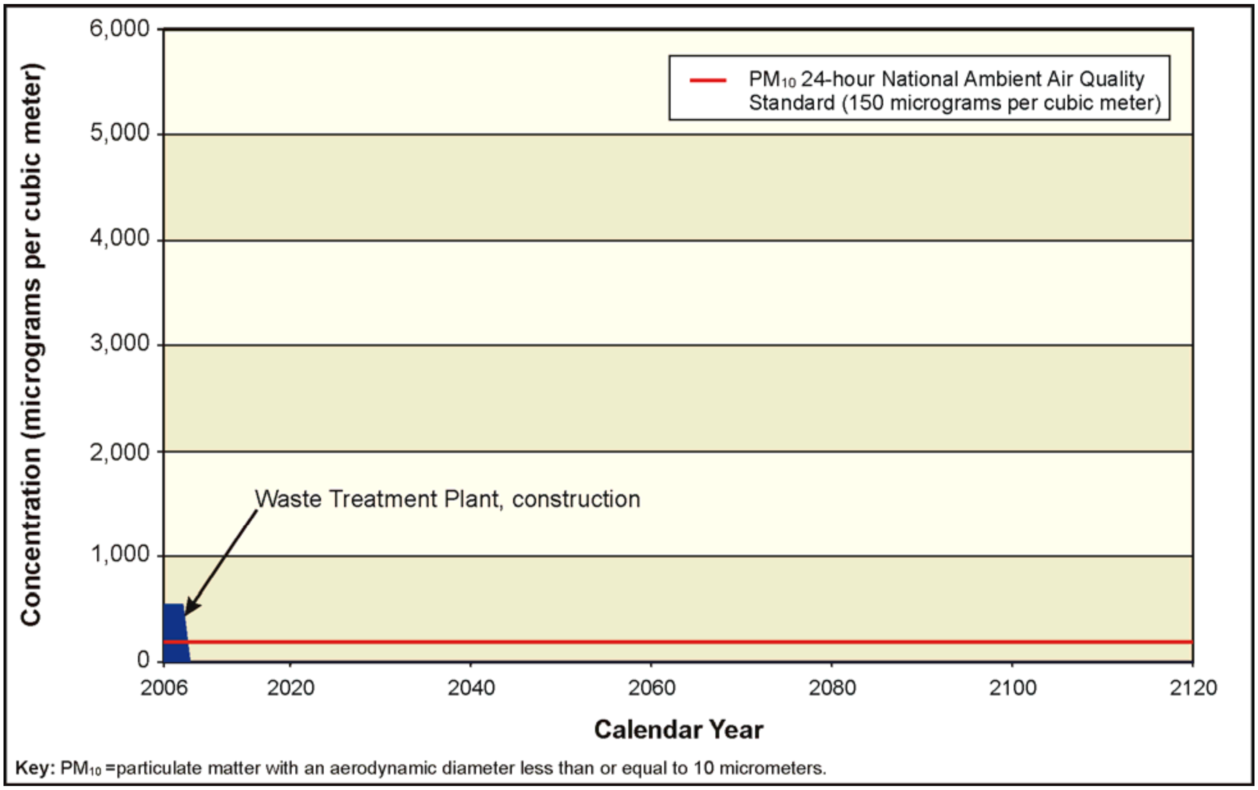


Figure 4–3. Tank Closure Alternative 1 PM_{10} Maximum 24-Hour Concentration

Maximum concentrations for carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

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. The peak concentrations occur from 2065–2066 for all criteria pollutants. The peak period concentrations would result primarily from WTP replacement construction and Borrow Area C operations, except for sulfur dioxide, which would result from WTP operations and replacement construction and for carbon monoxide, which would result from WTP replacement construction and 242-A Evaporator replacement construction. Maximum air quality impacts of PM_{10} 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.

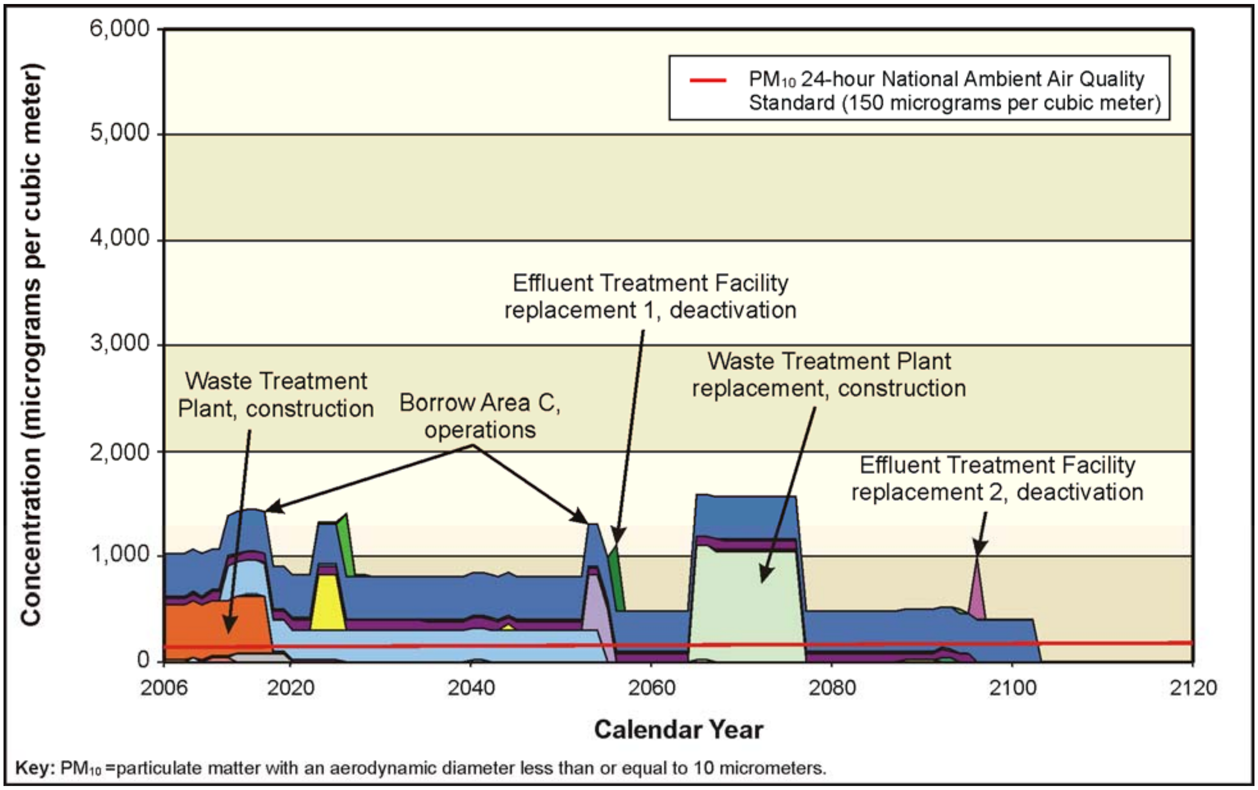


Figure 4–4. Tank Closure Alternative 2A PM_{10} Maximum 24-Hour Concentration

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–4. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

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. The peak concentrations occur in 2040 for all criteria pollutants except the carbon monoxide 1-hour average, which occurs from 2015–2016. The peak period PM_{10} concentration would result primarily from modified RCRA Subtitle C barrier placement and Borrow Area C operations. Maximum air quality impacts of PM_{10} 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

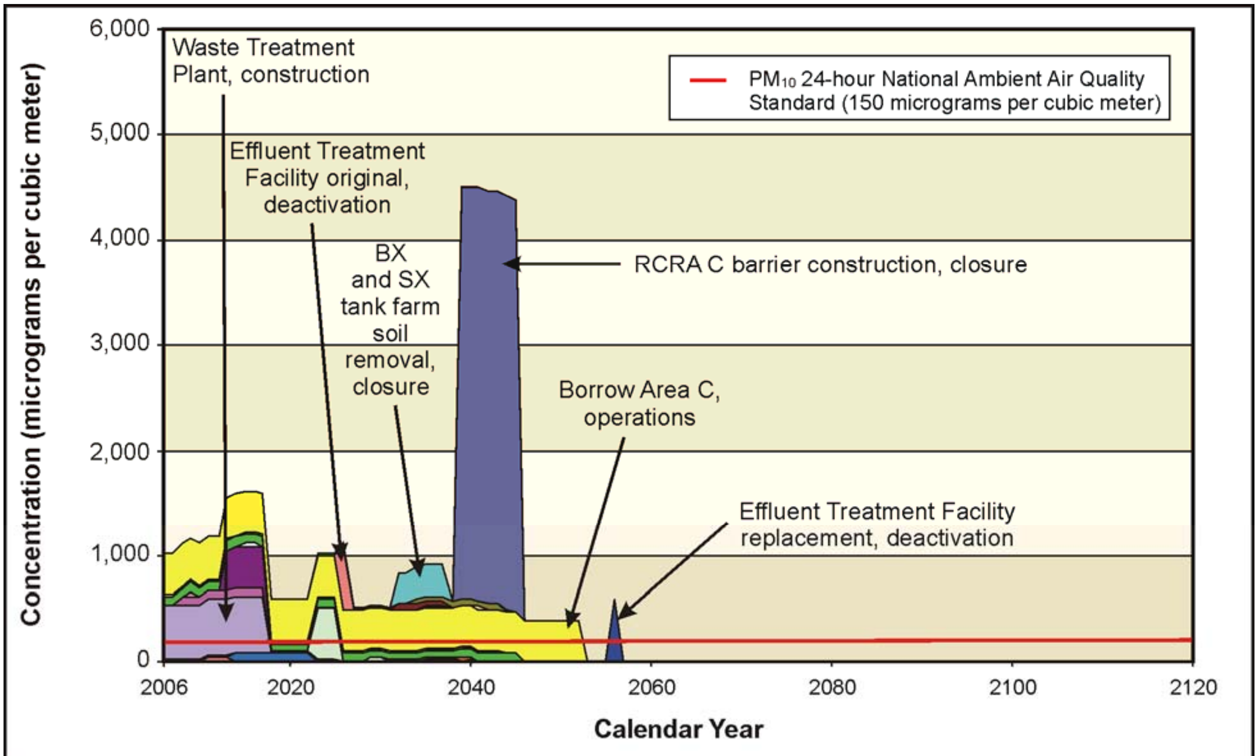


Figure 4–5. Tank Closure Alternative 2B PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur from 2035–2036 for carbon monoxide, sulfur dioxide, and nitrogen dioxide, and in 2039 for PM. The peak period concentration would result primarily from modified RCRA Subtitle C barrier construction for nitrogen dioxide and PM; from Cesium and Strontium Capsule Processing Facility construction and modified RCRA Subtitle C barrier construction for carbon monoxide; and from Cesium and Strontium Capsule Processing Facility construction, WTP operations, and Bulk Vitrification Facility operations for sulfur dioxide. Other periods of PM_{10} exceeding standards occur through 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

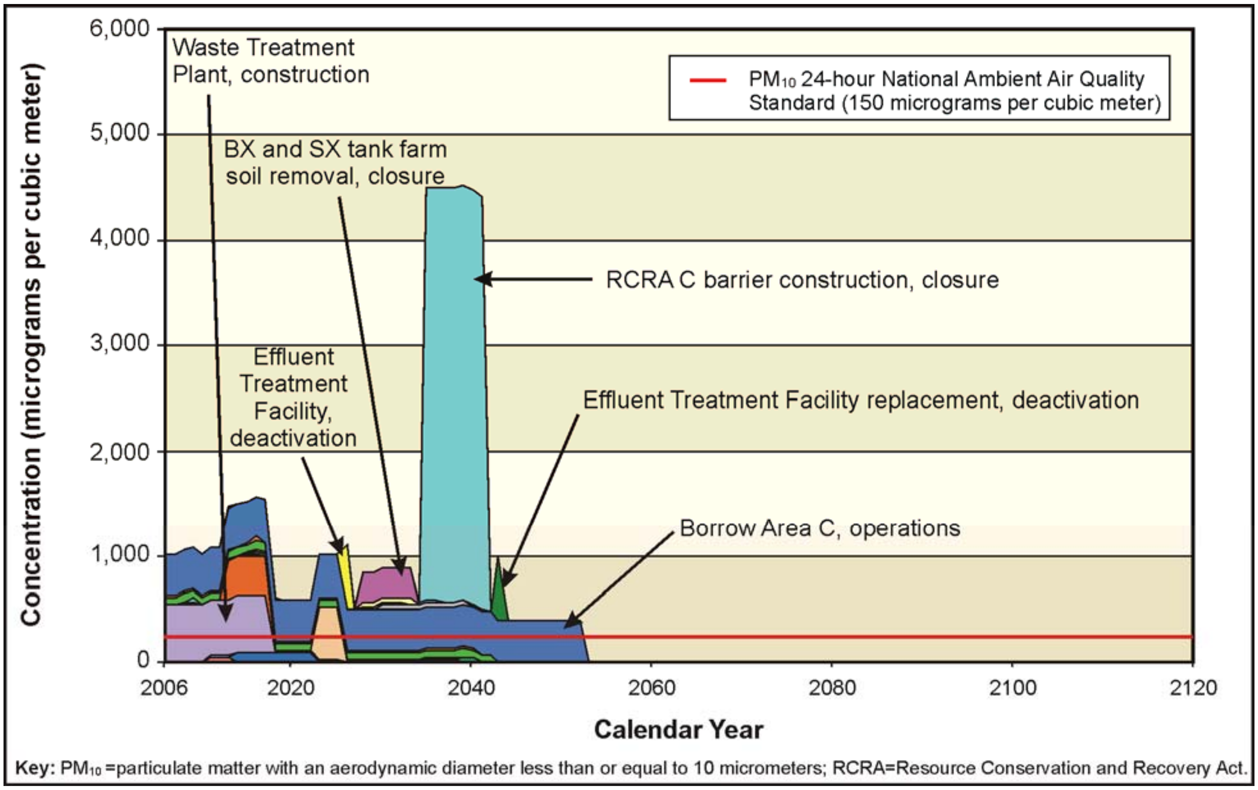


Figure 4–6. Tank Closure Alternative 3A PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur from 2035–2036 for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and in 2039 for PM. The peak period concentration would result primarily from modified RCRA Subtitle C barrier construction and Borrow Area C operations for PM; from Cesium and Strontium Capsule Processing Facility deactivation, WTP operations, and modified RCRA Subtitle C barrier construction for sulfur dioxide; from Cesium and Strontium Capsule Processing Facility construction and modified RCRA Subtitle C barrier construction for carbon monoxide; and from modified RCRA Subtitle C barrier construction for nitrogen dioxide. Other periods of PM_{10} exceeding standards occur 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

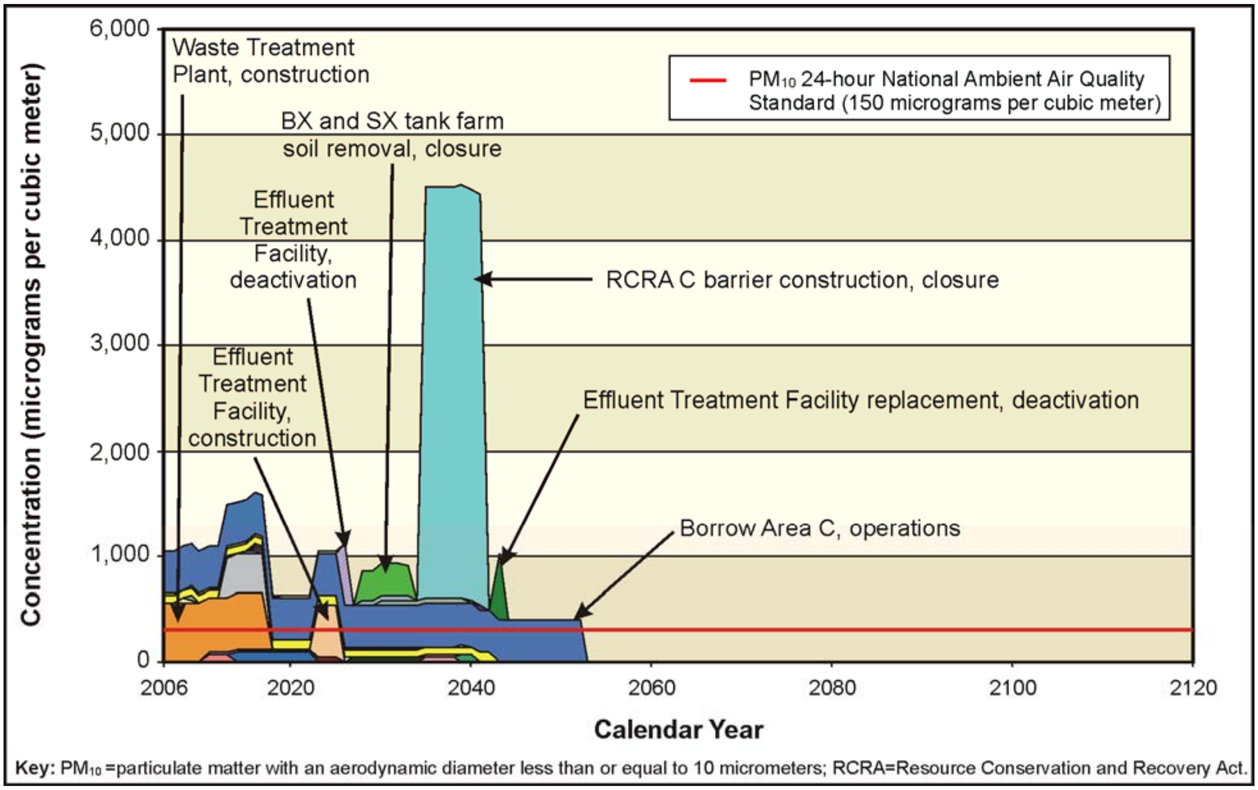


Figure 4–7. Tank Closure Alternative 3B PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur from 2035–2036 for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and in 2039 for PM. The peak period concentration would result primarily from modified RCRA Subtitle C barrier construction and Borrow Area C operations for PM; from Cesium and Strontium Capsule Processing Facility construction, WTP operations, and modified RCRA Subtitle C barrier construction for sulfur dioxide; from modified RCRA Subtitle C barrier construction for nitrogen dioxide; and from Cesium and Strontium Capsule Processing Facility construction and modified RCRA Subtitle C barrier construction for carbon monoxide. The peak period concentration would result primarily from WTP operations for sulfur dioxide. Other periods of PM_{10} exceeding standards occur 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

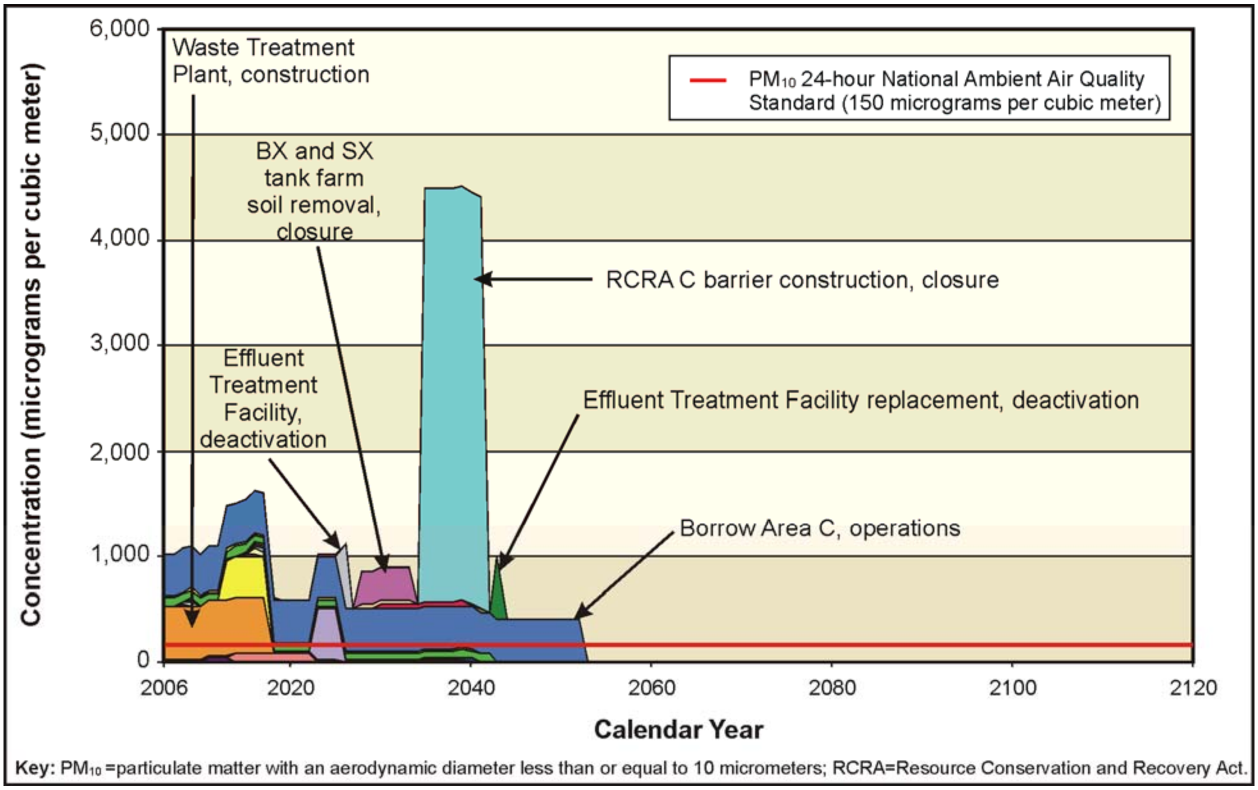


Figure 4–8. Tank Closure Alternative 3C PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur in 2016 for carbon monoxide, from 2038–2039 for nitrogen dioxide and sulfur dioxide, and in 2042 for PM. The peak period concentration would result primarily from WTP construction for carbon monoxide, from modified RCRA Subtitle C barrier construction for nitrogen dioxide and PM, and from WTP and Bulk Vitrification Facility operations and modified RCRA Subtitle C barrier construction for sulfur dioxide. Other periods of PM_{10} exceeding standards occur 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

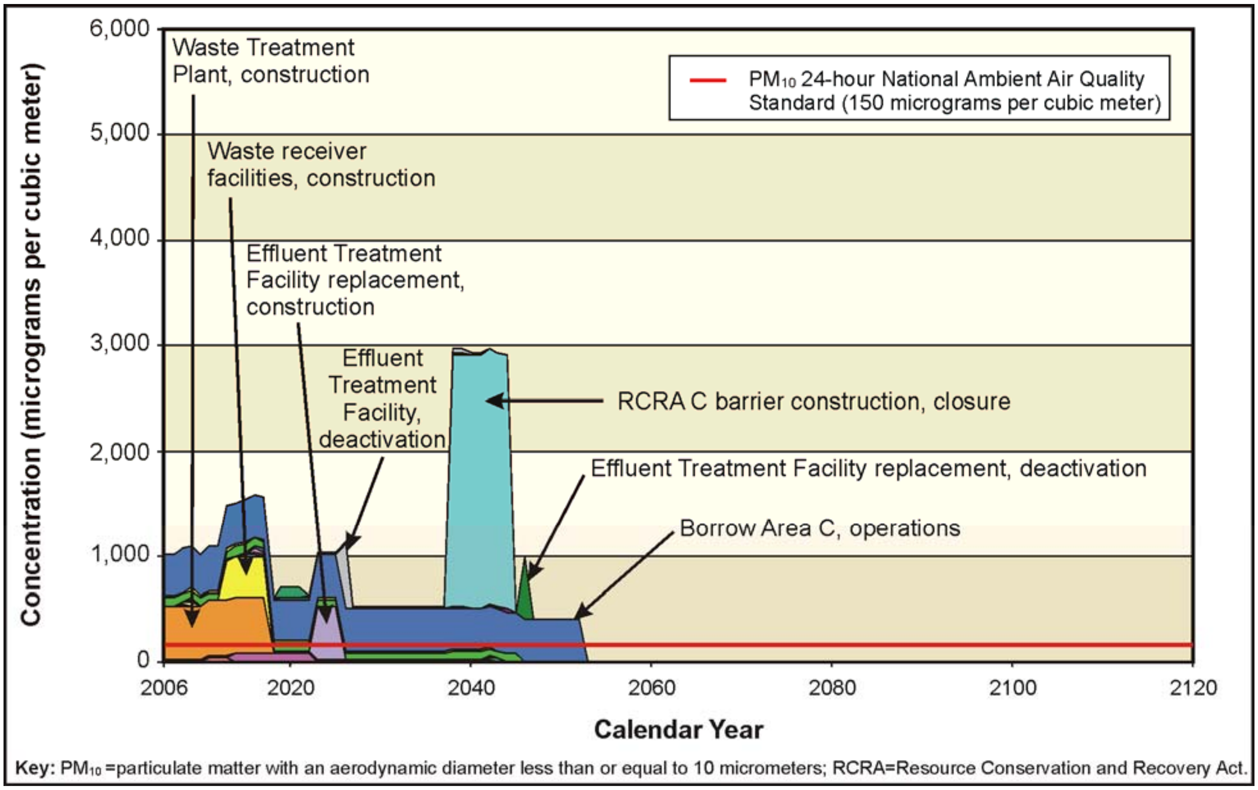
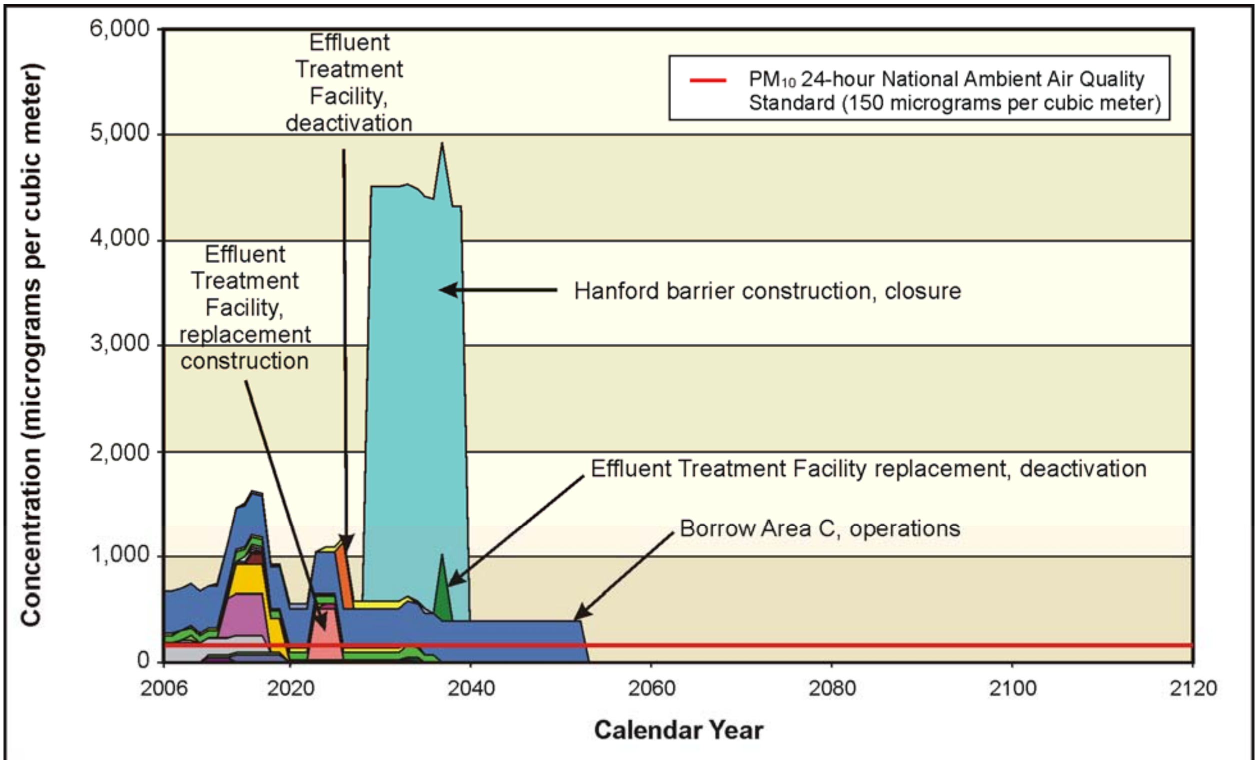


Figure 4–9. Tank Closure Alternative 4 PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur from 2029–2032 for the carbon monoxide 8-hour average, nitrogen dioxide, and sulfur dioxide; in 2016 for the carbon monoxide 1-hour average; and in 2037 for PM. The peak period concentration would result primarily from Hanford barrier construction for carbon monoxide 8-hour average, nitrogen dioxide, and PM; from WTP, tank upgrade, and Sulfate Removal Facility construction for carbon monoxide 1-hour average; and from WTP and Bulk Vitrification Facility operations and Hanford barrier construction for sulfur dioxide. Other periods of PM_{10} exceeding standards occur through year 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.



Key: PM_{10} =particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

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. The peak concentrations occur from 2149–2150 for carbon monoxide, nitrogen dioxide, PM, and sulfur dioxide. The peak period concentration would result primarily from modified RCRA Subtitle C barrier construction for carbon monoxide, nitrogen dioxide, PM, and sulfur dioxide. Other periods of PM_{10} exceeding standards occur through year 2197. 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

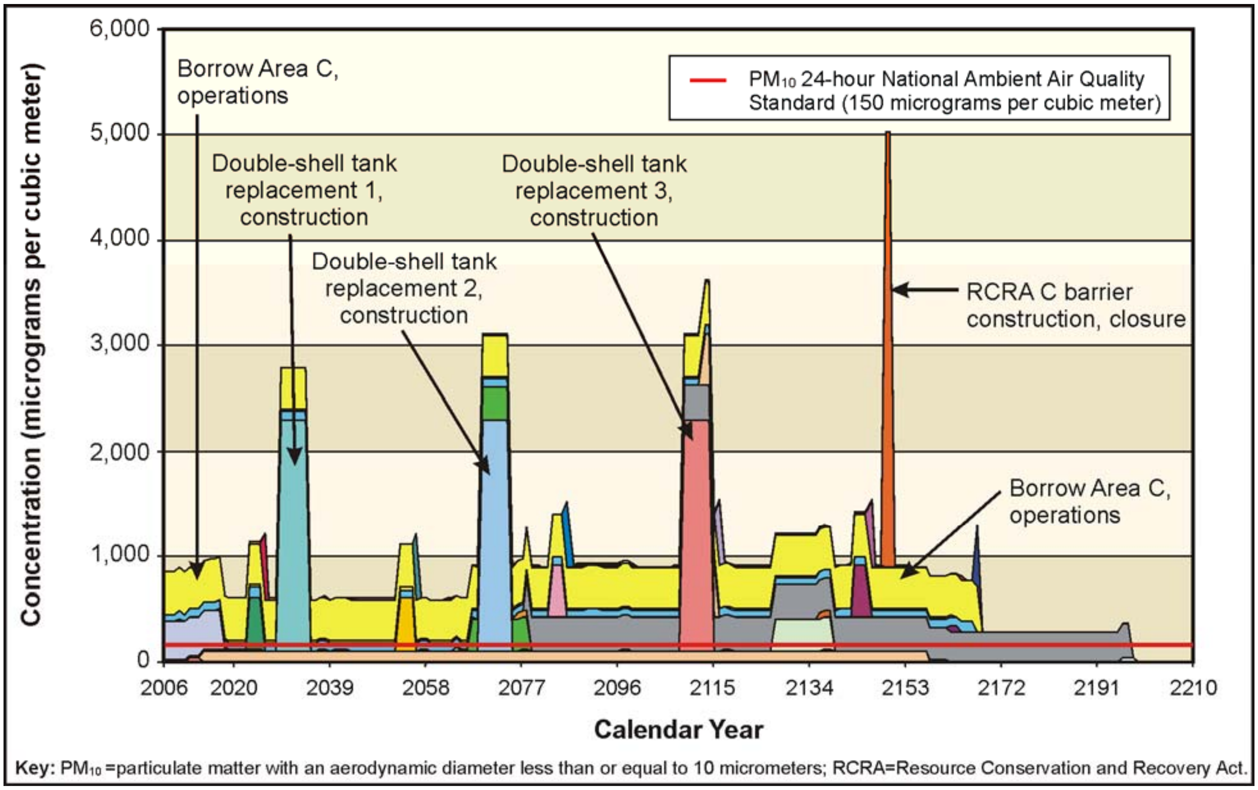


Figure 4–11. Tank Closure Alternative 6A, Base Case, PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur from 2113–2114 for carbon monoxide and PM, from 2158–2161 for sulfur dioxide (1-hour, 3-hour, and annual averages), in 2115 for sulfur dioxide (24-hour average), and from 2069–2074 for nitrogen dioxide. The peak period concentration would result primarily from ETF and double-shell tank (DST) replacement construction for carbon monoxide and PM, from ETF replacement construction and WTP operations for sulfur dioxide (24-hour average), from WTP operations for sulfur dioxide (1-hour, 3-hour, and annual averages), and from DST and WTP replacement construction and WTP operations for nitrogen dioxide. Other periods of PM_{10} exceeding standards occur through year 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

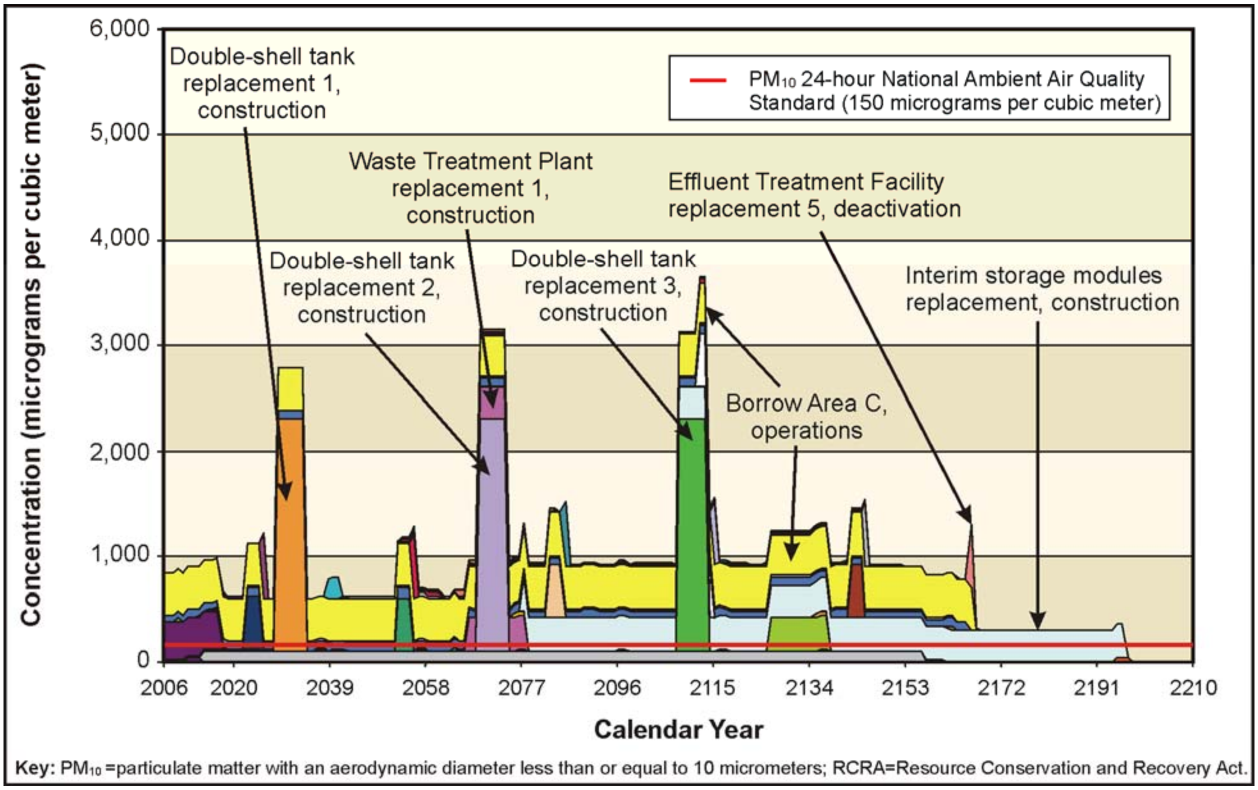


Figure 4–12. Tank Closure Alternative 6A, Option Case, PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur in 2016 for carbon monoxide, in 2101 for nitrogen dioxide and PM, and in 2040 for sulfur dioxide. The peak period concentration resulted primarily from WTP, tank upgrade, and 242-A Evaporator construction for carbon dioxide; from modified RCRA Subtitle C barrier construction for nitrogen dioxide and PM; and from WTP and WTP Cesium and Strontium Capsule Processing Facility operations for sulfur dioxide. Other periods of PM_{10} exceeding standards occur through year 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

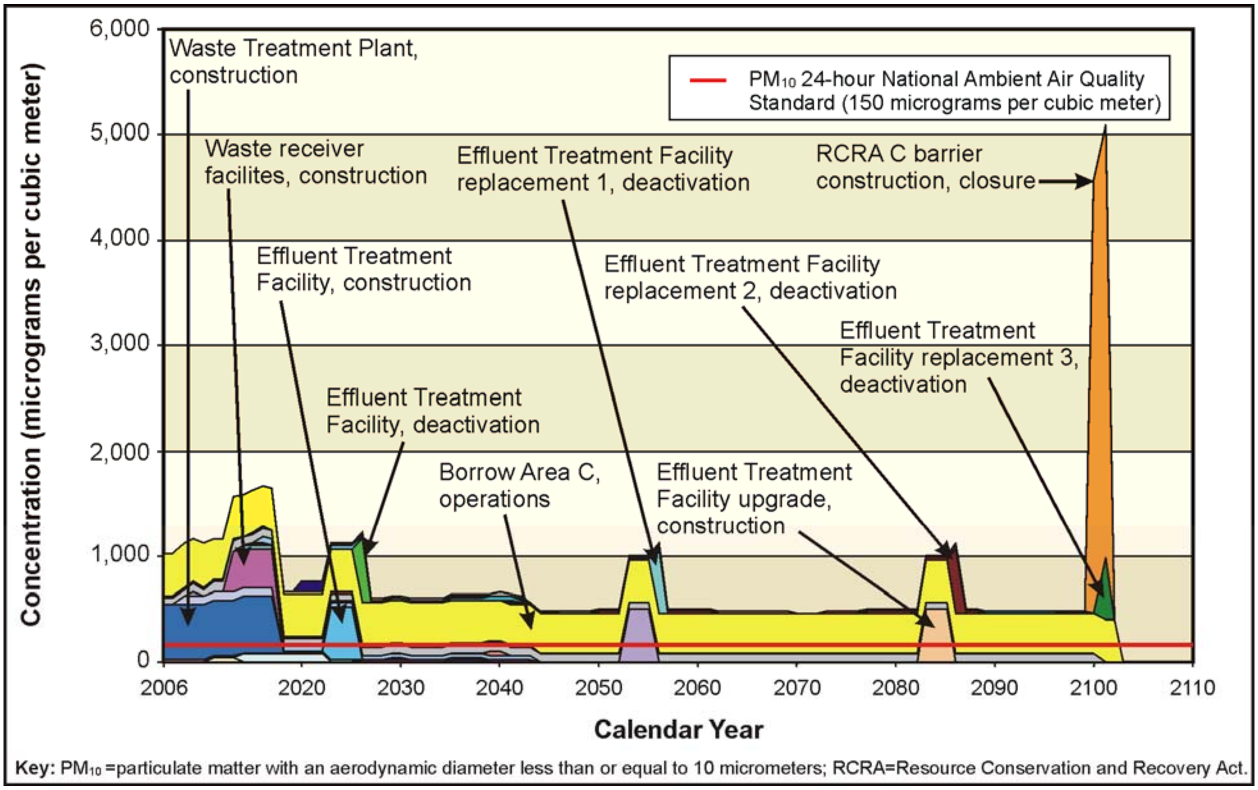


Figure 4–13. Tank Closure Alternative 6B, Base Case, PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur in 2016 for carbon monoxide and PM and in 2040 for nitrogen dioxide and sulfur dioxide. The peak period concentration would result primarily from WTP construction for carbon monoxide, from WTP and waste receiver facility (WRF) construction and Borrow Area C operations for PM, and from WTP and WTP Cesium and Strontium Capsule Processing Facility operations for nitrogen dioxide and sulfur dioxide. Other periods of PM_{10} exceeding standards occur through year 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

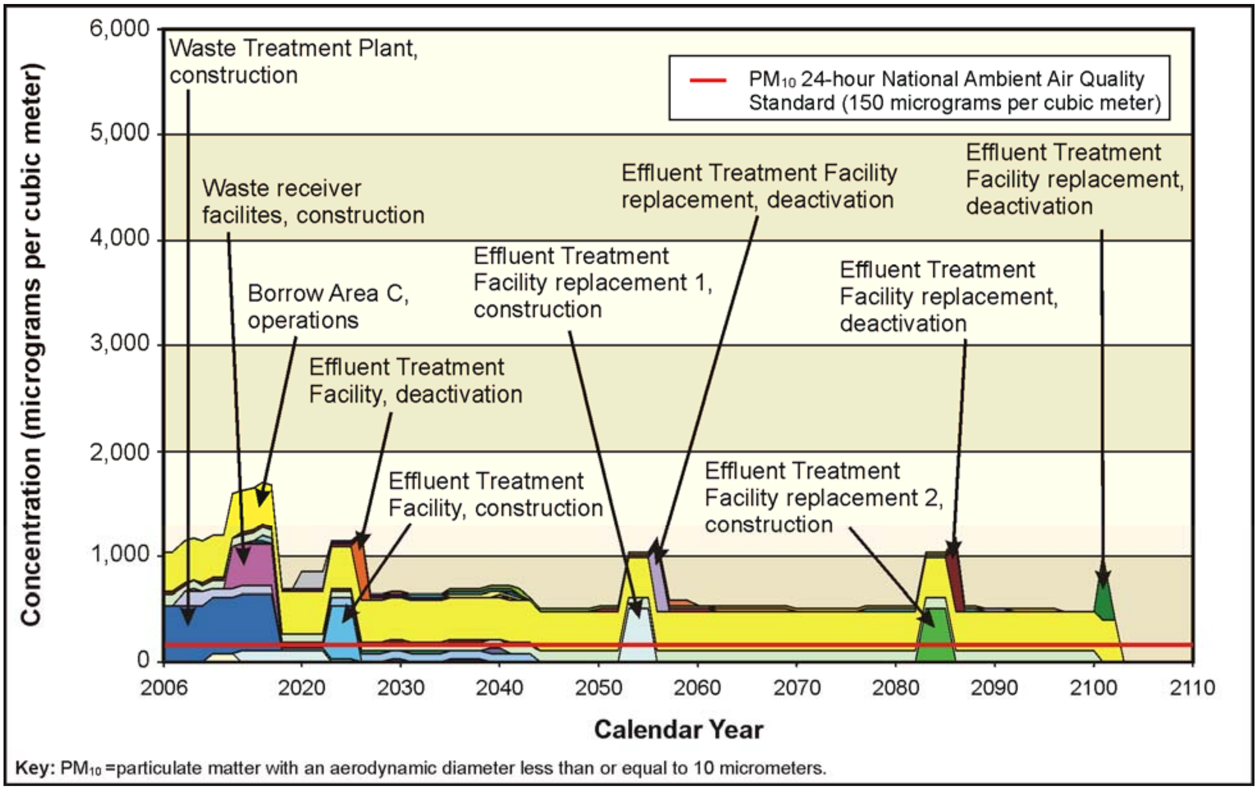


Figure 4–14. Tank Closure Alternative 6B, Option Case, PM_{10} Maximum 24-Hour Concentration

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. The peak concentrations occur in 2040 for carbon monoxide, nitrogen dioxide, PM, and sulfur dioxide. The peak period concentration would result primarily from modified RCRA Subtitle C barrier construction for carbon monoxide, nitrogen dioxide, and PM and from WTP and WTP Cesium and Strontium Capsule Processing Facility operations and modified RCRA Subtitle C barrier construction for sulfur dioxide. Other periods of PM_{10} exceeding standards occur through year 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. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–5 and 4–6.

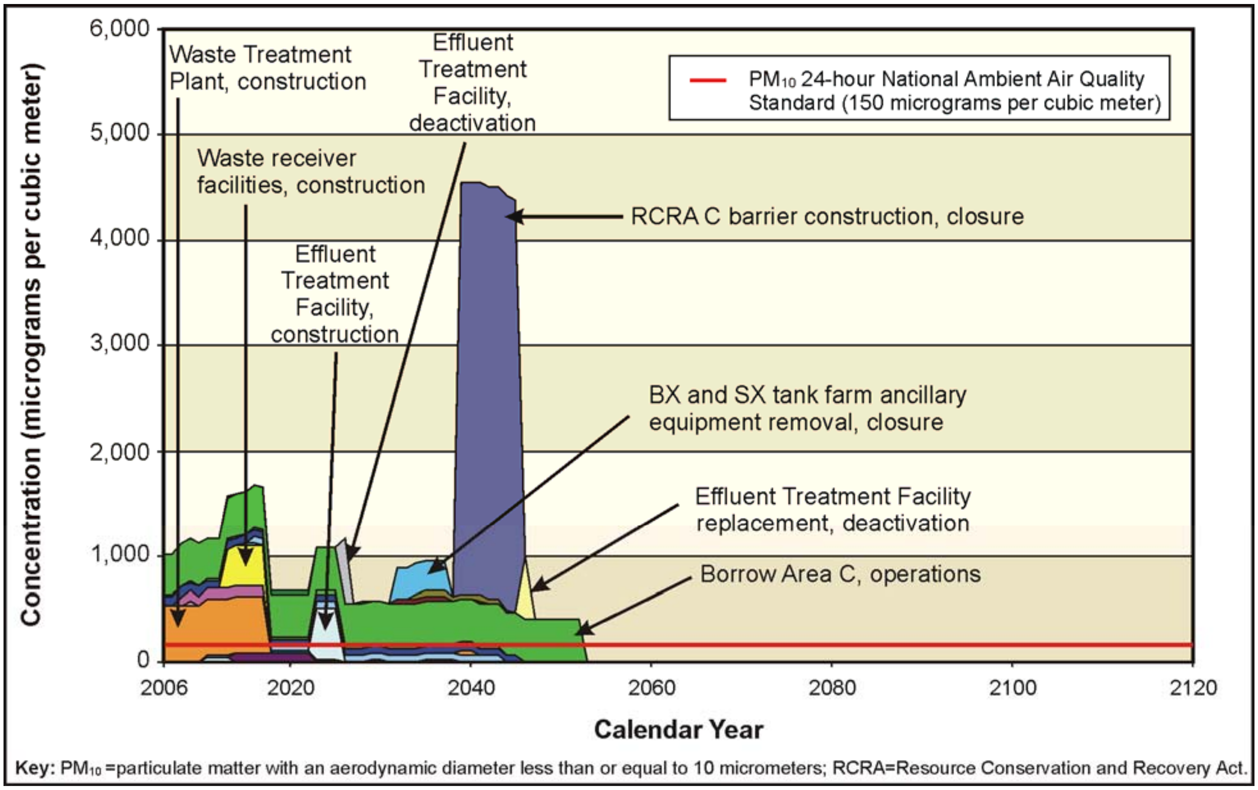


Figure 4–15. Tank Closure Alternative 6C PM_{10} Maximum 24-Hour Concentration

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). 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.

Although site construction for the WTP is ongoing, denuded surface soils and unconsolidated sediments in excavations to support tank waste retrieval, treatment, and disposal and excavations and cut slopes for other facilities 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 serve to 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, or excavations would be backfilled and revegetated and would not be subject to long-term soil erosion.

Consumption of geologic resources, including rock, mineral, and soil resources, 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 930-hectare (2,300-acre) borrow area has been designated for use in providing necessary materials including rock riprap (basalt), aggregate (gravel and sand), and soil (silt and loam) 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, which is located between the 200-East and 200-West Areas, has been and would continue to be used 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, 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; uses include filling and stabilizing tanks and associated ancillary equipment within each tank farm and filling ancillary equipment outside the landfill closure barrier lobes that would be constructed under all alternatives except Alternative 2A. 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 Alternatives										
	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	59.8	111	118	112	112	120	138	704 *781*	356 *433*	165
Construction materials											
Concrete	33,400	612,000	403,000	388,000	387,000	396,000	495,000	368,000	10,400,000 *10,500,000*	1,390,000 *1,510,000*	780,000
Cement[b]	8,270	146,000	96,700	93,900	93,500	95,400	120,000	87,800	2,550,000 *2,580,000*	340,000 *369,000*	190,000
Sand[b]	16,200	297,000	196,000	188,000	188,000	192,000	240,000	178,000	5,070,000 *5,130,000*	675,000 *732,000*	378,000
Gravel[b]	21,100	388,000	255,000	246,000	245,000	251,000	313,000	233,000	6,620,000 *6,690,000*	880,000 *954,000*	494,000
Other borrow materials[c]											
Rock/basalt	0	9,630	12,800	12,800	12,800	12,800	12,800	9,630	671,000 *671,000*	12,800 *12,800*	12,800
Sand	187	1,250	3,750	3,750	3,750	3,750	3,750	3,750	1,250 *1,250*	1,250 *1,250*	3,750
Gravel	246	5,630	8,470	8,470	8,470	8,470	11,400	8,470	11,000 *11,000*	8,910 *8,910*	8,470
Soil (specification backfill)	55,100	550,000	782,000	748,000	748,000	748,000	1,960,000	221,000	9,320,000 *13,100,000*	8,550,000 *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	210,000[f]	0	0	0	0	0
Closure-specific materials											
Grout[g]	0	100	796,000	796,000	796,000	796,000	721,000	791,000	237,000 *788,000*	237,000 *788,000*	796,000
Cement	0	10.0	13,200	13,000	13,200	13,200	20,500	12,600	28,000 *93,000*	28,000 *93,000*	13,200
Sand[h]	0	50.1	774,000	774,000	774,000	774,000	661,000	772,000	116,000 *384,000*	116,000 *384,000*	774,000

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

Parameter/ Resource	**Tank Closure Alternatives**										
	1	**2A**	**2B**	**3A**	**3B**	**3C**	**4**	**5**	**6A Base Case, *Option Case***	**6B Base Case, *Option Case***	**6C**
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] *0*	689,000[k] *0*	2,300,000[i]
Total[l]	92,800	1,250,000	4,330,000	4,610,000	4,280,000	4,290,000	4,660,000	5,380,000	22,500,000 *26,000,000*	10,900,000 *14,400,000*	4,750,000

[a] Reflects land area assumed to be permanently disturbed for new facilities. The value also includes land area excavated in 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 are 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 2007a.

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 that would range 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 allocating 20 percent of the total site for cut-slope maintenance, haul roads, stockpile and buffer areas, could yield a conservative estimate of 34.3 million cubic meters (44.9 million cubic yards) of borrow material to address 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), for a total of 49.6 million cubic meters (55 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 the transport of excavated borrow materials to points of use across Hanford. It has been assumed for the purposes of analysis 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 as 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, and, therefore, 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 are 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 ground shaking of Modified Mercalli Intensity (MMI) V to VII associated with postulated earthquakes (see Appendix F, Table F–7) would have the potential to 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, with the result 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 32.3 hectares (79.9 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 (see Section 4.1.1.2.1 and Table 4–1). An additional 27.5 hectares (68 acres) would also be excavated in Borrow Area C, for a total of 59.8 hectares (148 acres) of new, permanent land disturbance. An additional 17 hectares (42 acres) of land, consisting of the 18 tanks 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 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 are projected to be 1,250,000 cubic meters (1,640,000 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 (55 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 and 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 16.2 hectares (40 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 94.7 hectares (234 acres) would also be excavated in Borrow Area C, for a total of 111 hectares (274 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 Section 4.1.5.2 under Alternative 2A; 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 effect 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 uniform topography upon which to emplace barrier layers. Also, 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 are projected to be 4,330,000 cubic meters (5,660,000 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 (55 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 17.4 hectares (43 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 101 hectares (249 acres) would also be excavated in Borrow Area C, for a total of 118 hectares (292 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 Section 4.1.5 and Section 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 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 also 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 4,610,000 cubic meters (6,030,000 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 (55 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 18.3 hectares (45.2 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. Also, 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 Section 4.1.1.5.1 and Table 4–1). An additional 93.5 hectares (231 acres) would also be excavated in Borrow Area C, for 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 described in Section 4.1.5 and Section 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 Section 4.1.5 and 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 4.1.5.3. 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). For this alternative, use of the cast stone supplemental treatment technology would reduce the demand for clean soil and sand as compared with Alternative 3A, as 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 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 4,280,000 cubic meters (5,600,000 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 to total 49.6 million cubic meters (55 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards with potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 18.2 hectares (45 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. Also, 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 93.9 hectares (232 acres) would also be excavated in Borrow Area C, for a total of 112 hectares (277 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 Section 4.1.5 and Section 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 4,290,000 cubic meters (5,610,000 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 (55 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 17.8 hectares (44.1 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. Also, 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 also be excavated in Borrow Area C, for a total of 120 hectares (296 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 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 excavating and removing 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 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 4,660,000 cubic meters (6,100,000 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 (55 million cubic yards), as further described in Section 4.1.5.

Design consideration of hazards with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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. Also, 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 118 hectares (291 acres) would also be excavated in Borrow Area C, for a total of 138 hectares (341 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 Section 4.1.5 and Section 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 5,380,000 cubic meters (7,040,000 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 (55 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, disposal; and 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. Also, 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 494 hectares (1,220 acres) would also be excavated in Borrow Area C, for a total of 704 hectares (1,740 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 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 installation would be followed by erection of the containment structure. Closure operations would then proceed by excavating and removing soils and ancillary equipment, including demolition and removal of the tank structures, tank slabs, and footings. Excavated soils, with the exception of 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 22,500,000 cubic meters (29,400,000 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 onsite from gravel pit No. 30 and Borrow Area C are estimated to total 49.6 million cubic meters (55 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 with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 210 hectares (519 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 571 hectares (1,410 acres) would be excavated in Borrow Area C to support remediation activities, for a total of 781 hectares (1,930 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 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 26 million cubic meters (34 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 (55 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 with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 117 hectares (288 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 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 4.1.1.10.1.1 and Table 4–1). An additional 239 hectares (591 acres) would also be excavated in Borrow Area C, for a total of 356 hectares (879 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 as 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 10,900,000 cubic meters (14,300,000 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 (55 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 with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 117 hectares (288 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 would also be constructed as compared to the Base Case. An additional 316 hectares (780 acres) would also be excavated in Borrow Area C, for a total of 433 hectares (1,070 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 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 14,400,000 cubic meters (18,800,000 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 (55 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 with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 61.1 hectares (151 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 (257 acres) would also be excavated in Borrow Area C, for a total of 165 hectares (408 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 4,750,000 cubic meters (6,200,000 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 (55 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 with the potential to affect new and existing facilities under this alternative from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions 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 are 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. Also, 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 and spill prevention and waste management practices would be employed to minimize suspended sediment, the transport of other deleterious materials, and 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, to the vadose zone and underlying groundwater would mainly be limited to SST leaks that could be induced by waste retrieval activities under all alternatives, with the exception of 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 passing 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 (750,000–1,050,000 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 has been 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 to 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 (160 feet). As such, construction dewatering should not be required for any proposed activities under this alternative. Also, 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 2.3.1.1. 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 purposes of analysis, 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 (750,000–1,050,000 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 similar manner 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 3,560 million liters (940 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 involves 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, followed by emplacement of a landfill barrier over the tank farms under this alternative. The modified RCRA Subtitle C barrier lobes would serve to impede the movement of residual contaminants from the tanks to the vadose zone and associated contaminants in the vadose zone, principally by retarding surface-water infiltration. 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 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 similar manner 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 2,180 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, followed by emplacement of a landfill barrier over the tank farms under this alternative. The modified RCRA Subtitle C barrier system would serve to impede the movement of residual contaminants from the tanks to the vadose zone and associated contaminants in the vadose zone, principally by retarding surface-water infiltration. 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 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 similar manner 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 2,180 million liters (576 million gallons), which is less than the estimated requirements under Alternatives 2A and 2B and the same as 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, followed by emplacement of a landfill barrier over the tank farms under this alternative. The modified RCRA Subtitle C barrier system would serve to impede the movement of residual contaminants from the tanks to the vadose zone and associated contaminants in the vadose zone, principally by retarding surface-water infiltration. 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 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 similar manner 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 2,190 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, followed by emplacement of a landfill barrier over the tank farms under this alternative. The modified RCRA Subtitle C barrier system would serve to impede the movement of residual contaminants from the tanks to the vadose zone and associated contaminants in the vadose zone, principally by retarding surface-water infiltration. 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 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 similar manner 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 2B, 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 farms 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. Also, 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, followed by emplacement of 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 serve to impede the movement of residual contaminants from the tanks to the vadose zone and associated contaminants in the vadose zone, principally by retarding surface-water infiltration. 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 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 under this alternative.

Effluents generated by facility operations would be managed in a similar manner 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 3,800 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, followed by emplacement of 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 serve to impede the movement of residual contaminants from the tanks to the vadose zone and associated contaminants in the vadose zone, principally by retarding surface-water infiltration. 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 as compared with the previously discussed alternatives, due to the substantially larger land area that would be disturbed from 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 as compared to the previously discussed alternatives.

Effluents generated by facility operations would be managed in a similar manner 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 644,000 million liters (170,000 million gallons), with a peak demand of 6,580 million liters (1,740 million gallons), which is an nearly order of magnitude greater than the previously described alternatives due to HLW waste treatment operations occurring over a relatively long period of time. While some water use may occur through 2250 associated with the DOE postclosure care period for the B and T Areas, this water demand would primarily occur during the 159-year facility construction, waste retrieval, waste treatment, and facility deactivation and closure phases. Given the relatively long timeframe over which this demand would occur, 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 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 is estimated that removal would result in additional water use of approximately 200 million liters (52.8 million gallons) associated with the closure phase of this option as compared with Alternative 6A, Base Case, as well as the generation of 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 similar manner 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 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. Also, 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 Section 4.1.6.9.1.1 and in Section 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. Also, 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 as compared with all of the previously discussed alternatives, with the exception of 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 similar manner 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 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 may occur through 2201 associated with the DOE postclosure care period for the B and T Areas, 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 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 is estimated that clean closure would result in additional water use of approximately 200 million liters (52.8 million gallons) associated with the closure phase of this option as compared with Alternative 6B, Base Case, as well as the generation of 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 similar manner 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 option, 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 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 similar manner 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 under this alternative, 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 3,560 million liters (940 million gallons). While some water use may occur through 2145 associated with the DOE postclosure care period, 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, followed by emplacement of a landfill barrier over the tank farms under this alternative. The modified RCRA Subtitle C barrier lobes would serve to impede movement of residual contaminants from the tanks to the vadose zone and associated contaminants in the vadose zone principally by retarding surface-water infiltration. 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 that 2 hectares (5 acres) within Borrow Area C be excavated 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. Since 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 are 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 Section 4.1.7.2).

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, 32.3 hectares (79.9 acres) would be disturbed by construction of new facilities within the 200 Areas under this alternative. Of this total, 29.1 hectares (71.9 acres) within the 200-East Area and 3.2 hectares (8 acres) would be developed 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 disturbed areas and would also 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 be taken in connection with mitigating 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 non-sagebrush habitat, up to 16.2 hectares (40 acres) of crusts could be destroyed. There would be no impact 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. Mitigation undertaken in connection with 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 clearly marking construction work zones to prevent intrusion into areas not slated for development would help prevent these impacts. Also, implementation of a spill prevention and control plan 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, 27.5 hectares (68 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 cheatgrass-bluegass (782 hectares [1,933 acres]) and needle-and-thread grass/Indian ricegrass (107 hectares [265 acres]) (see Chapter 3, Figure 3–19). 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 from developing Borrow Area C since 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 significant 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 do not support fish populations but are accessible to wildlife. 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.

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, 16.2 hectares (40 acres) would be disturbed by construction of new facilities within the 200 Areas under this alternative. Of this total, 12.5 hectares (30.9 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. Since all other new facilities constructed within the 200-East Area would be built within 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, 94.7 hectares (234 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 do not support fish populations but are accessible to wildlife. 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.

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. Since other proposed facilities associated with this alternative would be constructed on 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 94.7 hectares (234 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 since the exact areas to be excavated are not known. 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, 17.4 hectares (43 acres) would be needed for construction of new facilities within the 200 Areas under this alternative. Of this total, 13.2 hectares (32.7 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 would therefore have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, 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 underground transfer line and in the 200-West Area would not be mitigable. Also, mitigation would not be required within the 200-East Area Supplemental Treatment Technology Site (STTS-East) since the loss of sagebrush habitat does 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, 101 hectares (249 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.

4.1.7.4.2 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 do not support fish populations but are accessible to wildlife. 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.

Under this alternative, a number of state-listed, special status species have been observed in areas where new facilities would be built and therefore 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 101 hectares (249 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 since the exact areas to be excavated are not known. 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, 18.3 hectares (45.2 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 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 disturbed areas and would therefore have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, 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. Also, mitigation would not be required within STTS-East since the loss of sagebrush habitat does 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 in Section 4.1.7.3.1.

Under Alternative 3B, 93.5 hectares (231 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.

4.1.7.5.2 Wetlands

As noted in Chapter 3, Section 3.2.7.2.2, 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 do not support fish populations but are accessible to wildlife. 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.

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 93.5 hectares (231 acres) in Borrow Area C would be similar to those described under Alternative 2A since nearly the same area would be disturbed (see Section 4.1.7.2.4). As is the case under Alternative 2A, specific impacts cannot be identified since the exact areas to be excavated are not known. 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, 18.2 hectares (45 acres) would be needed for construction of new facilities within the 200 Areas under this alternative. Of this total, 13.9 hectares (34.3 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 disturbed areas and would therefore 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. 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. Also, mitigation would not be required within STTS-East since the loss of sagebrush habitat does 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 in Section 4.1.7.3.1.

Under Alternative 3C, 93.9 hectares (232 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 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 do not support fish populations but are accessible to wildlife. 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.

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 93.9 hectares (232 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 since the exact areas to be excavated are not known. 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, 17.8 hectares (44.1 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 adjacent to the 200-East Area and 4.2 hectares (10.3 acres) within the 200-West Area. Most new facilities would be built within disturbed areas and would therefore have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, new facilities would impact a total of 4 hectares (9.9 acres) of sagebrush habitat. 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. Also, mitigation would not be required within STTS-East since the loss of sagebrush habitat does 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. While 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, being in the highly developed 200 Areas the remediated areas 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 above 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 do not support fish populations but are accessible to wildlife. 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.

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 since the exact areas to be excavated are not known. 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 disturbed areas and would therefore have a negligible impact on terrestrial resources. However, within and adjacent to the 200-East Area, 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. Also, mitigation would not be required within STTS-East since the loss of sagebrush habitat does not meet the minimum mitigation threshold (5 hectares [12.5 acres]) (DOE 2003f:20, 21).

Under Alternative 5, 118 hectares (291 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 do not support fish populations but are accessible to wildlife. 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.

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 118 hectares (291 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 since the exact areas to be excavated are not known. 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, 207 hectares (511 acres) would be required within or adjacent to the 200-East Area and 3.2 hectares (8 acres) within the 200-West Area. Most of the land (i.e., 182 hectares [450 acres]) within or adjacent to the 200-East Area 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 be taken in connection with mitigating 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. Since 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, 494 hectares (1,220 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 3–19). 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 since the area(s) from which different types of geologic material would be excavated is not known. However, since approximately 53.1 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 182 hectares (450 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) since 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 571 hectares (1,410 acres) of land be excavated within 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 do not support fish populations but are accessible to wildlife. 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

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. Also, under this alternative the PPF and Packaged 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, since an additional 76.5 hectares (189 acres) would be excavated within 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 117 hectares (288 acres) would be needed for construction of new facilities within the 200 Areas. Of this total, 113 hectares (279 acres) would be required within or adjacent to the 200-East Area and 3.7 hectares (9.1 acres) within the 200-West Area. Most of the land (i.e., 100 hectares [248 acres]) within or adjacent to the 200-East Area 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 be taken in connection with mitigating 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, 239 hectares (591 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 of 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 98.3 hectares (243 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) since 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.

Under the Option Case, 316 hectares (780 acres) would need to be excavated from Borrow Area C to supply geologic material. Since this land represents about 34.1 percent of Borrow Area C as compared with 20 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 do not support fish populations but are accessible to wildlife. 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

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. Also, under this alternative the Packaged 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 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 239 hectares (591 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 since the exact areas to be excavated are not known. 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 [780 acres] versus 239 hectares [591 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, 61.1 hectares (151 acres) would be disturbed by construction of new facilities within the 200 Areas. Of this total, 57.5 hectares (142 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 in connection with mitigating 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 would be similar to those described in Section 4.1.7.3.1.

Under Alternative 6C, a total of 104 hectares (257 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 do not support fish populations but are accessible to wildlife. 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

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 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 (257 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 since the exact areas to be excavated are not known. 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; therefore, cultural resource monitoring would not be needed (Brockman 2007:Enclosure 2).

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. The location of excavation activities in Borrow Area C would determine where cultural monitoring would be required (Brockman 2007:Enclosure 2).

4.1.8.1.1 Prehistoric Resources

As noted in Chapter 3, Section 3.10.1.2, the prehistoric White Bluffs Road, 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 two cryptocrystalline flakes (i.e., fragments chipped from a rock core during tool making) found northwest of White Bluffs Road and one cryptocrystalline projectile point base located just to the east of the 200-East Area. Since there will be no new construction under this alternative, prehistoric resources will 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, 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. 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. Mitigation of the Atmospheric Dispersion Grid has been completed in accordance with the *Hanford Site Manhattan Project and Cold War Era Historic District Treatment Plan* (Marceau 1998). As is the case for prehistoric resources, if historic resources were discovered, procedures are in place to properly identify, evaluate, record, curate, and manage the discovery site.

4.1.8.1.3 American Indian Interests

Under this alternative, no resources would be directly affected by project-related facilities. White Bluffs Road would not be impacted by construction of the underground transfer line. The two cryptocrystalline flakes and the projectile point base found in the 200 Areas were collected and curated by site archaeologists upon discovery. 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 4.1.1.2.2, the industrial appearance of the 200-East and 200-West Areas from State Route 240 and nearby higher elevations would remain largely unchanged. The 2 hectares (5 acres) of Borrow Area C that would be excavated would be noticeable from these higher elevations, 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. As is the case for other cultural resources, if any paleontological resources were discovered during the excavation of geologic material from Borrow Area C, procedures are in place to properly manage the discovery site.

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 impact on known prehistoric resources. 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.

4.1.8.2.2 Historic Resources

Under Alternative 2A, there would be no impact 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 the excavation of geologic material from Borrow Area C, procedures are in place to properly identify, evaluate, record, curate, and manage the discovery site.

4.1.8.2.3 American Indian Interests

Under this alternative, no resources would be directly affected by project-related facilities. The construction of the underground transfer line and changes in the 200-East Area would not be visible from State Route 240. Rattlesnake Mountain, Gable Mountain, and Gable Butte, all of which are important to American Indians for religious and other cultural purposes, would not be affected under this alternative, and, as noted in Section 4.1.1.3.2, the view from these places would remain largely unchanged. However, the 27.5 hectares (68 acres) excavated from Borrow Area C would be readily visible from State Route 240 and Rattlesnake Mountain. Upon completion of work, Borrow Area C would be revegetated, lessening the visual impact. As is the case for prehistoric and historic resources, if any artifacts that have importance to American Indians were discovered during excavation of geologic material from Borrow

Area C, procedures are in place to properly manage the discovery site. 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. As is the case for other cultural resources, if any paleontological resources were discovered during excavation of geologic material from Borrow Area C, procedures are in place to properly manage the discovery site.

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 impact on known prehistoric resources. If prehistoric resources were discovered during construction or 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.

4.1.8.3.2 Historic Resources

Under Alternative 2B, there would be no impact 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

4.1.8.3.3 American Indian Interests

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 Rattlesnake Mountain, Gable Mountain, and Gable Butte, all of which are important to American Indians for religious and other cultural purposes. The view from these places would remain largely unchanged. Under this alternative, 94.7 hectares (234 acres) of Borrow Area C would be excavated. The development of Borrow Area C would be readily visible from these sites. Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impacts. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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. As is the case for other cultural resources, if any paleontological resources were found during construction or excavation, procedures are in place to properly manage the discovery site.

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. 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 impact on White Bluffs Road or other early historic artifacts within the 200-East and 200-West Areas, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

4.1.8.4.3 American Indian Interests

Under this alternative, visual impacts would be similar to Alternative 2B as described in Section 4.1.8.3.3. Construction and closure activities would not greatly change the industrial nature of the view from State Route 240 and nearby higher elevations. An additional 6.1 hectares (15 acres) of land would be disturbed within Borrow Area C, and the visual impacts would be similar to those described under Alternative 2B. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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. As is the case for other cultural resources, if any paleontological resources were found during construction, procedures are in place to properly manage the discovery site.

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. 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 impact on White Bluffs Road or known early historic artifacts within the 200-East and 200-West Areas, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

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. Closure activities would not greatly change the industrial view of nearby higher elevations. The land requirement in Borrow Area C would be slightly less than under Alternative 3B (e.g., 1.2 hectares [3 acres]) but visual impacts would be similar (see Section 4.1.1.3.2). As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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, as no such resources have been discovered within the 200 Areas. As is the case for other cultural resources, if any paleontological resources were found during construction, procedures are in place to properly manage the discovery site.

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. 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 impact on White Bluffs Road or known early historic artifacts within the 200-East or 200-West Area, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

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. Construction, operations, deactivation and closure activities would not greatly change the industrial nature of the view and approximately the same amount of geologic material would be required in Borrow Area C. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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, as no such resources have been discovered within the 200 Areas. As is the case for other cultural resources, if any paleontological resources were found during construction, procedures are in place to properly manage the discovery site.

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. 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.

4.1.8.7.2 Historic Resources

Under this alternative, there would be no impact on White Bluffs Road or other known early historic artifacts within the 200-East or 200-West Area, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

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. Although an additional 7.3 hectares (18 acres) of land within Borrow Area C would be disturbed, the view would remain largely unchanged. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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, as no such resources have been discovered within the 200 Areas. As is the case for other cultural resources, if any paleontological resources were found during construction, procedures are in place to properly manage the discovery site.

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 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.

4.1.8.8.2 Historic Resources

Under this alternative, there would be no impact on White Bluffs Road or other known early historic artifacts within the 200-East or 200-West Area, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

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. The industrial nature of the view from State Route 240 and higher elevations would not greatly change.

Under this alternative, 118 hectares (291 acres) of Borrow Area C would be excavated. Development of Borrow Area C would be visible from Rattlesnake Mountain and result in the BLM visual resource management rating changing from Class II to Class IV (see Section 4.1.1.8.2). Upon completion of work under this alternative, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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, as no such resources have been discovered within the 200 Areas. As is the case for other cultural resources, if any paleontological resources were found during construction, procedures are in place to properly manage the discovery site.

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. 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 impact on White Bluffs Road or other known early historic artifacts within the 200-East and 200-West Areas, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

4.1.8.9.2.2 Option Case

As noted in Section 4.1.8.9.2.1 above, Alternative 6A, Option Case, would not affect historic resources.

4.1.8.9.3 American Indian Interests

4.1.8.9.3.1 Base Case

Under this alternative case, 210 hectares (519 acres) would be converted to industrial use. The majority of this land would be adjacent to the 200-East Area. Facilities constructed would noticeably add to the industrial nature of the 200 Areas and would be visible from nearby higher elevations (see Section 4.1.1.10.2.1). The viewscape from these higher elevations is important to American Indians with cultural ties to Hanford.

In addition, 494 hectares (1,220 acres) of Borrow Area C would be excavated in connection with 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. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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 in the Base Case, excavations in Borrow Area C would be recontoured and revegetated upon completion of work, thereby lessening the visual impact. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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, as no such resources have been discovered within the 200 Areas. As is the case for other cultural resources, if any paleontological resources were found during construction, procedures are in place to properly manage the discovery site.

4.1.8.9.4.2 Option Case

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

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. 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.

4.1.8.10.2 Option Case

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

4.1.8.10.3 Historic Resources

4.1.8.10.3.1 Base Case

There would be no impact on White Bluffs Road or other known early historic artifacts within the 200-East or 200-West Area, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

4.1.8.10.3.2 Option Case

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

4.1.8.10.4 American Indian Interests

4.1.8.10.4.1 Base Case

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. The BLM Visual Resource Management Class IV rating would not change. Approximately

239 hectares (591 acres) of Borrow Area C would be excavated. This would be visible from Rattlesnake Mountain, and thus would have an impact on the viewscape. The BLM visual resource management rating would change from Class II to Class IV. Upon completion of the work, excavations in Borrow Area C would be recontoured and revegetated, thereby lessening the visual impact. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. If there were visual impacts on American Indian interests, appropriate mitigation measures would be developed in consultation with area tribes.

4.1.8.10.4.2 Option Case

Activities and visual impacts would be similar to those noted in the Base Case above. Remediation of the deep plumes would result in an additional 76.5 hectares (189 acres) within Borrow Area C compared with the Base Case. This would further impact the view from State Route 240 and nearby higher elevations.

4.1.8.10.5 Paleontological Resources

4.1.8.10.5.1 Base Case

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

4.1.8.10.5.2 Option Case

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

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. 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 impact on White Bluffs Road or other known early historic artifacts within the 200-East and 200-West Areas, as 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 are in place to properly identify, evaluate, record, curate, and manage the discovery site.

4.1.8.11.3 American Indian Interests

Under Alternative 6C, newly constructed aboveground facilities would add to the overall industrial view from the higher elevations, such as Rattlesnake Mountain, which is important to American Indians with cultural ties to Hanford. Although the overall view would change, the BLM Visual Resource Management Class IV rating would not change. In addition, 104 hectares (257 acres) of Borrow Area C would be excavated. This would also be visible from 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. As is the case for prehistoric and historic resources, if any artifacts were discovered during construction that have importance to American Indians, procedures are in place to properly manage the discovery site. 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, as no such resources have been discovered within the 200 Areas. As is the case for other cultural resources, if any paleontological resources were found during construction, procedures are in place to properly manage the discovery site.

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 set forth 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 have the potential to generate economic impacts that may affect 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, and expenditures in the area, as well as changes in demands for social services. Analysis of these potential secondary economic and social impacts across the alternatives was conducted using a blended multiplier develop by the U.S. Department of Commerce, Bureau of Economic Analysis's Regional Input-Output Modeling System specifically for the Tri-Cities area, which is made up of Richland, Pasco, and Kennewick. 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. Since each activity type may peak during different years, the totals do not add up, as they represent different time periods.

The projected workforce estimates could also potentially impact the local commuter traffic. A 2005 commuter survey found that 88 percent of the employees commuting to Hanford do so in single-occupancy vehicles, while 12 percent of the vehicles were carpools or vanpools (two or more persons) (BFCOG 2006). It was assumed that employees would commute to work in vehicles with an average of 1.25 passengers each (Malley 2007). In addition, the number of calculated truck trips associated with the various activities was rounded up to the nearest whole trip.

Common Socioeconomic Impacts

The potential socioeconomic impacts from the alternatives below have many commonalities based on the activities associated with them. The 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 to provide administrative controls of remaining facilities and postclosure care. During the high employment periods, an increase in the projected workforce would result in some in-migration of workers from outside the region and their associated secondary impacts on the local economy. The number of immigrating workers accompanied by their families and their associated family sizes would affect the predicted impacts for most public services.

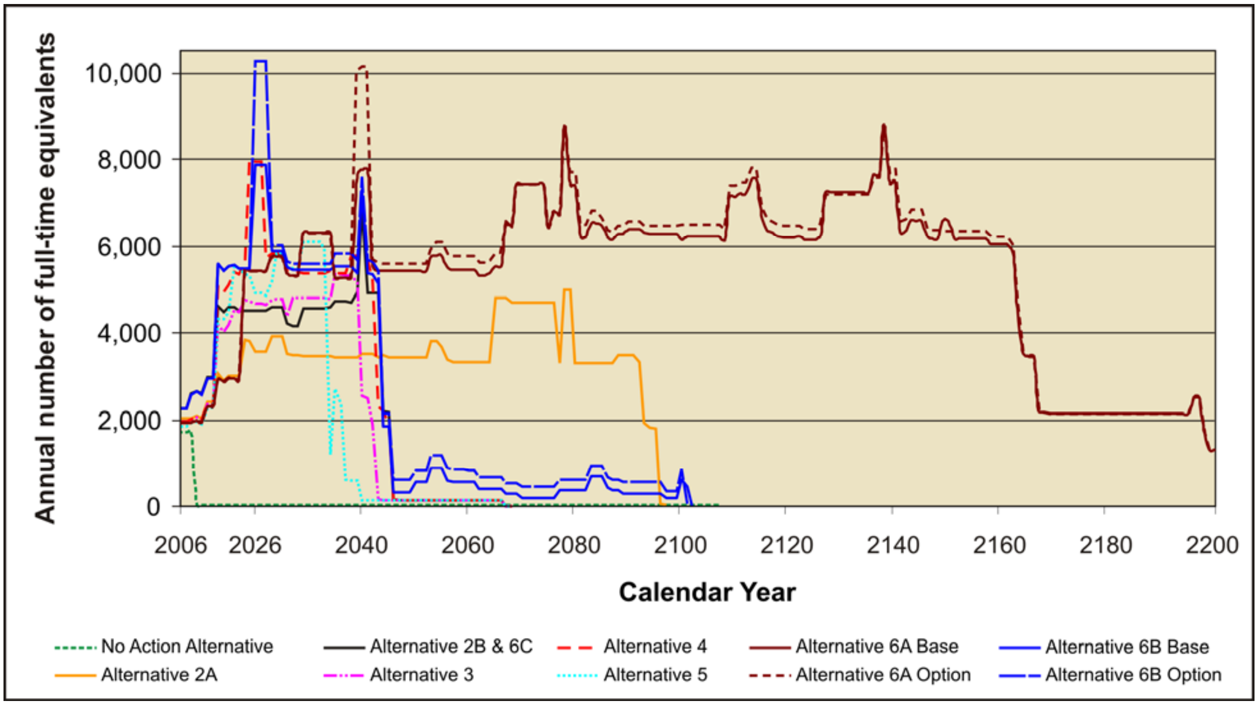


Figure 4–16. Tank Closure Alternatives – Annual Workforce Estimates (2006–2200)

After some peak employment periods, sharp drops in onsite employment might occur. These reductions could also potentially 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, since 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.

4.1.9.1 Alternative 1: No Action

Under Alternative 1, the No Action Alternative, total onsite employment as shown in Figure 4–16 would remain steady (1,730 FTEs) to 2008, then drop immediately to 15 FTEs needed to cover administrative controls for 100 years through 2107. Over 50 percent of the workforce (906 FTEs) during the peak years would be from 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 would likely be created as 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 2007a.

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, in 2006 the employment of approximately 10,000 people at Hanford was about 10 percent of those employed in the Hanford ROI. Reduction in onsite employment and expenditures in 2009 would 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.

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 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 plan 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. The current anticipated deadline for the Tri-Cities CTR plan is February 2009, and the ordinance deadline is September 2009 (BFCOG 2006:2-5, 2-6). 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 as 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 from 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, increasing 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 would be 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 at the WTP. Construction of the WTP (2006 through 2017) and its replacement facility (2065 through 2076) dominate the construction workforce of up to 1,880 FTEs. From 2053 through 2076, over half of the roughly 3,010 FTE operations workers would be employed at the WTP (see Figure 4–17). The deactivation of the WTP and its replacement facility dominates the deactivation workforce as well with a projection of approximately 1,700 FTEs from 2078 through 2079 and again from 2094 through 2095 (see Table 4–9).

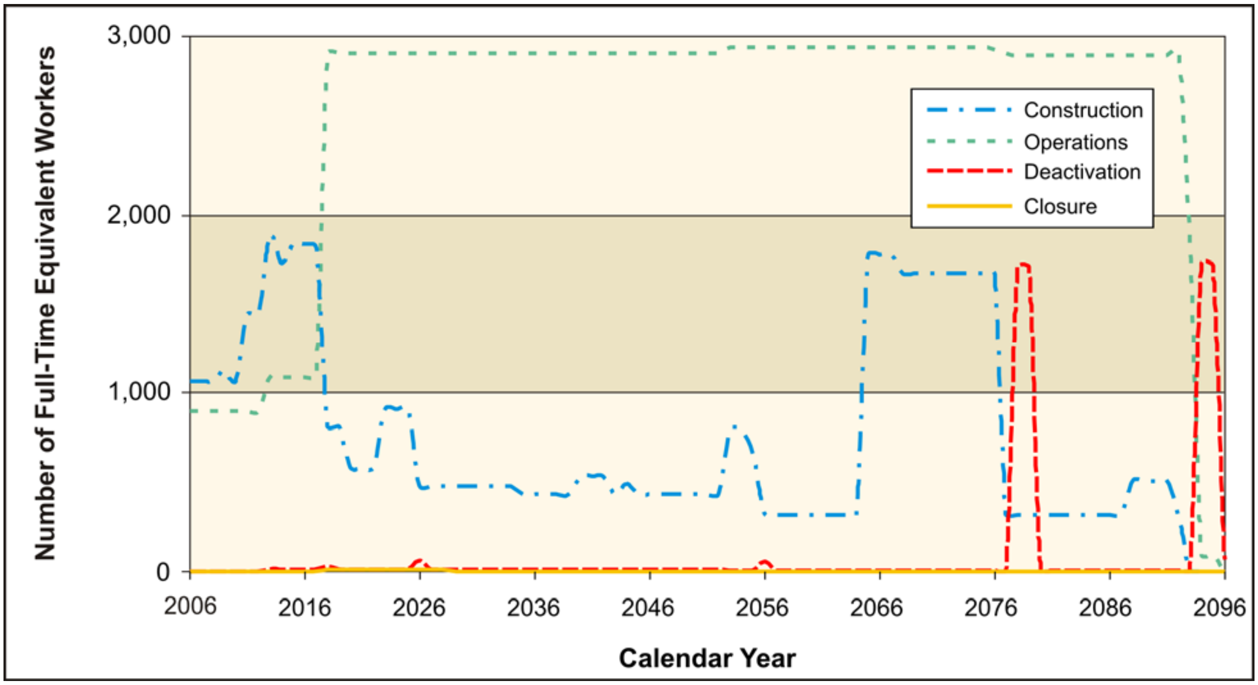


Figure 4–17. Tank Closure Alternative 2A Annual Estimated Onsite Full-Time Equivalent Workforce Requirements (2006–2096)

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 2065–2076	1,730–1,880 1,670–1,780
Operations	2018–2092	2,970–3,010
Deactivation	2078–2079 2094–2095	1,710 1,720–1,730
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 2007a.

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, both direct and indirect, at Hanford.

4.1.9.2.2 Demographic Characteristics

While the alternative would draw some workers from the local labor force, the continuing demand for operations workers under this alternative 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.

4.1.9.2.3 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 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 activity 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 2,000 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 15,500 truck trips per year (60 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) from 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 would be projected in this peak year. Direct employment projections would then decrease significantly until 2047, when operations workers would make up the bulk (120 out of 123 FTEs) of the employment requirements. The workforce employment requirements would then remain steady until 2068, when three 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 its supplemental operations. In addition, deactivation of the WTP in 2044 and 2045 dominates 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 dominates the peak closure workforce of 412 FTEs.

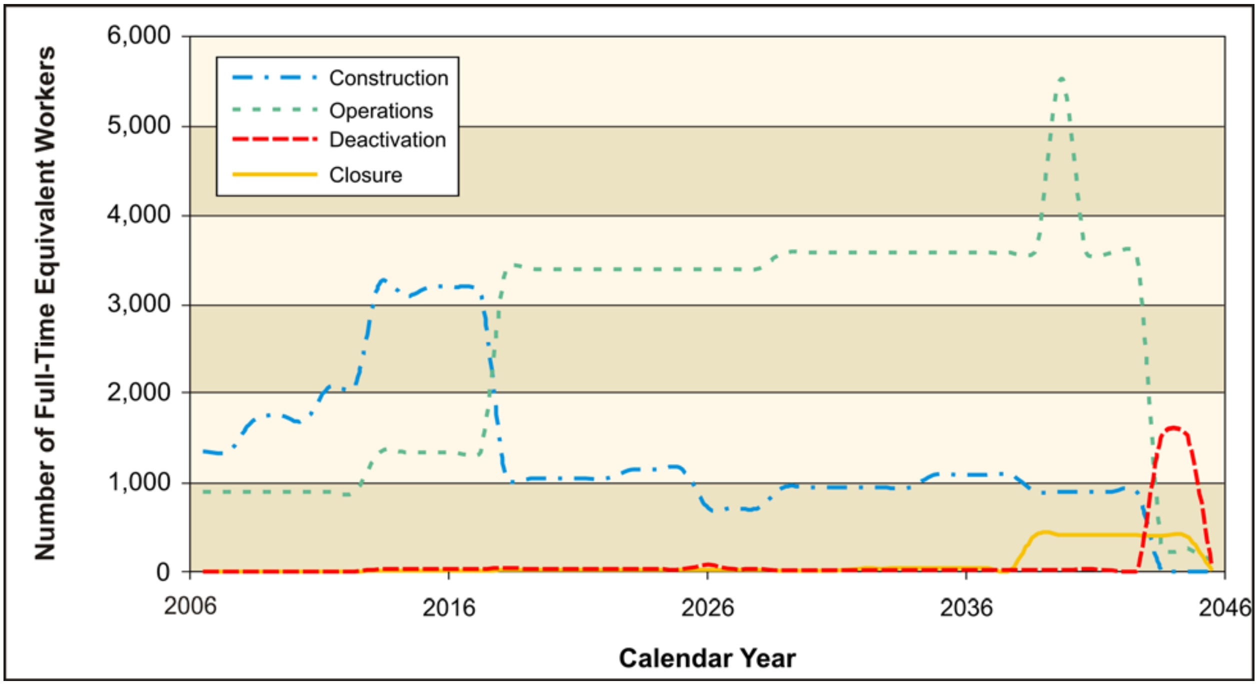


Figure 4–18. Tank Closure Alternative 2B Annual Estimated Onsite Full-Time Equivalent Workforce Requirements (2006–2046)

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	3,090–3,240
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 2007a.

4.1.9.3.1 Regional Economic Characteristics

The near-term impact under Alternative 2B 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) as compared with approximately 10 percent in 2006. Implementing Alternative 2B could temporarily (30 years) increase demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment, both 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 under this alternative 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. 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 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 activity 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 to mainly support WTP operations. It is projected that an average of 6,760 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—18,800 peak truck trips in 2015 and 2016. Onsite truck traffic would average around 17,400 truck trips per year (67 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 projections would then decrease significantly until 2044, when operations workers would make up the bulk (120 out of 123 FTEs) of the employment requirements. The employment requirements would then remain steady until 2068, 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 3,010 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 2016–2017	2,750 2,940–3,010
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 2007a.

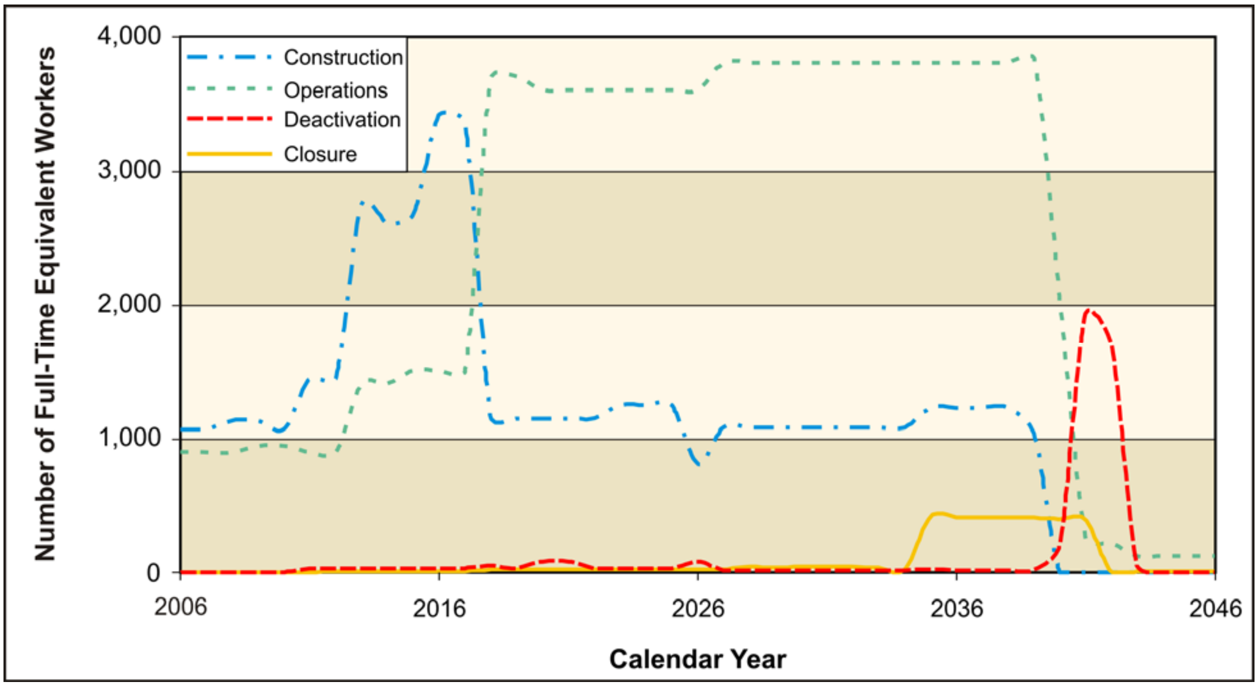


Figure 4–19. Tank Closure Alternatives 3A, 3B, and 3C Annual Estimated Onsite Full-Time Equivalent Workforce Requirements (2006–2046)

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, both 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 the alternative would draw some workers from the local labor force, the continuing demand for operations workers under this alternative 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.

4.1.9.4.3 Housing and Community Service

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 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 activity 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 5,300 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 55,500 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 are only differentiated by 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).

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 2016–2017	2,750 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 2007a.

The total workforce estimate peaks in 2035 (5,260 FTEs) under Alternative 3B. As this total workforce estimate is only 75 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.

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. Under Alternative 3B, the construction and operations activity 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.

4.1.9.5.1.1 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 8,500 truck trips per year (33 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 (37 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 are only differentiated by 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 2016–2017	2,750 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 2007a.

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. Under Alternative 3C, the construction and operations activity 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.

4.1.9.6.1.1 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 operations workers would make up the bulk (120 out of 123 FTEs) of the employment requirements. The workforce employment requirements would then remain steady until 2068, when only three FTEs would be needed for postclosure care of the site. The existence of these direct jobs would be 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 makeup 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 2016–2017	3,150 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 2007a.

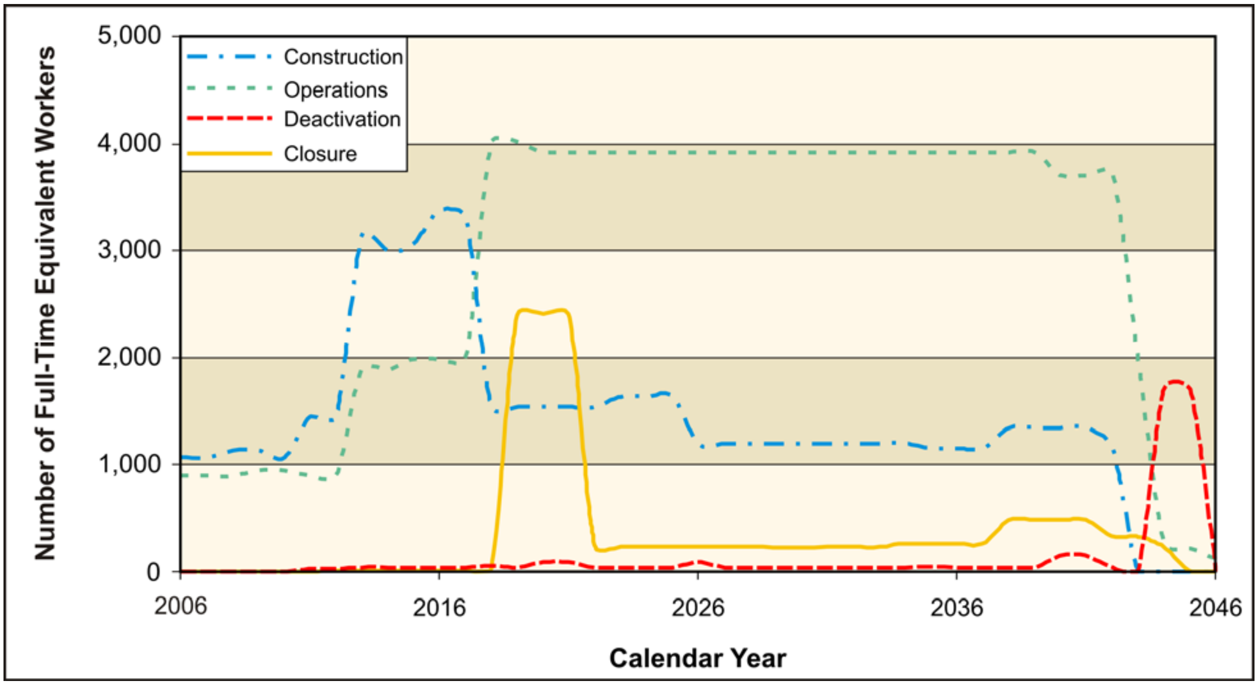


Figure 4–20. Tank Closure Alternative 4 Annual Estimated Onsite Full-Time Equivalent Workforce Requirements (2006–2046)

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 (30 years) increasing demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment, both 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 the 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 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 activity 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 significant 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, there would begin a sharp decrease in total employment, falling steadily until 2040, when operations workers would make up the bulk (120 out of 123 FTEs) of the employment requirements. By 2068, only a handful of workers (three 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 more than quadruple by the time it reaches its peak of 3,890 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 over 3,800 FTEs. The operations activities at the WTP, for 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), of which the majority (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	3,830–3,890
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 2007a.

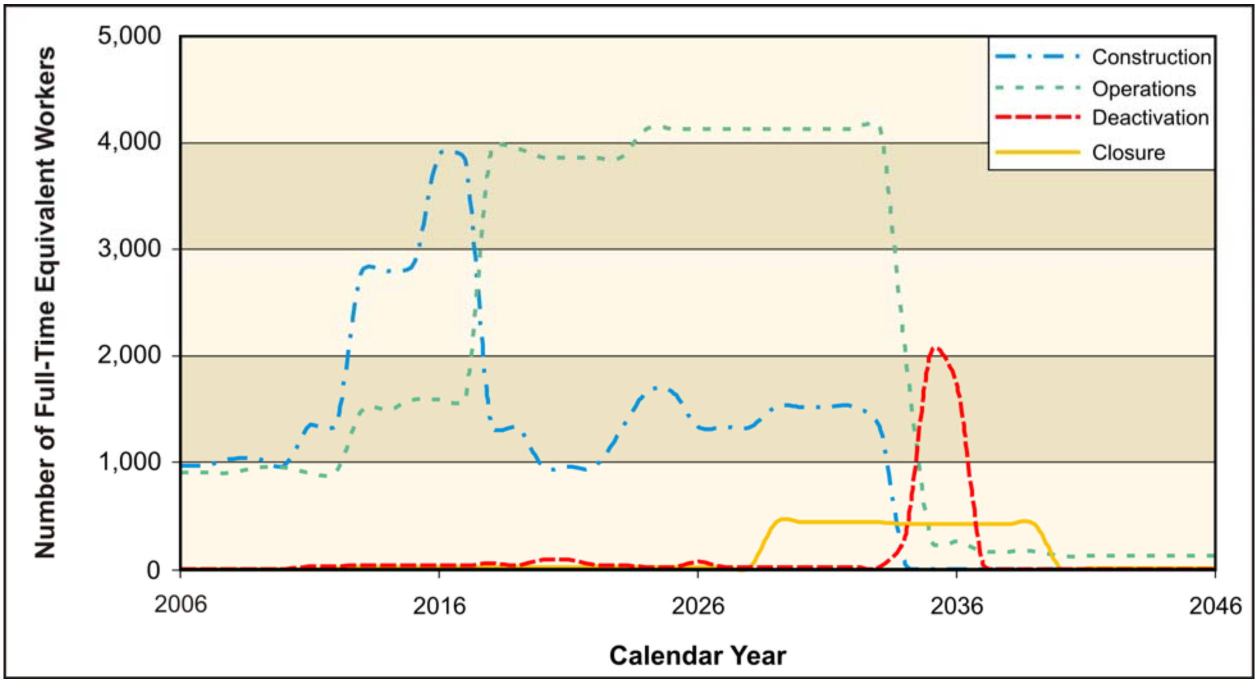


Figure 4–21. Tank Closure Alternative 5 Annual Estimated Onsite Full-Time Equivalent Workforce Requirements (2006–2046)

4.1.9.8.2 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 (20 years) increasing demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment, both direct and indirect, at Hanford. The increase in demand would be followed by an abrupt decrease in expenditures, income, and employment.

4.1.9.8.3 Demographic Characteristics

While the alternative would draw some workers from the local labor force, the demand for operations workers under this alternative 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.

4.1.9.8.4 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.

4.1.9.8.5 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 below the minimum acceptable (“D”) LOS (Perteet, Thomas/Lane, and SCM 2001).

4.1.9.8.5.1 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.

4.1.9.8.5.2 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

Alternatives 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 almost double to 5,430 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 significant increases and subsequent decreases in total onsite workforce requirements. These large spikes in total workforce requirements would potentially occur from 2029 through 2034, from 2039 through 2041, from 2069 through 2074, in 2078, from 2109 through 2114, and in 2138. Under Alternative 6A, Base Case, the peak of 8,500 FTEs would occur in the 2138 spike. Alternative 6A, Option Case, would have a peak in 2041 with a high of 10,100 FTEs. Beginning in 2162, there would be a sharp decrease (over 60 percent) in total employment, leveling out at over 2,100 FTEs in

2168. The existence of these direct jobs would be expected to result in the creation of up to 7,600 additional indirect jobs in the peak years.

Under this alternative, more than 4,600 FTEs 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 11 spikes (short-term annual increase and subsequent decrease in employment) involving more than a 15 percent change in workforce requirements. The largest of these spikes would peak in 2041, 2078, 2113–2114, and 2136–2138 (see Table 4–16). The bulk of the deactivation workforce requirements would occur during the deactivation of the WTP (1,210 FTEs) and its replacement facilities from 2078–2080, 2138–2140, and 2164–2166. The closure workforce would remain under 200 FTEs under Alternative 6A, Base Case, except from 2039–2041 and 2149–2150. Under Alternative 6A, Option Case, the closure workforce requirements after the peak in 2041 would more than double those under Alternative 6A, Base Case, ranging from 212 to 503 FTEs.

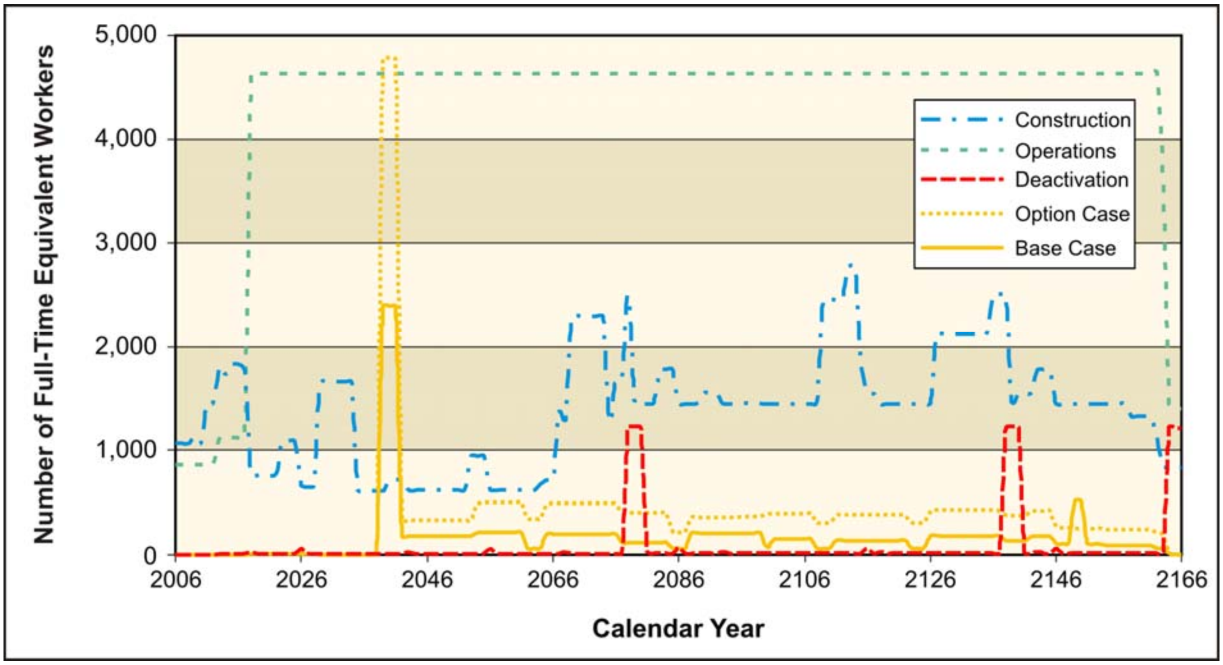


Figure 4–22. Tank Closure Alternative 6A, Base/Option Case, Annual Estimated Onsite Full-Time Equivalent Workforce Requirement (2006–2166)

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 2029–2034 2078 2113–2114 2136–2138	1,730–1,830 1,660 2,510 2,780 2,500	Same
Operations	2018–2162	4,630–4,660	Same
Deactivation	2078–2080 2138–2140 2164–2166	1,230 1,230 1,220–1,230	Same
Closure	2039–2041 2149–2150	2,390 515	4,800 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 2007a.

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, both direct and indirect, at Hanford. The peak workforce estimates of up to 8,500 FTEs occur in 2078 and 2138. These peaks represent approximately 3.2 and 2.2 percent, respectively, of the projected labor force in the ROI (267,000 in 2078 and 390,000 in 2138). 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 impacts of implementing the Base Case. The higher number of closure workers in the Option Case is double those in the Base Case. The peak workforce estimate in 2041 (10,100 FTEs) represents 5.3 percent of the projected labor force in the ROI (191,000 in 2041).

4.1.9.9.2 Demographic Characteristics

4.1.9.9.2.1 Base and Option Cases

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. The impacts on the demographic characteristics of the ROI would be virtually the same for the Base and Option Cases. The increased number of closure workers in the Option Case represents a 6 percent increase in the total number of workers over the Base Case.

4.1.9.9.3 Housing and Community Services

BASE AND OPTION CASES

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.

4.1.9.9.4 Local Transportation

Implementation of Alternative 6A 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 below the minimum acceptable ("D") LOS (Perteet, Thomas/Lane, and SCM 2001).

4.1.9.9.4.1 Commuter Traffic

BASE AND OPTION CASES

Under Alternative 6A, 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 10,100 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, up to 6,800 commuter vehicles could travel to and from the site each day.

4.1.9.9.4.2 Truck Traffic

BASE AND OPTION CASES

In both 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 8,800 (under Alternative 6A, Base Case) and 10,600 (under Alternative 6A, Option Case) truck trips per year (34 and 41 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 15,000 truck trips per year (58 trips per day). Under Alternative 6A, Option Case, the peak would occur in 2078 with an estimated 18,500 truck trips per year (71 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 76,800 truck trips per year (295 trips per day). Under Alternative 6A, Option Case, the peak would occur in 2137 with up to 63,300 onsite truck trips per year (243 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, would differ only in the intensity of some closure workforce employment projections (see Figure 4–16). Under both alternatives, total employment projections would steadily increase, almost doubling by 2013. Under Alternative 6B, Base Case, the peak of 7,870 FTEs would be in 2021 and 2022. Alternative 6B, Option Case, has the highest total onsite workforce projection of all Tank Closure alternatives, reaching a peak of over 10,000 FTEs in 2021 and 2022. As a result of these increases in employment, up to 7,600 additional indirect jobs are projected in the peak years. Employment projections in both the Base and Option Cases would then decrease to remain steady at or above 5,000 FTEs until a short spike in employment in 2040. The total onsite workforce projections would then sharply decrease until 2046. From 2046 until 2096, total onsite workforce projections would range from 200 to 882 FTEs under Alternative 6B, Base Case, and from 454 to 1,170 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 employed 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 Table 4–17) when construction workforce requirements would briefly increase to 333 FTEs. Beginning in 2018, operations workers would make up the bulk of the employment requirements, remaining steady at 3,910 FTEs except for a spike up to 5,880 FTEs in 2039 and 2040. The deactivation workforce requirements would peak in 2044, the majority (1,530 FTEs) would be required for deactivating the WTP. After a spike from 2020 through 2022, the closure workforce would range from 59 to 333 FTEs under Alternative 6B, Base Case, and from 313 to 586 FTEs under Alternative 6B, Option Case.

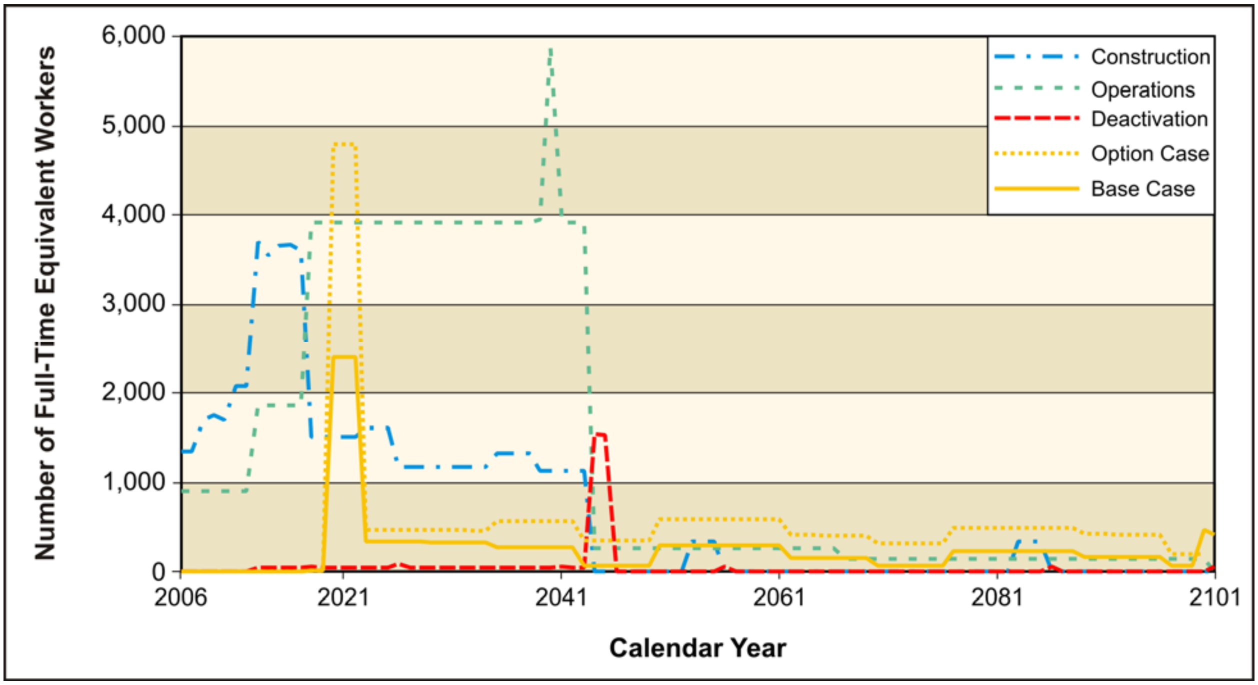


Figure 4–23. Tank Closure Alternative 6B, Base/Option Case, Annual Estimated Onsite Full-Time Equivalent Workforce Requirements (2006–2101)

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 2053–2055 2083–2085	3,550–3,690 333 333	Same
Operations	2018–2043	3,910–5,880	Same
Deactivation	2044–2045	1,530–1,540	Same
Closure	2020–2022 2100–2101	2,400 414–468	4,790 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 2007a.

The socioeconomic impacts of implementing the Base and Option Cases of this alternative would be similar. All construction, operations, and deactivation activities would be during the same time periods and involve the identical workforce for both cases. The closure activities are projected to include higher workforce estimates (approximately double those in the Base Case) under the Option Case.

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, both direct and indirect, at Hanford. The peak workforce estimates, up to 7,870 FTEs, occur from 2020 through 2022 and in 2040. These near-term peaks represent approximately 5.2 and 4.2 percent, respectively, of the projected labor force in the ROI (150,000 in 2021 and 189,000 in 2040).

4.1.9.10.1.2 Option Case

The socioeconomic impacts of implementing the Option Case would be higher than those impacts from implementing the Base Case. The higher number of closure workers in the Option Case is almost double those in the Base Case. The peak workforce estimate in 2021 and 2022 (10,300 FTEs) represents 6.8 percent of the projected labor force in the ROI.

4.1.9.10.2 Demographic Characteristics

4.1.9.10.2.1 Base and Option Cases

While the alternative would draw some workers from the local labor force, the demand for operations workers under this alternative 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. The increased number of closure workers in the Option Case during the later years (after 2045) represents from one-third to over double the total number of workers in the Base Case. Nevertheless, the impacts on the demographic characteristics of the ROI would be virtually the same for the Base and Option Cases, as the total workforce is small compared to the projected labor force in the ROI (201,000 in 2046).

4.1.9.10.3 Housing and Community Service

BASE AND OPTION CASES

Implementation of Alternative 6B 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 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 below the minimum acceptable (“D”) LOS (Perteet, Thomas/Lane, and SCM 2001).

4.1.9.10.4.1 Commuter Traffic

BASE AND OPTION CASES

Under Alternative 6B, the peak years of construction and operations activity 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 2020 through 2022, under Alternative 6B, Option Case. Assuming an average of 1.25 persons per passenger vehicle, this personnel increase could represent over 8,200 commuter vehicles per day traveling to and from the site. Under the Base Case during the same time period (2020–2022), up to 6,300 commuter vehicles could travel to and from the site each day.

4.1.9.10.4.2 Truck Traffic

BASE AND OPTION CASES

Under both cases, an average of over 2,200 offsite truck trips per year (9 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 the 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 from 2053 through 2055 with up to 44,700 truck trips per year (172 trips per day). These periods of onsite truck activity would support 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 under Alternative 2B (see Figure 4–16). The construction workforce of 11 FTEs from 2016 through 2043 needed 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	3,090–3,240
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 2007a.

4.1.9.11.1 Regional Economic Characteristics

The near-term impact from implementing Alternative 6C would alter the economic characteristics of the region by temporarily (30 years) increasing demands for goods and services in the Tri-Cities area due to increases in expenditures, income, and employment, both 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.

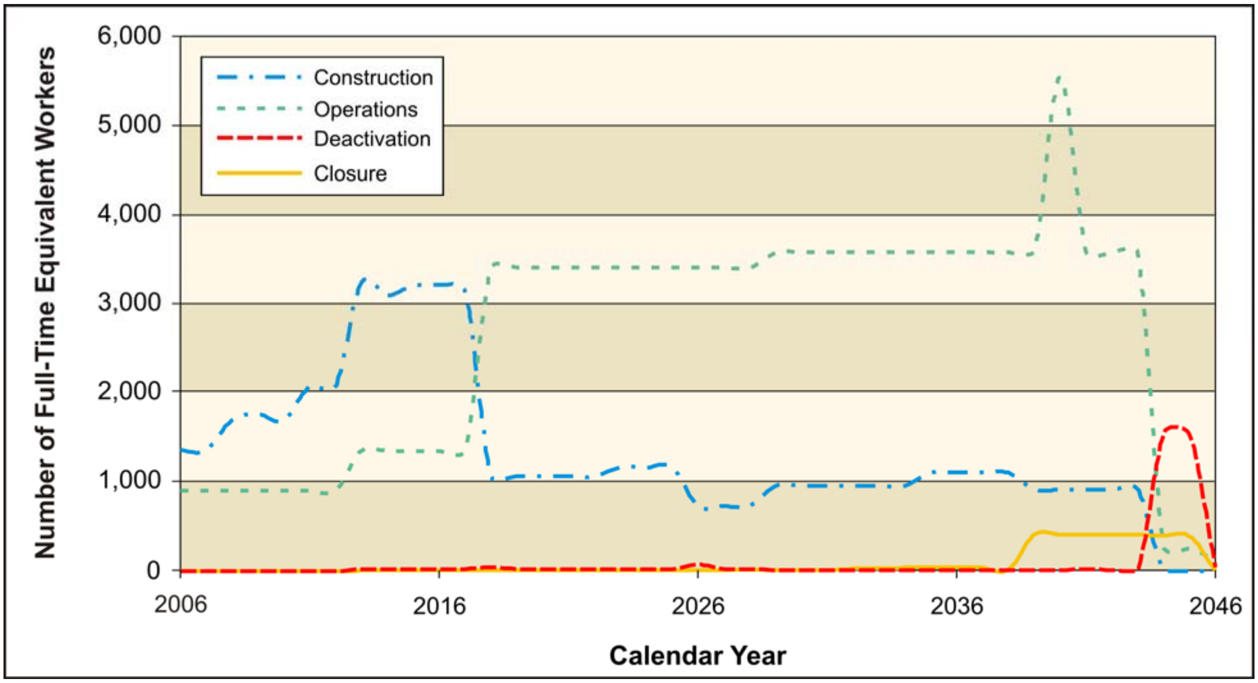


Figure 4–24. Tank Closure Alternative 6C Annual Estimated Onsite Full-Time Equivalent Workforce Requirements (2006–2046)

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 below the minimum acceptable (“D”) LOS (Perteet, Thomas/Lane, and SCM 2001).

4.1.9.11.5 Commuter Traffic

Under Alternative 6C, the peak years of construction and operations activity 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 personnel increase could represent about 5,500 commuter vehicles per day traveling to and from the site.

4.1.9.11.5.1 Truck Traffic

From 2006 through 2017, an average of 2,200 offsite truck trips per year (8 trips per day) is projected 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 (28 trips per day) would be required to ship in materials during this time. At its peak in 2040, there would be an estimated 13,000 truck trips per year (50 trips per day).

Onsite trucking would be at its highest during the period of modified RCRA Subtitle C landfill barrier construction, supplemented by trucks needed for construction of the ILAW Interim Storage Facility and the onsite movement of concrete aggregate materials, other borrow materials, and excavated soil supporting closure activities under Alternative 6C. 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 radiation exposure to workers and members of the public are presented in Appendix K. Radiological impacts are presented for three public receptors: the general population (approximately 463,000[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. Radiation exposure occurs through inhalation, direct exposure to the radiological 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 or LIGO, would be from inhalation and exposure to the plume and material deposited on the ground. Doses are presented as the total effective dose equivalent.

The radiological impacts on members of the public are presented for each alternative in terms of impacts over the life of the project (operational life of the project during which there are radiological air emissions) and peak annual impacts. Impacts over the life of the project are the total estimated radiological doses incurred by members of the public over the duration of an alternative. The peak annual impacts are the estimated annual radiological doses incurred by members of the public during the year(s) of largest radiological dose. For all alternatives, the dose to an onsite MEI was less than the dose to an offsite MEI located near the Hanford boundary; 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).

In addition to members of the public, workers directly involved in the activities associated with each alternative and nearby noninvolved workers may receive radiological doses or chemical exposures. Doses to an involved worker are calculated based on an FTE. It is assumed for purposes of this dose evaluation that an FTE involved 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 radiological air emissions associated with the alternatives considered.

[1] The approximate population is based on populations of 447,354, 451,556, and 488,897 people residing within 80 kilometers (50 miles) of the WTP, STTS-East, and STTS-West, respectively.

The location selected for the noninvolved worker is a facility that is expected to be staffed on a daily basis that is near the assumed emission sources.

Impacts of radionuclide releases from each facility involved in the Tank Closure alternatives are evaluated for construction, operations, deactivation and cleanup, and postclosure care, as applicable to each alternative. Based on the data presented in the following subsections, radiation exposure to members of the public is not expected to result in a latent cancer fatality (LCF) in the population within an 80-kilometer (50-mile) radius under Alternatives 1, 2B, 3B, 3C, 4, 5, and 6C, while 1 LCF might occur under Alternatives 2A, 3A, 6A (both the Base and Option Cases), and 6B (both the Base and Option Cases). 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, during the year of maximum impact, the MEI would be about 19.1 kilometers (11.9 miles) east-southeast of the 200 Areas. Under Alternative 1, the MEI would be to the east-northeast, about 11 kilometers (6.8 miles) from the 200 Areas. The dose to the MEI over the life of the project is not expected to exceed 20 millirem for any of the alternatives; on an annual basis, the dose to the MEI is expected to be well below the regulatory limit of 10 millirem per year (40 CFR 61.90–61.97). 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 less than 0.1 millirem.

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 radiological 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, radiological contaminants released to the atmosphere from tank farm management, tank waste retrieval and treatment, and tank closure activities. The highest radiological 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, 600 meters (2,000 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 1.1 kilometers (3,600 feet) east of the 200-West Area source. Radiation doses to noninvolved workers are calculated to remain below 1 millirem per year.

Based on the data presented in the following subsections, the average radiation dose to an FTE worker would be 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 could be exceeded on the basis of exposure of an average FTE worker if Alternatives 4, 6A or 6B (both the Base and 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. Also, 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 1098-99, *Radiological Control*, recommends that the annual dose not exceed 2 rem unless explicitly authorized by DOE management and that the dose generally be controlled at a level of 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 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 in turn 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 are 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 have radiological air emissions would occur from 2006 to 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	310			3.2	
	200-West Area	290			3.1	
	Total	600	0 (4×10^{-1})	2008	6.3	0 (4×10^{-3})
		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]**
Maximally exposed individual	WTP	0			0	
	200-East Area	7.7			0.083	
	200-West Area	3.9			0.042	
	Total	12	7×10^{-6}	2008	0.13	8×10^{-8}
Onsite MEI	Total	1.8	1×10^{-6}	2008	0.018	1×10^{-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) in 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.1.1.3).

[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 8.0 millirem, with a corresponding lifetime risk of an LCF of 5×10^{-6}; the onsite MEI dose from 40 years of exposure would be 0.71 millirem, with a lifetime LCF risk of 4×10^{-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 dose of 600 person-rem[2] and the MEI would receive a dose of 12 millirem. Using the risk factor of 0.0006 LCFs per rem (DOE 2003h), no LCFs would be expected in the general population as a result of this alternative. There would be a probability of 7×10^{-6}, or 1 chance in 140,000, of the MEI developing an LCF, assuming the same MEI was exposed over the life of the project. Radiological air emissions would remain fairly constant over the duration of the alternative, not accounting for radioactive decay, with an annual population dose of 6.3 person-rem and an annual MEI dose of 0.13 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 the Columbia Generating Station would receive a maximum annual dose of 0.018 millirem. The increased risk of an LCF from this dose would be 1×10^{-8} (1 in 93 million).

4.1.10.1.2 Radiological Impacts on Workers

Table 4–20 presents dose and risk estimates for an involved and noninvolved FTE workers. The average annual FTE radiation worker dose would be 140 millirem, less 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, which corresponds to a risk of 3×10^{-3} (1 chance in 300) of developing an LCF.

Table 4–20. Tank Closure Alternative 1 Normal Operations Radiological Impacts on Workers

Receptor	Dose	Latent Cancer Fatality Risk[a]
Average Involved Full-Time Equivalent Worker		
Average annual impact	140 millirem	9×10^{-5}
Impact over life of project[b]	5,700 millirem	3×10^{-3}
Life-of-Project Worker Population	280 person-rem	0 (2×10^{-1})
Noninvolved Worker (Year of Maximum Impact)		
At the 242-A Evaporator (2008)[c]	0.25 millirem	2×10^{-7}
At the Environmental Restoration Disposal Facility (2008)[d]	0.71 millirem	4×10^{-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.1.1.3).

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.

c The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

d The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 is estimated to be 280 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, no LCFs would be expected as a result of the dose associated with this

[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.

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 have radiological air emissions would occur from 2006 to 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	450			60	
	200-East Area	320			0.00000053	
	200-West Area	310			0	
	Total	1,100	1 (6×10^{-1})	2093	60	0 (4×10^{-2})
		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]**
Maximally exposed individual	WTP	7.3			1.4	
	200-East Area	8.3			0.0000000078	
	200-West Area	4.2			0	
	Total	20	1×10^{-5}	2093	1.4	8×10^{-7}
Onsite MEI	Total	2.6	2×10^{-6}	2093	0.058	4×10^{-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) in 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.1.1.3).

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 7.4 millirem, with a corresponding lifetime risk of an LCF of 4×10^{-6}; the onsite MEI dose from 40 years of exposure would be 0.55 millirem, with a lifetime LCF risk of 3×10^{-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 dose of 1,100 person-rem. Doses from this alternative could result in 1 LCF in the general population. For purposes of comparison with other alternatives, a dose is calculated for an MEI although the same individual could not be exposed over the duration of this alternative. The MEI would receive a dose of 20 millirem. There would be a probability of 1×10^{-5}, or 1 chance in 100,000, of the MEI developing an LCF, assuming the same MEI was exposed over the life of the project. The main sources of radiological air emissions would be the WTP during its operations from 2018 to 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 60 person-rem and an MEI dose of 1.4 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.058 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 29 million).

4.1.10.2.2 Radiological Impacts on Workers

Table 4–22 presents dose and risk estimates for an involved and noninvolved FTE worker. The average annual FTE radiation worker dose would be 170 millirem, less 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 6,900 millirem, which corresponds to a risk of 4×10^{-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	1×10^{-4}
Impact over life of project[b]	6,900 millirem	4×10^{-3}
Life-of-Project Worker Population	23,000 person-rem	13
Noninvolved Worker (Years of Maximum Impact)		
At the 242-A Evaporator (2094–2095)[c]	0.30 millirem	2×10^{-7}
At the Environmental Restoration Disposal Facility (2094–2095)[d]	0.71 millirem	4×10^{-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.1.1.3).

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.

c The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

d The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 is estimated to be 23,000 person-rem. Applying 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 total dose would be distributed over several generations of workers. A majority of the collective worker dose under this alternative (19,000 person-rem, or 84 percent) would be associated with operations of the WTP, routine tank farm operations, and operations of the ETF. 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 have radiological air emissions would occur from 2006 to 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		
General population		Dose (person-rem)	Number of Latent Cancer Fatalities[b]	Year of Maximum Impact	Dose (person-rem per year)	Number of Latent Cancer Fatalities[b]
	WTP	450			76	
	200-East Area	6.0			0.17	
	200-West Area	5.7			0.16	
	Total	460	0 (3×10^{-1})	2040	76	0 (5×10^{-2})
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	8.9			1.7	
	200-East Area	0.15			0.0041	
	200-West Area	0.086			0.0024	
	Total	9.2	5×10^{-6}	2040	1.7	1×10^{-6}
Onsite MEI	Total	1.0	6×10^{-7}	2040	0.097	6×10^{-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) in 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.1.1.3).

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 dose of 460 person-rem, and the MEI would receive a dose of 9.2 millirem. No LCFs would be expected in the population as a result of the population dose. There would be a probability of 5×10^{-6}, or 1 chance in 200,000, of the MEI developing an LCF. The main source of radiological air emissions would be the WTP during its operations from 2018 to 2043. Fugitive and diffuse emission 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 76 person-rem and an MEI dose of 1.7 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.097 millirem. The increased risk of an LCF from this dose would be 6×10^{-8} (1 in 17 million).

4.1.10.3.2 Radiological Impacts on Workers

Table 4–24 presents dose and risk estimates for an involved and noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, less 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 6,400 millirem, which corresponds to a risk of 4×10^{-3} (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 61 years of occupational exposure under this alternative is 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. A majority of the collective worker dose under this alternative (7,600 person-rem, or 69 percent) would be associated with operations of the WTP, routine tank farm operations, and operations of the ETF.

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	1×10^{-4}
Impact over life of project[b]	6,400 millirem	4×10^{-3}
Life-of-Project Worker Population	11,000 person-rem	7
Noninvolved Worker (Years of Maximum Impact)		
At the 242-A Evaporator (2040)[c]	0.29 millirem	2×10^{-7}
At the Environmental Restoration Disposal Facility (2040)[d]	0.0042 millirem	2×10^{-9}

[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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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.

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 have radiological air emissions would occur from 2006 to 2042. No radiological 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 dose of 570 person-rem, and the MEI would receive a dose of 14 millirem. Doses under this alternative would likely result in no LCFs in the general population. There would be a probability of 8×10^{-6}, or 1 chance in 125,000, of the MEI developing an LCF. The main source of radiological air emissions contributing to offsite doses would be the WTP during its operations from 2018 to 2040. Another significant contribution to offsite doses would be carbon-14 emissions from operations of the Bulk

Vitrification Facilities. The year of maximum impact would be 2040, with a population dose of 61 person-rem and an MEI dose of 1.4 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.058 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 29 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	360			60	
	200-East Area	100			0.42	
	200-West Area	100			0.45	
	Total	570	0 (3×10^{-1})	2040	61	0 (4×10^{-2})
		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]**
Maximally Exposed Individual	WTP	5.7			1.4	
	200-East Area	5.4			0.015	
	200-West Area	2.7			0.0086	
	Total	14	8×10^{-6}	2040	1.4	8×10^{-7}
Onsite MEI	Total	0.93	6×10^{-7}	2040	0.058	4×10^{-8}

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) in 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.1.1.3).

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 and noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, less 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 6,300 millirem, which corresponds to a risk of 4×10^{-3} (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 61 years of occupational exposure under this alternative is 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. A majority of the collective worker dose under this alternative (5,800 person-rem, or 58 percent) would be associated with operations of the WTP, routine tank farm operations, and operations of the ETF. 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 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	1×10^{-4}
Impact over life of project[b]	6,300 millirem	4×10^{-3}
Life-of-Project Worker Population	10,000 person-rem	6
Noninvolved Worker (Years of Maximum Impact)		
At the 242-A Evaporator (2040)[c]	0.18 millirem	1×10^{-7}
At the Environmental Restoration Disposal Facility (2018–2019)[d]	0.14 millirem	9×10^{-8}

[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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 have radiological air emissions would occur from 2006 to 2042. No radiological 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 dose of 380 person-rem, and the MEI would receive a dose of 7.1 millirem. No LCFs would be expected in the general population as a result of this alternative. There would be a probability of 4×10^{-6}, or 1 chance in 250,000, of the MEI developing an LCF. The main source of radiological air emissions would be the WTP during its operations from 2018 to 2040. Lower radiological emissions would come from the nonthermal supplementary treatment technology of this alternative and result in lower offsite dose impacts as compared with the thermal supplementary treatment technologies of Alternatives 3A and 3C. The year of maximum impact would be 2040, with a population dose of 60 person-rem and an MEI dose of 1.4 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.058 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 29 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		
General Population		**Dose (person-rem)**	**Number of Latent Cancer Fatalities[b]**	**Year of Maximum Impact**	**Dose (person-rem per year)**	**Number of Latent Cancer Fatalities[b]**
	WTP	360			60	
	200-East Area	7.2			0.000062	
	200-West Area	5.6			0.0018	
	Total	380	0 (2×10^{-1})	2040	60	0 (4×10^{-2})
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	6.8			1.4	
	200-East Area	0.16			0.0000014	
	200-West Area	0.083			0.000023	
	Total	7.1	4×10^{-6}	2040	1.4	8×10^{-7}
Onsite MEI	Total	0.90	5×10^{-7}	2040	0.058	4×10^{-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) in 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.1.1.3).
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 and noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, less 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 6,300 millirem, which corresponds to a risk of 4×10^{-3} (1 chance in 250) of developing an LCF.

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	9×10^{-5}
Impact over life of project[b]	6,300 millirem	4×10^{-3}
Life-of-Project Worker Population	10,000 person-rem	6
Noninvolved Worker (Year[s] of Maximum Impact)		
At the 242-A Evaporator (2040)[c]	0.17 millirem	1×10^{-7}
At the Environmental Restoration Disposal Facility (2018–2019)[d]	0.0042 millirem	3×10^{-9}

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.1.1.3).
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.
c The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.
d The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.
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 61 years of occupational exposure under this alternative is 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. A majority of the collective worker dose under this alternative (5,800 person-rem, or 58 percent) would be associated with operations of the WTP, routine tank farm operations, and operations of the ETF. 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 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 4–28. 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 have radiological air emissions would occur from 2006 to 2042. No radiological air emissions are expected during the period of institutional control following tank closure that extends to 2141.

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		
General Population		Dose (person-rem)	Number of Latent Cancer Fatalities[b]	Year of Maximum Impact	Dose (person-rem per year)	Number of Latent Cancer Fatalities[b]
	WTP	360			60	
	200-East Area	100			0.42	
	200-West Area	100			0.45	
	Total	570	0 (3×10^{-1})	2040	61	0 (4×10^{-2})
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	5.7			1.4	
	200-East Area	5.4			0.015	
	200-West Area	2.7			0.0086	
	Total	14	8×10^{-6}	2040	1.4	8×10^{-7}
Onsite MEI	Total	0.93	6×10^{-7}	2040	0.058	4×10^{-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) in 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.1.1.3).

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 dose of 570 person-rem, and the MEI would receive a dose of 14 millirem. No LCFs would be expected in the general population as a result of this alternative. There would be a probability of 8×10^{-6}, or 1 chance in 125,000, of the MEI developing an LCF. The main source of radiological air emissions would be the WTP during its operations from 2018 to 2039. The year of maximum impact would be 2040, with a population dose of 61 person-rem and an MEI dose of 1.4 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.058 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 29 million).

4.1.10.6.2 Radiological Impacts on Workers

Table 4–30 presents dose and risk estimates for an involved and noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, less 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 6,400 millirem, which corresponds to a risk of 4×10^{-3} (1 chance in 250) of developing an LCF.

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	1×10^{-4}
Impact over life of project[b]	6,400 millirem	4×10^{-3}
Life-of-Project Worker Population	11,000 person-rem	6
Noninvolved Worker (Year[s] of Maximum Impact)		
At the 242-A Evaporator (2040)[c]	0.18 millirem	1×10^{-7}
At the Environmental Restoration Disposal Facility (2018–2019)[d]	0.14 millirem	9×10^{-8}

[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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 61 years of occupational exposure under this alternative is 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 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. A majority of the collective worker dose under this alternative (5,800 person-rem, or 53 percent) would be associated with operations of the WTP, routine tank farm operations, and operations of the ETF. 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 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 4–30. 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 have radiological air emissions would occur from 2006 to 2045. No radiological air emissions are expected during the period of institutional control following tank closure that extends to 2144.

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	370			60	
	200-East Area	12			0.023	
	200-West Area	110			0.023	
	Total	490	0 (3×10^{-1})	2043	60	0 (4×10^{-2})
		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]**
Maximally Exposed Individual	WTP	6.4			1.4	
	200-East Area	0.35			0.00045	
	200-West Area	2.6			0.00027	
	Total	9.3	6×10^{-6}	2043	1.4	8×10^{-7}
Onsite MEI	Total	0.93	6×10^{-7}	2043	0.058	4×10^{-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) in 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.1.1.3).

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 operational life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a dose of 490 person-rem, and the MEI would receive a dose of 9.3 millirem. No LCFs would be expected in the general population as a result of this alternative. There would be a probability of 6×10^{-6}, or 1 chance in 167,000, of the MEI developing an LCF. The main sources of radiological air emissions would be the WTP and the supplemental treatment facilities during their operations from 2009 to 2030. The year of maximum impact would be 2043, with a population dose of 60 person-rem and an MEI dose of 1.4 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.058 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 29 million).

4.1.10.7.2 Radiological Impacts on Workers

Table 4–32 presents dose and risk estimates for an involved and noninvolved FTE worker. The average annual FTE radiation worker dose would be 520 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a dose of 21,000 millirem, which corresponds to a risk of 1×10^{-2} (1 chance in 100) of developing an LCF. The high average FTE worker dose would be due to the exhumation of 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.

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	520 millirem	3×10^{-4}
Impact over life of project[b]	21,000 millirem	1×10^{-2}
Life-of-Project Worker Population	43,000 person-rem	26
Noninvolved Worker (Year[s] of Maximum Impact)		
At the 242-A Evaporator (2043)[c]	0.18 millirem	1×10^{-7}
At the Environmental Restoration Disposal Facility (2034–2039)[d]	0.20 millirem	1×10^{-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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 61 years of occupational exposure under this alternative is 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. A majority of the collective worker dose under this alternative (32,000 person-rem, or 74 percent) would be associated with deep soil removal from SX tank farm.

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 have radiological air emissions would occur from 2006 to 2036. No radiological 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.

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		
General Population		**Dose (person-rem)**	**Number of Latent Cancer Fatalities[b]**	**Year of Maximum Impact**	**Dose (person-rem per year)**	**Number of Latent Cancer Fatalities[b]**
	WTP	360			60	
	200-East Area	6.0			0.00003	
	200-West Area	95			0.56	
	Total	460	0 (3×10^{-1})	2034	61	0 (4×10^{-2})
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	6.9			1.4	
	200-East Area	0.14			0.00000069	
	200-West Area	1.8			0.011	
	Total	8.9	5×10^{-6}	2034	1.4	8×10^{-7}
Onsite MEI	Total	0.84	5×10^{-7}	2034	0.058	4×10^{-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) in 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.1.1.3).

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 operational life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a dose of 460 person-rem, and the MEI would receive a dose of 8.9 millirem. No LCFs would be expected in the general population as a result of this alternative. There would be a probability of 5×10^{-6}, or 1 chance in 200,000, of the MEI developing an LCF. The main source of radiological air emissions would be the WTP, which includes the contribution from sulfate removal associated with pretreatment under this alternative. Another large source of radiological 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 61 person-rem and an MEI dose of 1.4 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.058 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 29 million).

4.1.10.8.2 Radiological Impacts on Workers

Table 4–34 presents dose and risk estimates for an involved and noninvolved FTE worker. The average annual FTE radiation worker dose would be 150 millirem, less 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 5,900 millirem, which corresponds to a risk of 4×10^{-3} (1 chance in 250) of developing an LCF.

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	9×10^{-5}
Impact over life of project[b]	5,900 millirem	4×10^{-3}
Life-of-Project Worker Population	8,800 person-rem	5
Noninvolved Worker (Year[s] of Maximum Impact)		
At the 242-A Evaporator (2034)[c]	0.17 millirem	1×10^{-7}
At the Environmental Restoration Disposal Facility (2018–2019)[d]	0.18 millirem	1×10^{-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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 61 years of occupational exposure under this alternative is estimated to be 8,800 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 37 percent) would be operations of the WTP.

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.

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 have radiological air emissions would occur from 2006 to 2168. 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 dose of 560 person-rem, and the MEI would receive a dose of 11 millirem. No LCFs would be expected in the general population as a result of this alternative. There would be a probability of 7.0×10^{-6}, or 1 chance in 140,000 of the MEI developing an LCF. The main source of radiological air emissions would be the WTP during its operations from 2018 to 2163. The year of maximum impact would be 2163, with a population dose of 60 person-rem and an MEI dose of 1.4 millirem.

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	460			60	
	200-East Area	93			0.097	
	200-West Area	1.8			0.076	
	Total	560	0 (3×10^{-1})	2163	60	0 (4×10^{-2})
		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]**
Maximally Exposed Individual	WTP	9.2			1.4	
	200-East Area	2.3			0.0021	
	200-West Area	0.025			0.0011	
	Total	11	7×10^{-6}	2163	1.4	8×10^{-7}
Onsite MEI	Total	1.2	7×10^{-7}	2163	0.059	4×10^{-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) in 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.1.1.3).

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 4.9 millirem, with a corresponding lifetime risk of an LCF of 3×10^{-6}; the onsite MEI dose from 40 years of exposure would be 0.28 millirem, with a lifetime LCF risk of 2×10^{-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.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.059 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 28 million).

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 have radiological air emissions would occur from 2006 to 2168. 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 dose of 760 person-rem, and the MEI would receive a dose of 15 millirem. Doses in this case could result in 1 LCF in the general population. There would be a probability of 9×10^{-6}, or 1 chance in 110,000, of the MEI developing an LCF. The main source of radiological air emissions would be the WTP during its operations from 2018 to 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 60 person-rem and an MEI dose of 1.4 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	460			60	
	200-East Area	150			0.16	
	200-West Area	150			0.14	
	Total	760	1 (5×10^{-1})	2163	60	0 (4×10^{-2})
		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]**
Maximally Exposed Individual	WTP	7.6			1.4	
	200-East Area	4.9			0.0032	
	200-West Area	2.6			0.0017	
	Total	15	9×10^{-6}	2163	1.4	8×10^{-7}
Onsite MEI	Total	1.3	8×10^{-7}	2163	0.059	4×10^{-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) in 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.1.1.3).

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 6.5 millirem, with a corresponding lifetime risk of an LCF of 4×10^{-6}; the onsite MEI dose from 40 years of exposure would be 0.32 millirem, with a lifetime LCF risk of 2×10^{-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.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.059 millirem. The increased risk of an LCF from this dose would be 4×10^{-8} (1 in 28 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 and 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 dose of 17,000 millirem, which corresponds to a risk of 1×10^{-2} (1 chance in 100) of developing an LCF. The high average FTE worker dose would be due to exhumation of 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	2×10^{-4}
Impact over life of project[b]	17,000 millirem	1×10^{-2}
Life-of-Project Worker Population	120,000 person-rem	72
Noninvolved Worker (Year[s] of Maximum Impact)		
At the 242-A Evaporator (2163)[c]	0.18 millirem	1×10^{-7}
At the Environmental Restoration Disposal Facility (2054–2061)[d]	0.075 millirem	4×10^{-8}

[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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 257 years of occupational exposure under this alternative is 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. Another large contributor to collective worker dose (69,000 person-rem, or 58 percent) would be associated with operations of the PPF and deep soil removal from 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 and 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 dose of 16,000 millirem, which corresponds to a risk of 1×10^{-2} (1 chance in 100) of developing an LCF. The high average FTE worker dose would be due to exhumation of 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	2×10^{-4}
Impact over life of project[b]	16,000 millirem	1×10^{-2}
Life-of-Project Worker Population	120,000 person-rem	75
Noninvolved Worker (Year[s] of Maximum Impact)		
At the 242-A Evaporator (2163)[c]	0.18 millirem	1×10^{-7}
At the Environmental Restoration Disposal Facility (2138–2140)[d]	0.20 millirem	1×10^{-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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 257 years of occupational exposure under this alternative is 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. Another large contributor to collective worker dose (73,000 person-rem, or 61 percent) is associated with operations of the PPF and deep soil removal from 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 have radiological air emissions would occur from 2006 to 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		
General Population		**Dose (person-rem)**	**Number of Latent Cancer Fatalities[b]**	**Year of Maximum Impact**	**Dose (person-rem per year)**	**Number of Latent Cancer Fatalities[b]**
	WTP	450			74	
	200-East Area	75			1.3	
	200-West Area	75			1.1	
	Total	600	0 (4×10^{-1})	2040	76	0 (5×10^{-2})
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	8.1			1.6	
	200-East Area	2.3			0.032	
	200-West Area	1.3			0.016	
	Total	12	7×10^{-6}	2040	1.7	1×10^{-6}
Onsite MEI	Total	1.2	7×10^{-7}	2040	0.096	6×10^{-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) in 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.1.1.3).

[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 8.7 millirem, with a corresponding lifetime risk of an LCF of 5×10^{-6}; the onsite MEI dose from 40 years of exposure would be 0.49 millirem, with a lifetime LCF risk of 3×10^{-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 dose of 600 person-rem, and the MEI would receive a dose of 12 millirem. No LCFs would be expected in the general population as a result of this alternative. There would be a probability of 7×10^{-6}, or 1 chance in 143,000, of the MEI developing an LCF. The main source of the doses would be radiological air emissions from the WTP during its operations from 2018 to 2043. The year of maximum impact would be 2040, with a population dose of 76 person-rem and an MEI dose of 1.7 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.096 millirem. The increased risk of an LCF from this dose would be 6×10^{-8} (1 in 17 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 radiological air emissions would occur from 2006 to 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	450			74	
	200-East Area	130			2.2	
	200-West Area	130			1.8	
	Total	710	0 (4×10^{-1})	2040	78	0 (5×10^{-2})
		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]**
Maximally Exposed Individual	WTP	7.3			1.6	
	200-East Area	4.2			0.046	
	200-West Area	2.2			0.022	
	Total	14	8×10^{-6}	2040	1.7	1×10^{-6}
Onsite MEI	Total	1.3	8×10^{-7}	2040	0.098	6×10^{-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) in 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.1.1.3).

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 10 millirem, with a corresponding lifetime risk of an LCF of 6×10^{-6}; the onsite MEI dose from 40 years of exposure would be 0.54 millirem, with a lifetime LCF risk of 3×10^{-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 dose of 710 person-rem, and the MEI would receive a dose of 14 millirem. No LCFs would be expected in the general population as a result of this alternative. There would be a probability of 8×10^{-6}, or 1 chance in 125,000, of the MEI developing an LCF. The main source of the doses would be radiological air emissions from the WTP during its operations from 2018 to 2043. The higher dose over the life of the project of the Option Case compared with 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 78 person-rem and an MEI dose of 1.7 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.098 millirem. The increased risk of an LCF from this dose would be 6×10^{-8} (1 in 17 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 and noninvolved FTE worker. The average annual FTE radiation worker dose would be 870 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a dose of 35,000 millirem, which corresponds to a risk of 2×10^{-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 Case and Option Case) 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	870 millirem	5×10^{-4}
Impact over life of project[b]	35,000 millirem	2×10^{-2}
Life-of-Project Worker Population	82,000 person-rem	49
Noninvolved Worker (Year of Maximum Impact)		
At the 242-A Evaporator (2040)[c]	0.33 millirem	2×10^{-7}
At the Environmental Restoration Disposal Facility (2040)[d]	0.11 millirem	7×10^{-8}

[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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 is estimated to be 82,000 person-rem. The lower collective worker dose under Alternative 6B (both cases) compared with 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 operations of the PPF and deep soil removal from 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 and noninvolved FTE worker. The average annual FTE radiation worker dose would be 790 millirem. A radiation worker who received the average annual dose over the course of 40 years would receive a dose of 32,000 millirem, which corresponds to a risk of 2×10^{-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. 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	790 millirem	5×10^{-4}
Impact over life of project[b]	32,000 millirem	2×10^{-2}
Life-of-Project Worker Population	85,000 person-rem	51
Noninvolved Worker (Year of Maximum Impact)		
At the 242-A Evaporator (2040)[c]	0.40 millirem	2×10^{-7}
At the Environmental Restoration Disposal Facility (2040)[d]	0.28 millirem	2×10^{-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.1.1.3).

[b] Impact over the life of the project dose 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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 is 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 operations of the PPF and deep soil removal from 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 have radiological air emissions would occur from 2006 to 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		
General Population		**Dose (person-rem)**	**Number of Latent Cancer Fatalities[b]**	**Year of Maximum Impact**	**Dose (person-rem per year)**	**Number of Latent Cancer Fatalities[b]**
	WTP	450			74	
	200-East Area	6.0			0.17	
	200-West Area	5.7			0.16	
	Total	460	0 (3×10^{-1})	2040	74	0 (4×10^{-2})
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	8.8			1.6	
	200-East Area	0.15			0.0041	
	200-West Area	0.086			0.0024	
	Total	9.1	5×10^{-6}	2040	1.6	1×10^{-6}
Onsite MEI	Total	1.0	6×10^{-7}	2040	0.094	6×10^{-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) in 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.1.1.3).

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 dose of 460 person-rem, and the MEI would receive a dose of 9.1 millirem. Using the risk factor of 0.0006 LCFs per rem (DOE 2003h), no LCFs would be expected in the general population as a result of this alternative. There would be a probability of 5×10^{-6}, or 1 chance in 200,000, of the MEI developing an LCF. The main source of radiological air emissions would be the WTP during its operations from 2018 to 2043. The year of maximum impact would be 2040, with a population dose of 74 person-rem and an MEI dose of 1.6 millirem.

An onsite MEI who spends a normal workday at LIGO would receive a maximum annual dose of 0.094 millirem. The increased risk of an LCF from this dose would be 6×10^{-8} (1 in 18 million).

4.1.10.11.2 Radiological Impacts on Workers

Table 4–44 presents dose and risk estimates for an involved and noninvolved FTE worker. The average annual FTE radiation worker dose would be 160 millirem, less 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 6,400 millirem, which corresponds to a risk of 4×10^{-3} (1 chance in 250) of developing an LCF.

The total effective dose equivalent to the involved worker population from the 61 years of occupational exposure under this alternative is 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	1×10^{-4}
Impact over life of project[b]	6,400 millirem	4×10^{-3}
Life-of-Project Worker Population	11,000 person-rem	7
Noninvolved Worker (Year of Maximum Impact)		
At the 242-A Evaporator (2040)[c]	0.28 millirem	2×10^{-7}
At the Environmental Restoration Disposal Facility (2040)[d]	0.0042 millirem	2×10^{-9}

[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.1.1.3).

[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.

[c] The dose to a noninvolved worker at the 242-A Evaporator would be due to releases from the Waste Treatment Plant and other 200-East Area sources.

[d] The dose to a noninvolved worker at the Environmental Restoration Disposal Facility would be due to releases from 200-West Area sources.

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 is assumed to be inhalation.

Estimates of worker exposure to chemicals and the resulting health effects are highly dependent on modeling assumptions. 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 is made to estimate involved worker exposure to chemical releases associated with routine operations.

Based on historic 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 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 potential accidents under the alternatives. For each alternative, radiological impacts of postulated accident scenarios are quantified for an MEI living near Hanford, the offsite population as a whole, and a noninvolved worker. Hazardous chemical impacts are also evaluated. For an involved worker, accident consequences have not been quantified. While involved workers are expected to be near the Hanford tank farms during routine tank farm operations, as is the case under 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 not known. 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 are shown in Table 4–46. The radiological accident cancer risks from inhalation for a 100-year campaign period would be 6×10^{-9} for the MEI, 3×10^{-5} for the offsite population, and 7×10^{-6} for the noninvolved worker.

Table 4–45. Tank Closure Alternative 1 Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	$0 (6\times10^{-4})$	0.22	1×10^{-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 488,897 persons residing within 80 kilometers (50 miles) of the 200-West Area (see Appendix K, Section K.2.1.3.1.2).

[d] The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

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)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-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 488,897 persons residing within 80 kilometers (50 miles) of the 200-West Area (see Appendix K, Section K.2.1.3.1.2).

d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

Source: Appendix K, Section K.3.7.1.

4.1.11.1.2 Hazardous Chemical Impacts

Various hazardous chemicals exist in the waste tanks. Since the chemicals that exist in the tank waste are mixed with the radioactive material, any accident event would be 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 are 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 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. Table 4–48 shows the accident risks, 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)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	0.000014	9×10^{-9}	0.19	0 (1×10^{-4})	0.043	3×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	5×10^{-4}	4×10^{-12}	0 (6×10^{-8})	1×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–47).

Under Tank Closure Alternative 2A, operations would continue for a project period of 76 years; during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–48, the risk to the offsite population and onsite workers during this 75-year project period would be an increase of 1 in the number of LCFs in the offsite population and a 1×10^{-4} and 6×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

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 would be 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 forms a pool 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 (gallons)	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	11,500	160	2,450	1,100	730	41,000	27.0
Nitric acid	17,000	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 gallons to liters, multiply by 3.7854; 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 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. Table 4–51 shows the accident risks, 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)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day)	0.000043	3×10^{-8}	0.57	0 (3×10^{-4})	0.13	8×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop –unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day)	5×10^{-4}	1×10^{-11}	0 (2×10^{-7})	4×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–50).

Under Tank Closure Alternative 2B, operations would continue for a project period of 26 years, during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–51, the risk to the offsite population and onsite workers during this 26-year project period would be no (4×10^{-1}) increase in the number of LCFs in the offsite population and a 3×10^{-5} and 2×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

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 in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

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 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. Table 4–53 shows the accident risks, 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). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–52).

Under Tank Closure Alternative 3A, operations would continue for a project period of 23 years, during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–53, the risk to the offsite population and onsite workers during this 22-year project period would be no increase (4×10^{-1}) in the number of LCFs in the offsite population and a 3×10^{-5} and 2×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

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 in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

Table 4–52. Tank Closure Alternative 3A Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	7×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	6×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	0.000014	9×10^{-9}	0.19	0 (1×10^{-4})	0.043	3×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Bulk vitrification waste receipt tank failure – unmitigated (200-East Area) (BV61)	0.000000028	2×10^{-11}	0.00038	0 (2×10^{-7})	0.000083	5×10^{-8}
Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61)	0.0000035	2×10^{-9}	0.016	0 (1×10^{-5})	0.0032	2×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	0.0000022	1×10^{-9}	0.0029	0 (2×10^{-5})	0.0025	1×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	0.0000066	4×10^{-9}	0.030	0 (2×10^{-5})	0.0024	1×10^{-6}
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-4}

a The alphanumeric code following in 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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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: Maximally Exposed Individual[b]	Risk of Latent Cancer Fatality: Offsite Population[c, d]	Risk of Latent Cancer Fatality: Noninvolved Worker[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	5×10^{-4}	4×10^{-12}	0 (6×10^{-8})	1×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Bulk vitrification waste receipt tank failure – unmitigated (200-East Area) (BV61)	5×10^{-4}	8×10^{-15}	0 (1×10^{-10})	3×10^{-11}
Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61)	5×10^{-4}	1×10^{-12}	0 (5×10^{-9})	1×10^{-9}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	5×10^{-4}	6×10^{-13}	0 (9×10^{-9})	7×10^{-10}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	5×10^{-4}	2×10^{-12}	0 (9×10^{-9})	7×10^{-10}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-7}

[a] The alphanumeric code following in 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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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 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. Table 4–55 shows the accident risks, 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)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feeder preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	0.000014	9×10^{-9}	0.19	0 (1×10^{-4})	0.043	3×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71)	0.000000028	2×10^{-11}	0.00038	0 (2×10^{-7})	0.000083	5×10^{-8}
Cast stone feed receipt tank failure – unmitigated (200-West Area) (CS71)	0.0000035	2×10^{-9}	0.016	0 (1×10^{-5})	0.0032	2×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	0.0000022	1×10^{-9}	0.029	0 (2×10^{-5})	0.0025	1×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	0.0000066	4×10^{-9}	0.030	0 (2×10^{-5})	0.0024	1×10^{-6}
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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: Maximally Exposed Individual[b]	Risk of Latent Cancer Fatality: Offsite Population[c, d]	Risk of Latent Cancer Fatality: Noninvolved Worker[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	5×10^{-4}	4×10^{-12}	0 (6×10^{-8})	1×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71)	5×10^{-4}	8×10^{-15}	0 (1×10^{-10})	3×10^{-11}
Cast stone feed receipt tank failure – unmitigated (200-West Area) (CS71)	5×10^{-4}	1×10^{-12}	0 (5×10^{-9})	1×10^{-9}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	5×10^{-4}	6×10^{-13}	0 (9×10^{-9})	7×10^{-10}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	5×10^{-4}	2×10^{-12}	0 (9×10^{-9})	7×10^{-10}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–54).

Under Tank Closure Alternative 3B, operations would continue for a project period of 23 years; during this time period, workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–55, the risk to the offsite population and onsite workers during this 22-year project period would be no increase (4×10^{-1}) in the number of LCFs in the offsite population and a 3×10^{-5} and 2×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

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 in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

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 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. Table 4–57 shows the accident risks, 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). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–56).

Under Tank Closure Alternative 3C, operations would continue for a project period of 23 years, during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–57, the risk to the offsite population and onsite workers during this 22-year project period would be no increase (4×10^{-1}) in the number of LCFs in the offsite population and a 3×10^{-5} and 2×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

Table 4–56. Tank Closure Alternative 3C Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	0.000014	9×10^{-9}	0.19	0 (1×10^{-4})	0.043	3×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Steam reforming feed receipt tank failure – unmitigated (200-East Area) (SRF1)	0.000000028	2×10^{-11}	0.00038	0 (2×10^{-7})	0.000083	5×10^{-8}
Steam reforming feed receipt tank failure – unmitigated (200-West Area) (SRF1)	0.0000035	2×10^{-9}	0.016	0 (1×10^{-5})	0.0032	2×10^{-6}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	0.0000022	1×10^{-9}	0.029	0 (2×10^{-5})	0.0025	1×10^{-6}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	0.0000066	4×10^{-9}	0.030	0 (2×10^{-5})	0.0024	1×10^{-6}
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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		
		Maximally Exposed Individual[b]	Offsite Population[c, d]	Noninvolved Worker[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT 23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	5×10^{-4}	4×10^{-12}	0 (6×10^{-8})	1×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Steam reforming feed receipt tank failure – unmitigated (200-East Area) (SRF1)	5×10^{-4}	8×10^{-15}	0 (1×10^{-10})	3×10^{-11}
Steam reforming feed receipt tank failure – unmitigated (200-West Area) (SRF1)	5×10^{-4}	1×10^{-12}	0 (5×10^{-9})	1×10^{-9}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	5×10^{-4}	6×10^{-13}	0 (9×10^{-9})	7×10^{-10}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	5×10^{-4}	2×10^{-12}	0 (9×10^{-9})	7×10^{-10}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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 in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

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 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. Table 4–59 shows the accident risks, 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). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–58).

Under Tank Closure Alternative 4, operations would continue for a project period of 26 years, during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–59, the risk to the offsite population and onsite workers during this 26-year project period would be no increase (4×10^{-1}) in the number of LCFs in the offsite population and a 3×10^{-5} and 2×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

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 in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

Table 4–58. Tank Closure Alternative 4 Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	0.000014	9×10^{-9}	0.19	0 (1×10^{-4})	0.043	3×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71)	0.000000028	2×10^{-11}	0.00038	0 (2×10^{-7})	0.000083	5×10^{-8}
Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61)	0.0000035	2×10^{-9}	0.016	0 (1×10^{-5})	0.0032	2×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	0.0000022	1×10^{-9}	0.029	0 (2×10^{-5})	0.0025	1×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	0.0000066	4×10^{-9}	0.030	0 (2×10^{-5})	0.0024	1×10^{-6}
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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: Maximally Exposed Individual[b]	Risk of Latent Cancer Fatality: Offsite Population[c, d]	Risk of Latent Cancer Fatality: Noninvolved Worker[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (30 MTG/day)	5×10^{-4}	4×10^{-12}	0 (6×10^{-8})	1×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×30 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71)	5×10^{-4}	8×10^{-15}	0 (1×10^{-10})	3×10^{-11}
Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61)	5×10^{-4}	1×10^{-12}	0 (5×10^{-9})	1×10^{-9}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	5×10^{-4}	6×10^{-13}	0 (9×10^{-9})	7×10^{-10}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	5×10^{-4}	2×10^{-12}	0 (9×10^{-9})	7×10^{-10}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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 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. Table 4–61 shows the accident risks, 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)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (45 MTG/day)	0.000021	1×10^{-8}	0.29	0 (2×10^{-4})	0.065	4×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×45 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71)	0.000000028	2×10^{-11}	0.00038	0 (2×10^{-7})	0.000083	5×10^{-8}
Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61)	0.0000035	2×10^{-9}	0.016	0 (1×10^{-5})	0.0032	2×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	0.0000022	1×10^{-9}	0.029	0 (2×10^{-5})	0.0025	1×10^{-6}
Mixed TRU waste/ MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	0.0000066	4×10^{-9}	0.030	0 (2×10^{-5})	0.0024	1×10^{-6}
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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: Maximally Exposed Individual[b]	Risk of Latent Cancer Fatality: Offsite Population[c, d]	Risk of Latent Cancer Fatality: Noninvolved Worker[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (45 MTG/day)	5×10^{-4}	6×10^{-12}	0 (9×10^{-8})	2×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×45 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Cast stone feed receipt tank failure – unmitigated (200-East Area) (CS71)	5×10^{-4}	8×10^{-15}	0 (1×10^{-10})	3×10^{-11}
Bulk vitrification waste receipt tank failure – unmitigated (200-West Area) (BV61)	5×10^{-4}	1×10^{-12}	0 (5×10^{-9})	1×10^{-9}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-East Area) (TR81)	5×10^{-4}	6×10^{-13}	0 (9×10^{-9})	7×10^{-10}
Mixed TRU waste/MLLW liquid sludge transfer line spray leak – unmitigated (200-West Area) (TR81)	5×10^{-4}	2×10^{-12}	0 (9×10^{-9})	7×10^{-10}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MLLW=mixed low-level radioactive waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 chance in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–60).

Under Tank Closure Alternative 5, operations would continue for a project period of 17 years, during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–61, the risk to the offsite population and onsite workers during this 16-year project period would be no increase (3×10^{-1}) in the number of LCFs in the offsite population and a 2×10^{-5} and 1×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

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 in **Section 4.1.11.2.2** for Alternative 2A.

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 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. Table 4–63 shows the accident risks, 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 4–63) is the seismically induced WTP collapse and failure (accident WT41). For this accident, the risk to the offsite population would be no increase (2×10^{-4} per year) in the number of LCFs (i.e., about 1 in 4,200 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 2×10^{-8} per year (i.e., about 1 in 55 million per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 1×10^{-4} per year (i.e., about 1 in 9,000 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–62).

Under Tank Closure Alternative 6A, operations would continue for a project period of 146 years; during this time period, workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–63, the risk to the offsite population and onsite workers during this 145-year project period would be no increase (4×10^{-1}) in the likelihood of an LCF in the offsite population, a 3×10^{-6} increase in the likelihood of an LCF for the MEI, and a 2×10^{-2} increase in the likelihood of an LCF for the noninvolved worker.

4.1.11.9.1.2 Option Case

The radiological impacts of accident airborne releases associated with the Option Case would be the same as those associated with the Base Case.

Table 4–62. Tank Closure Alternative 6A Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (15 MTG/day)	0.029	2×10^{-5}	380	0 (2×10^{-1})	83	1×10^{-1}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (15 MTG/day)	0.046	3×10^{-5}	620	0 (4×10^{-1})	160	2×10^{-1}
Seismically induced WTP collapse and failure – unmitigated (WT41) (15×0 MTG/day)	0.058	4×10^{-5}	780	0 (5×10^{-1})	180	2×10^{-1}
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 a population of 451,556 persons residing within 80 kilometers (50 miles) of the 200-East Area.
[d] The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).
Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; 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		
		Maximally Exposed Individual[b]	Offsite Population[c, d]	Noninvolved Worker[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (15 MTG/day)	5×10^{-4}	9×10^{-9}	0 (1×10^{-4})	5×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (15 MTG/day)	5×10^{-4}	1×10^{-8}	0 (2×10^{-4})	9×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (15×0 MTG/day)	5×10^{-4}	2×10^{-8}	0 (2×10^{-4})	1×10^{-4}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 a population of 451,556 persons residing within 80 kilometers (50 miles) of the 200-East Area.
[d] The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).
Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; MTG/day=metric tons of glass per day; WTP=Waste Treatment Plant.
Source: Appendix K, Section K.3.7.1.

4.1.11.9.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios Base and Option Cases are expected to be the same as those described in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

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 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. Table 4–65 shows the accident risks, 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 4–65) is the seismically induced WTP collapse and failure (accident WT41). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–64).

Under Tank Closure Alternative 6B, operations would continue for a project period of 26 years, during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–65, the risk to the offsite population and onsite workers during this 26-year project period would be no increase (4×10^{-1}) in the number of LCFs in the offsite population and a 3×10^{-5} and 2×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

Table 4–64. Tank Closure Alternative 6B Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day)	0.000043	3×10^{-8}	0.57	0 (3×10^{-4})	0.13	8×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 a population of 451,556 persons residing within 80 kilometers (50 miles) of the 200-East Area.

d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; WTP=Waste Treatment Plant.

Source: Appendix K, Section K.3.7.1.

4.1.11.10.1.2 Option Case

The radiological impacts from accident 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 in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

Table 4–65. Tank Closure Alternative 6B 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)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day)	5×10^{-4}	1×10^{-11}	0 (2×10^{-7})	4×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-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 a population of 451,556 persons residing within 80 kilometers (50 miles) of the 200-East Area.

d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; WTP=Waste Treatment Plant.

Source: Appendix K, Section K.3.7.1.

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 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. Table 4–67 shows the accident risks, 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 4–66. Tank Closure Alternative 6C Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatalities[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatalities[b]
Spray release from jumper pit during waste retrieval – unmitigated (TK51)	0.0013	8×10^{-7}	5.8	0 (3×10^{-3})	1.4	8×10^{-4}
Spray leak in transfer line during excavation – unmitigated (PT23)	0.007	4×10^{-6}	94	0 (6×10^{-2})	24	3×10^{-2}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	0.88	5×10^{-4}	12,000	7	2,900	1
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	0.011	7×10^{-6}	150	0 (9×10^{-2})	33	4×10^{-2}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	0.019	1×10^{-5}	250	0 (1×10^{-1})	63	8×10^{-2}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day)	0.000043	3×10^{-8}	0.57	0 (3×10^{-4})	0.13	8×10^{-5}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day)	4.3	3×10^{-3}	58,000	35	13,000	1
Seismically induced waste tank dome collapse – unmitigated (TK53)	0.00021	1×10^{-7}	0.96	0 (6×10^{-4})	0.22	1×10^{-4}
IHLW glass canister drop – unmitigated (SH91)	0.00026	2×10^{-7}	3.5	0 (2×10^{-3})	0.91	5×10^{-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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; 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 4–67) is the seismically induced WTP collapse and failure (accident WT41). For this accident, the risk to the offsite population would be no increase (2×10^{-2} per year) in the number of LCFs (i.e., about 1 in 60 per year of an LCF in the population). For the offsite MEI, the risk of an increase in likelihood of an LCF would be 1×10^{-6} per year (i.e., about 1 in 770,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the risk of an increase in likelihood of an LCF would be 8×10^{-3} per year (i.e., about 1 in 130 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 and an LCF would depend on the distance and other factors, but would generally be higher. If this accident were to occur, it would also have the highest consequences (see Table 4–66).

Table 4–67. Tank Closure Alternative 6C 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)	1.1×10^{-2}	8×10^{-9}	0 (4×10^{-5})	9×10^{-6}
Spray leak in transfer line during excavation – unmitigated (PT23)	1×10^{-4}	4×10^{-10}	0 (6×10^{-6})	3×10^{-6}
PT Facility waste feed receipt vessel or piping leak – unmitigated (PT22)	5×10^{-4}	3×10^{-7}	0 (4×10^{-3})	2×10^{-3}
Seismically induced failure of HLW melter feed preparation vessels – unmitigated (HL11) (6 MTG/day)	5×10^{-4}	3×10^{-9}	0 (5×10^{-5})	2×10^{-5}
HLW molten glass spill caused by HLW melter failure – unmitigated (HL14) (6 MTG/day)	5×10^{-4}	6×10^{-9}	0 (7×10^{-5})	4×10^{-5}
Seismically induced LAW Vitrification Facility collapse and failure – unmitigated (LA31) (90 MTG/day)	5×10^{-4}	1×10^{-11}	0 (2×10^{-7})	4×10^{-8}
Seismically induced WTP collapse and failure – unmitigated (WT41) (6×90 MTG/day)	5×10^{-4}	1×10^{-6}	0 (2×10^{-2})	8×10^{-3}
Seismically induced waste tank dome collapse – unmitigated (TK53)	5×10^{-4}	6×10^{-11}	0 (3×10^{-7})	7×10^{-8}
IHLW glass canister drop – unmitigated (SH91)	1×10^{-3}	2×10^{-10}	0 (2×10^{-6})	5×10^{-7}

a The alphanumeric code following in 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 451,556 and 488,897 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) in 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.1.1.3).

Key: HLW=high-level radioactive waste; IHLW=immobilized high-level radioactive waste; LAW=low-activity waste; MTG/day=metric tons of glass per day; PT=Pretreatment; WTP=Waste Treatment Plant.

Source: Appendix K, Section K.3.7.1.

Under Alternative 6C, operations would continue for a project period of 26 years, during which workers and the public would be at risk of exposure to radioactivity from an accident. For the highest-risk accident (accident WT41) in Table 4–67, the risk to the offsite population and onsite workers during this 26-year project period would be no increase (4×10^{-1}) in the number of LCFs in the offsite population and a 3×10^{-5} and 2×10^{-1} increased likelihood of an LCF for the MEI and noninvolved worker, respectively.

4.1.11.11.2 Hazardous Chemical Impacts

Potential human health impacts of postulated chemical release scenarios are expected to be the same as those described in Section 4.1.11.2.2 for Tank Closure Alternative 2A.

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 radiological, 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 indepth, 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 are essentially the same under each of the alternatives, with the exception of 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 involves the same inventory of radioactive material (TK53, seismically induced waste tank dome collapse). The offsite population dose is estimated to be 3.8 person-rem, with no (2×10^{-3}) additional LCFs as a result. The MEI dose would be 0.00083 rem, which corresponds to an increased risk of an LCF of 5×10^{-7}. The noninvolved worker dose would be 0.88 rem, which corresponds to an increased risk of an LCF of 5×10^{-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 are 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 involves the same inventory of radioactive material (WT41, seismically induced WTP collapse and failure – unmitigated). The offsite population dose was estimated to be 3,400 person-rem, which would result in 2 additional LCFs. The MEI dose would be 0.25 rem with an increased risk of an LCF of 2×10^{-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 involves 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

A number of factors affect the risk of transporting radioactive materials. These factors 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, or 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 at stops along the route. The Radioactive Material Transportation (RADTRAN 5) computer program (Neuhauser and Kanipe 2003) was used to estimate the impacts on transportation workers and populations, as well as the impact on an MEI (a person stuck in traffic, a gas station attendee, an inspector, etc.) 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 significant 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 1×10^{-7} (1 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 Risks and Consequences of Radiological Material Transport (RISKIND) computer program to estimate doses to individuals and populations (Yuan et al. 1995).

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 the incident-free and radiological accident conditions using the RADTRAN 5 computer program (Neuhauser and Kanipe 2003) in conjunction with the Transportation Routing Analysis Geographic Information System (TRAGIS) 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 population density estimates for each area based on the 2000 census along the routes to determine population radiological risk factors. 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 is 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

Alternative	Number of Shipments									
	Offsite Shipments		Onsite Shipments							
	CH-TRU Waste[a]	RH-TRU Waste[a]	IHLW[b]	ILAW Glass	Bulk Vit Waste	Cast Stone Waste	Steam-Reformed Waste	CH-TRU Waste	RH-TRU Waste	Other Wastes[c]
2A	N/A	N/A	12,340	92,250	N/A	N/A	N/A	N/A	N/A	30
2B	N/A	N/A	12,340	92,250	N/A	N/A	N/A	N/A	N/A	23,581
3A	170	3,397	9,040	28,510	6,030	N/A	N/A	178	728	23,558
3B	170	3,397	9,040	28,510	N/A	23,270	N/A	178	728	23,558
3C	170	3,397	9,040	28,510	N/A	N/A	57,980	178	728	23,558
4	172	3,427	11,140	28,730	2,380	14,380	N/A	180	735	85,573
5	155	3,090	8,140	31,100	2,150	8,060[d]	N/A	162	663	10
6A-Base	N/A	N/A	171,670	670	N/A	N/A	N/A	N/A	N/A	254,559
6A-Option	N/A	N/A	171,670	18,290	N/A	N/A	N/A	N/A	N/A	254,680
6B-Base	N/A	N/A	12,340	93,670	N/A	N/A	N/A	N/A	N/A	254,581
6B-Option	N/A	N/A	12,340	111,290	N/A	N/A	N/A	N/A	N/A	254,658
6C	N/A	N/A	12,340	92,250	N/A	N/A	N/A	N/A	N/A	23,581

[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 sulfated grout.

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 172 person-rem under Tank Closure Alternative 5, and the highest expected dose of about 191 person-rem, associated with the transport of TRU waste to the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, under Tank Closure Alternative 4. The additional LCFs that would be expected from such exposures to the general population would be less than 1 for all alternatives, ranging from 1.0×10^{-1} to 1.1×10^{-1}. 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 569 person-rem), while the highest would be under Alternative 4 (about 631 person-rem). The additional LCFs expected among the exposed transportation crews would be less than 1 ranging from 3.4×10^{-1} to 3.8×10^{-1}. Under all alternatives, no combination of transports (off site and on site) would be expected to result in an LCF among the exposed population or transportation crews. The expected number of traffic fatalities from accidents involving radioactive material transport is 0 (0.22). Considering that the durations of alternatives range from 20 to over 150 years, and the average traffic fatalities in the United States is about 40,000 per year, the expected risk of traffic fatality is small.

Table 4–69. Tank Closure Alternatives – Risks of Transporting Radioactive Waste

Alternative	Transport	Number of Shipments[a]	Incident-Free				Accident		
			Crew		Population				
			Dose (person-rem)	Risk[b]	Dose (person-rem)	Risk[b]	Rad. Risk[b, c]	Non-rad. Risk[b]	One-Way Offsite Travel (10^6 km)
2A[c]	Off site	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	On site	105,000	260	1.56×10^{-1}	72.5	4.40×10^{-2}	1.2×10^{-11}	0.028	N/A
2B[c]	Off site	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	On site	128,000	262	1.57×10^{-1}	72.5	4.40×10^{-2}	5.5×10^{-8}	0.034	N/A
3A	Off site	3,570	625	3.70×10^{-1}	189	1.10×10^{-1}	8.6×10^{-4}	0.22	11.0
	On site	68,000	217	1.30×10^{-1}	158	9.50×10^{-2}	9.1×10^{-7}	0.018	N/A
3B	Off site	3,570	625	3.70×10^{-1}	189	1.10×10^{-1}	8.6×10^{-4}	0.22	11.0
	On site	85,300	464	2.79×10^{-1}	76.6	4.60×10^{-2}	9.1×10^{-7}	0.023	N/A
3C	Off site	3,570	625	3.70×10^{-1}	189	1.10×10^{-1}	8.6×10^{-4}	0.22	11.0
	On site	120,000	600	3.60×10^{-1}	148	8.90×10^{-2}	9.1×10^{-7}	0.033	N/A
4	Off site	3,600	631	3.80×10^{-1}	191	1.10×10^{-1}	8.7×10^{-4}	0.22	11.1
	On site	143,000	456	2.73×10^{-1}	115	6.90×10^{-2}	1.4×10^{-6}	0.039	N/A
5	Off site	3,250	569	3.40×10^{-1}	172	1.00×10^{-1}	7.8×10^{-4}	0.20	10.0
	On site	50,300	222	1.33×10^{-1}	85.1	5.10×10^{-2}	7.7×10^{-7}	0.013	N/A
6A-Base	Off site	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	On site	427,000	450	2.70×10^{-1}	60.4	3.60×10^{-2}	2.0×10^{-6}	0.096	N/A
6A-Option	Off site	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	On site	445,000	498	2.99×10^{-1}	73.6	4.40×10^{-2}	2.0×10^{-6}	0.101	N/A
6B-Base	Off site	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	On site	361,000	560	3.36×10^{-1}	88.9	5.30×10^{-2}	2.0×10^{-6}	0.100	N/A
6B-Option	Off site	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	On site	378,000	608	3.65×10^{-1}	102	6.10×10^{-2}	2.0×10^{-6}	0.105	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	262	1.57×10^{-1}	72.5	4.40×10^{-2}	5.5×10^{-8}	0.034	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: To convert kilometers to miles, multiply by 0.6214. Values presented in the table have been rounded to no more than three significant digits, where appropriate.
Key: km=kilometers; N/A=not applicable; 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, as 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 are 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 is the largest under Alternative 6A, Option Case, with the potential for six fatalities followed by Alternative 3C and Alternative 6A, Base Case, with the potential for approximately three fatalities. 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 (kilometers)	Number of Accidents	Number of Traffic Fatalities
1	1.04×10^6	0.13	0.009
2A	49.5×10^6	6.08	0.41
2B	65.0×10^6	7.99	0.54
3A	67.2×10^6	7.52	0.51
3B	94.3×10^6	11.6	0.78
3C	407×10^6	50.1	3.38
4	120×10^6	14.8	1.00
5	88.0×10^6	10.8	0.73
6A-Base	385×10^6	47.4	3.20
6A-Option	767×10^6	94.3	6.37
6B-Base	140×10^6	17.3	1.16
6B-Option	273×10^6	33.6	2.26
6C	71.1×10^6	8.75	0.59

Note: To convert kilometers to miles, multiply by 0.6214. Values presented in the table have been rounded to no more than three significant digits, where appropriate.
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, local, or regional locations to Hanford to support construction activities through 2008, tank farm infrastructure and tank upgrades, and administrative control activities. The transportation impacts of these activities would be 1.04 million kilometers (0.65 million miles) traveled, 0 (0.13) traffic accidents, and 0 (0.009) 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 has been 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 (1.6×10^{-1}) LCFs among transportation workers and 0 (4.4×10^{-2}) 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 6.0×10^{-4} LCFs per person-rem. Note that the maximum annual dose to a transportation crew member 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 1098-99). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is 1.2×10^{-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 in 10 million per year. Therefore, no further impacts analysis has been performed.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 0.00000002 person-rem, resulting in 1.2×10^{-11} LCFs, and traffic accidents resulting in 0 (0.03) 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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The impacts in terms of total distance traveled, accidents, and traffic fatalities under this alternative would be 49.5 million kilometers (30.8 million miles), 6 (6.08) accidents, and 0 (0.41) fatalities over the entire duration, 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 has been estimated at about 262 person-rem; the dose to the public would be about 73 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (1.6×10^{-1}) LCFs among transportation workers and 0 (4.4×10^{-2}) 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 are similar to those described under Alternative 2A.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population (on site) of 0.000092 person-rem, resulting in 5.5×10^{-8} LCFs, and traffic accidents resulting in 0 (0.03) 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, and piping) and feed materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be about 65 million kilometers (40.4 million miles) traveled, 8 (7.99) accidents, and 1 (0.54) fatality over the entire duration, 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 3,570 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 has been estimated at about 842 person-rem; the dose to the public would be about 347 person-rem. Accordingly, incident-free transportation of radioactive material would result in 1 (5.0×10^{-1}) LCF among transportation workers and 0 (2.1×10^{-1}) LCFs in the total affected population over the duration of transportation activities. Note that the maximum annual dose to a transportation crew member 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 1098-99). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is 1.2×10^{-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) involves a shipment of RH-TRU waste. The consequences of such an accident in terms of population dose in the rural, suburban, and urban zones are 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 1.6×10^{-3}, 3.2×10^{-5}, and 9.4×10^{-7} in rural, suburban, and urban zones, respectively. This accident could result in a dose of 0.027 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 1.6×10^{-5}.

[3] Truck transportation is the preferred mode for transporting TRU waste to WIPP (DOE 1997).

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 1.43 person-rem, resulting in 8.6×10^{-4} LCFs, and traffic accidents resulting in 0 (0.24) fatalities. Nearly all of the risks would result from shipping waste to WIPP.

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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be 67.2 million kilometers (41.8 million miles) traveled, 8 (7.52) accidents, and 1 (0.51) fatality over the entire duration, 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 3,570 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 has been estimated at about 1,089 person-rem; the dose to the public would be about 266 person-rem. Accordingly, incident-free transportation of radioactive material would result in 1 (6.5×10^{-1}) LCF among transportation workers and 0 (1.6×10^{-1}) LCFs in the total affected population over the duration of transportation activities. Note that the maximum annual dose to a transportation crew member 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 1098-99). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is 1.2×10^{-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) involves a shipment of RH-TRU waste. The consequences of such an accident are similar to those described under Tank Closure Alternative 3A.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 1.43 person-rem, resulting in 8.6×10^{-4} LCFs, and traffic accidents resulting in 0 (0.24) 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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be 94.3 million kilometers (58.6 million miles) traveled, 12 (11.6) accidents, and 1 (0.78) fatality over the entire duration, 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 3,570 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 has been estimated at about 1,225 person-rem; the dose to the public would be about 337 person-rem. Accordingly, incident-free transportation of radioactive material would result in 1 (7.3×10^{-1}) LCF among transportation workers and 0 (2.0×10^{-1}) LCFs in the total affected population over the duration of transportation activities. As stated earlier, note that the maximum annual dose to a transportation crew member 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 1098-99). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is 1.2×10^{-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) involves a shipment of RH-TRU waste. The consequences of such an accident are similar to those described under Tank Closure Alternative 3A.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 1.43 person-rem, resulting in 8.6×10^{-4} LCFs, and traffic accidents resulting in 0 (0.25) 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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be about 407 million kilometers (253 million miles) traveled, 50 (50.1) accidents, and 3 (3.38) fatalities over the entire duration, 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, 143,000 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 has been estimated at about 1,087 person-rem; the dose to the public would be about 306 person-rem. Accordingly, incident-free transportation of radioactive material would result in

1 (6.5×10^{-1}) LCF among transportation workers and 0 (1.8×10^{-1}) LCFs in the total affected population over the duration of transportation activities. As stated earlier, note that the maximum annual dose to a transportation crew member 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 1098-99). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure is 1.2×10^{-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 in 10 million per year) involves a shipment of RH-TRU waste. The consequences of such an accident are similar to those described under Tank Closure Alternative 3A.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 1.45 person-rem, resulting in 8.7×10^{-4} LCFs, and traffic accidents resulting in 0 (0.26) 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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be about 120 million kilometers (74.7 million miles) traveled, 15 (14.8) accidents, and 1 (1.00) fatality over the entire duration, 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, 3,245 truck shipments of TRU waste would be made to WIPP. In addition, 50,285 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 off site and on site) under this alternative has been estimated at about 791 person-rem; the dose to the public would be about 257 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (4.7×10^{-1}) LCFs among transportation workers and 0 (1.5×10^{-1}) 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 in 10 million per year) involves a shipment of RH-TRU waste. The consequences of such an accident are similar to those described under Tank Closure Alternative 3A.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 1.3 person-rem, resulting in 7.8×10^{-4} LCFs, and traffic accidents resulting in 1 (0.74) fatality. 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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be about 88 million kilometers (54.7 million miles) traveled, 11 (10.8) accidents, and 0 (0.21) fatalities over the entire duration, 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 Option Case of this alternative, no offsite radioactive waste shipments would be made. However, about 427,000 and 445,000 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 has been 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 (2.7×10^{-1}) LCFs among transportation workers and 0 (3.6×10^{-2}) 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 has been estimated at about 498 person-rem; the dose to the public would be about 74 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (3.0×10^{-1}) LCFs among transportation workers and 0 (4.4×10^{-2}) 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 in 10 million per year. Therefore, no further impacts analysis has been performed.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 0.0033 person-rem, resulting in 2.0 × 10-6 LCFs, and traffic accidents resulting in 0 (0.10) fatalities, under both the Base and Option Cases.

4.1.12.9.2.2 Option Case

The consequences of the maximum reasonably foreseeable accident and total transportation accident risks are similar to those described under the Base Case.

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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be about 385 million kilometers (239 million miles) traveled, 47 (47.4) accidents, and 3 (3.2) fatalities over the entire duration, 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 767 million kilometers (477 million miles) traveled, 94 (94.3) accidents, and 6 (6.37) fatalities over the entire duration, 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 361,000 and 378,000 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 has been 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 (3.4×10^{-1}) LCFs among transportation workers and 0 (5.3×10^{-2}) 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 has been estimated at about 608 person-rem; the dose to the public would be about 102 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (3.7×10^{-1}) LCFs among transportation workers and 0 (6.1×10^{-2}) 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 are similar to those described under Alternative 6A (see Section 4.1.12.9.2).

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 0.0033 person-rem, resulting in 2.0×10^{-6} LCFs, and traffic accidents resulting in 0 (0.10) fatalities, under both the Base and Option Cases.

4.1.12.10.2.2 Option Case

The consequences of the maximum reasonably foreseeable accident and the estimates of the total transportation accident risks are similar to those provided under the Base Case.

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, and piping) and materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be about 140 million kilometers (87 million miles) traveled, 17 (17.3) accidents, and 1 (1.16) fatality over the entire duration, 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 273 million kilometers (170 million miles) traveled, 34 (33.6) accidents, and 2 (2.26) fatalities over the entire duration, 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 has been estimated at about 262 person-rem; the dose to the public would be about 73 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (1.6×10^{-1}) LCFs among transportation workers and 0 (4.4×10^{-2}) 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).

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 0.000092 person-rem, resulting in 5.5×10^{-8} LCFs, and traffic accidents resulting in 0 (0.03) 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, and piping) and feed materials for the production and transport of waste (e.g., glass-forming materials, grout, fly ash, containers, boxes, and canisters) were evaluated. The transportation impacts under this alternative would be 71.1 million kilometers (44.2 million miles) traveled, 9 (8.75) accidents, and 1 (0.59) fatality over the entire duration, 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 bear 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. Access to Hanford is restricted to the public, 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. Resource areas that could potentially be impacted and that may also affect populations residing off site include public and occupational health and safety, including normal operations and facility accidents; and air quality. These impacts were analyzed because of their potential for environmental justice concerns in the short term. 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. 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 are 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	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.1	1.4
American Indian	0.75	1.3
Hispanic or Latino	1.1	1.4
Low-income	1.1	1.3

Source: Appendix J, Section J.5.6.1.1.

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 approximately two orders of magnitude less than the total dose 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 for 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 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, local, or 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological air emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 are 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	Individual Average Dose (millirem)	
	Subset Population	**Remainder of Population**
Minority	2.1	2.5
American Indian	1.4	2.4
Hispanic or Latino	2.0	2.5
Low-income	2.0	2.4

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for 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; 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 4.1.12.2 discusses the potential human health risks of transporting radioactive waste on site at Hanford and construction materials from onsite, local, or 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	0.92	1.1
American Indian	0.62	1.0
Hispanic or Latino	0.92	1.1
Low-income	0.91	1.1

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for 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, local, or 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.1	1.3
American Indian	0.73	1.3
Hispanic or Latino	1.1	1.3
Low-income	1.1	1.3

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for 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 mixed TRU waste to WIPP, as well as the risks of transporting construction materials from onsite, local, or regional locations to Hanford. Examination of the radiological transport 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	0.75	0.90
American Indian	0.50	0.85
Hispanic or Latino	0.75	0.88
Low-income	0.74	0.86

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.5. 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 mixed TRU waste to WIPP, as well as the risks of transporting construction materials from onsite, local, or regional locations to Hanford. Examination of the radiological transport 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.1	1.3
American Indian	0.73	1.3
Hispanic or Latino	1.1	1.3
Low-income	1.1	1.3

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for 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 mixed TRU waste to WIPP, as well as the risks of transporting construction materials from onsite, local, or regional locations to Hanford. Examination of the radiological transport 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	0.95	1.1
American Indian	0.64	1.1
Hispanic or Latino	0.95	1.1
Low-income	0.92	1.1

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.7. 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 mixed TRU waste to WIPP, as well as the risks of transporting construction materials from onsite, local, or regional locations to Hanford. Examination of the radiological transport 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	**Remainder of Population**
Minority	0.88	1.1
American Indian	0.60	1.0
Hispanic or Latino	0.89	1.1
Low-income	0.87	1.0

Source: Appendix J, Section J.5.6.1.1.

Section 4.1.10.8.1 discusses radiological 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 approximately one order of magnitude less than the total dose 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 for facility accidents under Tank Closure Alternative 5. Examination of the risks shows that there would be essentially no LCFs per year for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.8. 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 mixed TRU waste to WIPP, as well as the risks of transporting construction materials from onsite, local, or regional locations to Hanford. Examination of the radiological transport 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.2	1.3
American Indian	0.81	1.3
Hispanic or Latino	1.2	1.3
Low-income	1.2	1.3

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for facility accidents under Tank Closure Alternative 6A, Base Case. Examination of the risks shows that there would be essentially no LCFs per year for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.9.1. 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 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.5	1.8
American Indian	0.99	1.7
Hispanic or Latino	1.5	1.8
Low-income	1.5	1.7

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for facility accidents under Tank Closure Alternative 6A, Option Case. Examination of the risks shows that there would be essentially no LCFs per year for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.9.2. 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 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.2	1.4
American Indian	0.75	1.3
Hispanic or Latino	1.2	1.4
Low-income	1.2	1.4

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for facility accidents under Tank Closure Alternative 6B, Base Case. Examination of the risks shows that there would be essentially no LCFs per year for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.10.1. 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, local, or 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.4	1.6
American Indian	0.92	1.6
Hispanic or Latino	1.4	1.6
Low-income	1.4	1.6

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for facility accidents under Tank Closure Alternative 6B, Option Case. Examination of the risks shows that there would be essentially no LCFs per year for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.10.2. 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, local, or 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 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to 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 total doses for the life of the project under this alternative. There are 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 Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	**Remainder of Population**
Minority	0.92	1.1
American Indian	0.62	1.0
Hispanic or Latino	0.91	1.1
Low-income	0.90	1.1

Source: Appendix J, Section J.5.6.1.1.

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 approximately one order of magnitude less than the total dose 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 for facility accidents under Tank Closure Alternative 6C. Examination of the risks shows that there would be essentially no LCFs per year for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to accident consequences.

Air quality impacts are discussed in Section 4.1.4.11. 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, local, or 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 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 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, sulfate grout, steam reforming product, RH-TRU waste, and CH-TRU waste; and melters including IHLW 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. 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 6A, 6B, and 6C, a portion of the LAW melters, 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 is 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 Alternative 4 with an additional pretreatment step in the Pretreatment Facility that would yield a grouted sulfate 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 a grouted sulfate waste form. 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, and cast stone waste and the grouted sulfate 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.

The LAW melters that are disposed of as MLLW would be disposed of in an RCRA-compliant, onsite IDF. The impacts of providing disposal capacity in an IDF are included in the disposal capacities of the corresponding Waste Management alternatives. Long-term impacts of radiological 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. For more on LAW melters, see Appendix E, Section E.1.2.4.4.

The PPF melters generated from processing soils contaminated by past tank leaks would be disposed of on site in an IDF. Disposal of the PPF melters is included in the disposal capacity of the corresponding Waste Management alternatives. Long-term impacts of PPF melter disposal on groundwater quality and human health are evaluated in Chapter 5, Sections 5.1.1 and 5.1.2.

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 (75,000 cubic yards) of CH-TRU waste and 29,000 cubic meters (38,000 cubic yards) 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 volume of RH-TRU waste shipped to WIPP from all DOE sites to 7,080 cubic meters (9,261 cubic yards) (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, and soil in the case of closure activities) would be generated during operations, deactivation and closure. Using a combination of on and offsite capabilities, secondary MLLW would be treated to meet an RCRA land disposal restriction treatment standards prior to disposal.

Also included as MLLW are the PPF glass canisters that are generated from the treatment of the soils in the PPF 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 onsite in an IDF. The long-term impacts on groundwater and human health of radiological 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 for 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 that are not highly contaminated but result from clean closure activities. 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 (42 million cubic feet) and RPPDF capacity at 1.08 million cubic meters (38.1 million cubic feet). Under Waste Management Alternative 3, Disposal Group 1, IDF-East, IDF-West, and RPPDF operations would be completed in 2050. The IDF-East's capacity would be at 1.08 million cubic meters (38.1 million cubic feet), IDF-West's at 90,000 cubic meters (3.2 million cubic feet), and the RPPDF's at 1.08 million cubic meters (38.1 million cubic feet). Under Waste Management action 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 for 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 (15 million cubic feet) and RPPDF capacity at 8.37 million cubic meters (296.6 million cubic feet). Under Waste Management Alternative 3, Disposal Group 2, IDF-East and RPPDF operations would be completed in 2100, and the IDF-West operations in 2050. The IDF-East's capacity would be at 340,000 cubic meters (12 million cubic feet), IDF-West's at 90,000 cubic meters (3.2 million cubic feet), and the RPPDF's capacity at 8.37 million cubic meters (296.6 million cubic feet). 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 (15 million cubic feet) and RPPDF capacity at 8.37 million cubic meters (296.6 million cubic feet). 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 (12 million cubic feet), IDF-West's at 90,000 cubic meters (3.2 million cubic feet), and the RPPDF's at 8.37 million cubic meters (296.6 million cubic feet). 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 (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 in current operation.

MIXED TRANSURANIC WASTE

Secondary mixed TRU waste (e.g., equipment, tools, filters, and 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 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 (75,000 cubic yards) of CH-TRU waste and 29,000 cubic meters (38,000 cubic yards) of RH-TRU waste from Hanford (DOE 1997:S-10). The 206 cubic meters (290 cubic yards) 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 (408,186 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 rate would include two peak years with generation of approximately 31,500 cubic meters (41,202 cubic yards). 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 is 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 of sanitary and hazardous wastes. Affirmative procurement at Hanford achieved 100 percent of the 2006 goal. Hanford generated 4,278 cubic meters (151,073 cubic feet) 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 the Settlement Agreement signed on January 6, 2006, by DOE, Ecology, and the Washington State Attorney General's Office (*State of Washington v. Bodman*, Civil No. 2:03-cv-05018-AAM), 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 (46 cubic yards) 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.

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	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cast stone	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Steam reforming	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	9
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	0
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
Liquid LLW (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: 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 2007a, 2008.

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.

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 [402 cubic yards]) 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, 14,220 cubic meters (18,600 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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 212,891 cubic meters (278,000 cubic yards) 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 3,677 cubic meters (4,810 cubic yards). DOE expects that the HLW melters would be stored on site.

The volume of LAW melters generated under this Tank Closure alternative would be 7,699 cubic meters (10,070 cubic yards). 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	14,220	N/A	N/A	14,220	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	212,891	N/A	N/A	212,891	2018–2092	2,839	212,891
WTP melters								
HLW melters (30 melters)	N/A	3,677	N/A	N/A	3,677	Various	245	N/A
LAW melters (30 melters)	N/A	7,699	N/A	N/A	7,699	Various	513	7,699
Secondary waste								
LLW	N/A	31,762	1,237	1,332	34,331	2018–2028	536	34,331
MLLW	N/A	31,779	3,269	4,206	39,254	2078–2079	840	39,254
Mixed TRU waste	N/A	219	N/A	N/A	219	2053–2092	3	N/A
Hazardous waste[c]	178	63,340	15,686	N/A	79,203	2092–2093	31,380	N/A
Nonradioactive-nonhazardous waste[d]	N/A	254	1,853	540	2,647	2094	320	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF capacities: Waste Management Alternative 2, Disposal Group 2: 200-East Area 425,000 m^3; 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): 284,175 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 the purposes of analysis, they are 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.

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: 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 2007a, 2008.

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 34,331 cubic meters (44,905 cubic yards) of LLW and 39,254 cubic meters (51,344 cubic yards) 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 79,203 cubic meters (103,598 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2092–2093), hazardous waste would be generated at 31,380 cubic meters (41,045 cubic yards) per year.

4.1.14.2.5.4 Nonhazardous Waste

As shown in Table 4–85, the estimated volume of nonhazardous waste would be 2,647 cubic meters (3,462 cubic yards). 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 9,691 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, 14,220 cubic meters (18,600 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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	14,220	N/A	N/A	14,220	2018–2039	646	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	212,891	N/A	N/A	212,891	2018–2043	8,188	212,891 (IDF)
WTP melters								
HLW melters (11 melters)	N/A	1,348	N/A	N/A	1,348	Various	245	N/A
LAW melters (31 melters)	N/A	8,007	N/A	N/A	8,007	Various	1,540	8,007 (IDF)
Secondary waste								
LLW	N/A	27,553	968	9,175	37,696	2040	2,801	37,696 (IDF)
MLLW	N/A	27,512	2,869	6,576	36,957	2040	3,022	36,957 (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	467,955	467,955	2032–2037	77,993	467,955 (RPPDF)
Mixed TRU waste	N/A	206	N/A	N/A	206	2029–2043	8	N/A
Hazardous waste[d]	165	63,304	15,686	106	79,262	2039–2040	31,393	N/A
Nonradioactive-nonhazardous waste[e]	N/A	254	1,342	677	2,273	2044	594	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 m^3, RPPDF 1,080,000 m^3 Waste Management Alternative 3, Disposal Group 1: IDF-E 1,080,000 m^3, IDF-W 90,000 m^3, RPPDF 1,030,000 m^3					Total waste to IDF(s)/RPPDF: 295,551 m^3/468,634 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

4.1.14.3.3 Treated Low-Activity Tank Waste

As shown in Table 4–86, the 212,891 cubic meters (278,461 cubic yards) 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 radiological and chemical releases from disposed ILAW are evaluated in Sections 4.3.2.6.3 and 4.3.2.13, respectively.

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 8,007 cubic meters (10,473 cubic yards); 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 IHLW melters generated under this Tank Closure alternative would be 1,348 cubic meters (1,763 cubic yards). 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 (270 cubic yards) 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 37,696 cubic meters (49,306 cubic yards) of LLW, 679 cubic meters (888 cubic yards) of LLW generated by tank closure, and 36,957 cubic meters (48,340 cubic yards) 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 (467,955 cubic meters [612,085 cubic yards]) 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 confirming 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 79,262 cubic meters (103,675 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2039–2040), hazardous waste would be generated at 31,393 cubic meters (41,062 cubic yards) per year.

4.1.14.3.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 2,273 cubic meters (2,973 cubic yards). 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 9,691 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, 10,310 cubic meters (13,486 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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 168,518 cubic meters (220,422 cubic yards) 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 radiological and chemical releases from WTP and bulk vitrification glass on groundwater quality and human health are evaluated in Sections 4.4.1.6.3 and 4.4.1.13, respectively.

4.1.14.4.3.1 Mixed Transuranic Waste

The 1,500 cubic meters (1,962 cubic yards) of CH-mixed and 2,140 cubic meters (2,800 cubic yards) 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: Construction	Operations	Deactivation	Closure	Total	Peak Annual Generation: Year(s) of Peak	Waste Volume/Year	Total Waste Volume to IDF(s)/RPPDF
High-level radioactive waste								
IHLW (12,000 canisters)	N/A	10,310	N/A	N/A	10,310	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	65,780	N/A	N/A	65,780	2018–2039	2,990	65,780 (IDF)
Bulk vitrification	N/A	102,738	N/A	N/A	102,738	2018–2039	4,670	102,738 (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	1,103	N/A	N/A	1,103	Various	245	N/A
LAW melters (9 melters)	N/A	2,258	N/A	N/A	2,258	Various	513	2,258 (IDF)
Secondary waste								
LLW	N/A	17,429	1,980	9,175	28,584	2035	1,750	28,584 (IDF)
MLLW	N/A	31,248	3,922	6,576	41,746	2040	2,501	41,746 (IDF)
Closure LLW[b]	N/A	N/A	N/A	679	679	2034–2036	679	679 (IDF)
Closure MLLW[c]	N/A	N/A	N/A	467,955	467,955	2028–2033	77,993	467,955(RPPDF)
Mixed TRU waste	N/A	206	N/A	N/A	206	2027–2039	9	206 (RPPDF)
Hazardous waste[d]	206	63,306	15,686	106	79,304	2039–2040	31,397	N/A
Nonradioactive-nonhazardous waste[e]	N/A	254	1,089	677	2,021	2041	356	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 m^3, RPPDF 1,030,000 m^3 Waste Management Alternative 3, Disposal Group 1: IDF-E 1,080,000 m^3, IDF-W 90,000 m^3, RPPDF 1,080,000 m^3					Total waste to IDF(s)/RPPDF: 241,786 m^3/468,161 m^3			

a Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 2,258 cubic meters (2,954 cubic yards); 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 1,348 cubic meters (1,763 cubic yards). 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 28,584 cubic meters (37,388 cubic yards) of LLW, 679 cubic meters (888 cubic yards) of LLW generated by tank closure, and 41,966 cubic meters (54,892 cubic yards) 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 (525,297 cubic meters [687,089 cubic yards]) 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 confirming 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 79,304 cubic meters (103,730 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2039–2040), hazardous waste would be generated at 31,397 cubic meters (41,067 cubic yards) per year.

4.1.14.4.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 2,021 cubic meters (2,644 cubic yards). 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 9,691 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, 10,310 cubic meters (13,486 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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 298,461 cubic meters (390,387 cubic yards) 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.

4.1.14.5.3.1 Mixed Transuranic Waste

Under this Tank Closure alternative, 1,500 cubic meters (1,962 cubic yards) of CH-mixed and 2,140 cubic meters (2,800 cubic yards) 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 2,258 cubic meters (2,954 cubic yards) 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 1,103 cubic meters (1,443 cubic yards). 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	10,310	N/A	N/A	10,310	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	65,780	N/A	N/A	65,780	2018–2039	2,990	65,780 (IDF)
Cast stone	N/A	232,781	N/A	N/A	232,781	2018–2039	10,581	232,781 (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	1,103	N/A	N/A	1,103	Various	245	N/A
LAW melters (9 melters)	N/A	2,258	N/A	N/A	2,258	Various	513	2,258 (IDF)
Secondary waste								
LLW	N/A	10,928	2,019	9,175	22,121	2040	1,681	22,121 (IDF)
MLLW	N/A	24,559	4,006	6,576	35,141	2040	2,548	35,141 (IDF)
Closure LLW[b]	N/A	N/A	N/A	679	679	2028–2033	226	679 (RPPDF)
Closure MLLW[c]	N/A	N/A	N/A	467,955	467,955	2034–2036	76,895	467,955 (RPPDF)
Mixed TRU waste	N/A	206	N/A	N/A	206	2027–2039	9	N/A
Hazardous waste[d]	206	63,306	15,686	106	79,304	2039–2040	31,397	N/A
Nonradioactive-nonhazardous waste[e]	N/A	N/A	698	677	1,375	2041	343	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 m^3, RPPDF 1,030,000 m^3 Waste Management Alternative 3, Disposal Group 1: IDF-E 1,080,000 m^3, IDF-W 90,000 m^3, RPPDF 1,080,000 m^3					Total waste to IDF(s)/RPPDF: 358,082 m^3/468,634 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 22,121 cubic meters (28,934 cubic yards) of LLW, 679 cubic meters (888 cubic yards) of LLW generated by tank closure, and 35,201 cubic meters (46,043 cubic yards) 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 (467,955 cubic meters [612,085 cubic yards]) 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 confirming 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 79,304 cubic meters (103,730 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2039–2040), hazardous waste would be generated at 31,397 cubic meters (41,067 cubic yards) per year.

4.1.14.5.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 1,375 cubic meters (1,799 cubic yards). 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 9,691 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, 10,310 cubic meters (13,486 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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 326,700 cubic meters (427,324 cubic yards) 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 radiological and chemical releases from WTP and steam reforming waste on groundwater quality and human health are evaluated in Sections 4.4.2.6.3 and 4.4.2.13, respectively.

4.1.14.6.3.1 Mixed Transuranic Waste

The 1,500 cubic meters (1,962 cubic yards) of CH-mixed and 2,140 cubic meters (2,799 cubic yards) 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 2,258 cubic meters (2,954 cubic yards) 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 1,103 cubic meters (1,443 cubic yards). 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	10,310	N/A	N/A	10,310	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	65,780	N/A	N/A	65,780	2018–2039	2,990	65,780 (IDF)
Cast stone	N/A	260,920	N/A	N/A	260,920	2018–2039	11,860	260,920 (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	1,103	N/A	N/A	1,103	Various	245	N/A
LAW melters (9 melters)	N/A	2,258	N/A	N/A	2,258	Various	513	2,258 (IDF)
Secondary waste								
LLW	N/A	10,700	1,980	9,175	21,854	2040	1,670	21,854 (IDF)
MLLW	N/A	10,885	3,648	6,576	21,109	2040	2,175	21,109 (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	467,955	467,955	2028–2033	77,993	467,955 (RPPDF)
Mixed TRU waste	N/A	206	N/A	N/A	206	2027–2039	9	N/A
Hazardous waste[d]	165	63,306	16,052	106	79,670	2039–2040	31,410	N/A
Nonradioactive-nonhazardous waste[e]	N/A	254	765	677	1,697	2041	377	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 m^3, RPPDF 1,030,000 m^3; 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: 371,922 m^3/468,634 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 21,854 cubic meters (28,585 cubic yards) of LLW, 679 cubic meters (888 cubic yards) of LLW generated by tank closure, and 21,109 cubic meters (27,611 cubic yards) 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 (467,955 cubic meters [612,085 cubic yards]) 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 confirming 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 79,670 cubic meters (104,208 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2092–2093), hazardous waste would be generated at 31,410 cubic meters (41,804 cubic yards) per year.

4.1.14.6.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 1,697 cubic meters (2,220 cubic yards). 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 9,691 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 (16,742 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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 248,131 cubic meters (324,555 cubic yards) of ILAW generated by the three 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.

4.1.14.7.3.1 Mixed Transuranic Waste

The 1,510 cubic meters (1,975 cubic yards) of CH-mixed and 2,160 cubic meters (2,825 cubic yards) 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 2,566 cubic meters (3,356 cubic yards) 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 4–90, the volume of HLW melters generated under this Tank Closure alternative would be 1,226 cubic meters (1,604 cubic yards). 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 (28,730 canisters)	N/A	63,825	N/A	N/A	63,825	2018–2042	2,553	63,825 (IDF)
Cast stone	N/A	143,771	N/A	N/A	143,771	2018–2039	6,535	143,771 (IDF)
Bulk vitrification	N/A	40,535	N/A	N/A	40,535	2018–2039	1,843	40,535 (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	1,226	N/A	N/A	1,226	Various	245	N/A
LAW melters (10 melters)	N/A	2,566	N/A	N/A	2,566	Various	513	2,566 (IDF)
Secondary waste								
LLW	N/A	14,927	2,586	24,451	41,964	2043	2,452	41,964 (IDF)
MLLW	N/A	14,634	5,083	23,777	43,495	2043	7,644	43,495 (IDF)
Closure LLW[b]	N/A	N/A	N/A	2,402	2,402	2022–2033	200	2,402 (RPPDF)
Closure MLLW[c]	N/A	N/A	N/A	1,013,034	1,013,034	2034–2041	100,575	1,013,034 (RPPDF)
Mixed TRU waste	N/A	412	N/A	N/A	412	2013–2042	14	N/A
Hazardous waste[d]	224	63,865	15,686	128	79,903	2042–2043	31,414	N/A
Nonradioactive-nonhazardous waste[e]	N/A	254	937	701	1,891	2044	317	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 m^3, RPPDF 1,030,000 m^3; Waste Management Alternative 3, Disposal Group 1: IDF-E 1,080,000 m^3, IDF-W 90,000 m^3, RPPDF 1,080,000 m^3					Total waste to IDF(s)/RPPDF: 336,156 m^3/1,015,436 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 (539 cubic yards) 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 41,694 cubic meters (54,535 cubic yards) of LLW, 2,402 cubic meters (3,141 cubic yards) of LLW generated by tank closure, and 43,495 cubic meters (56,891 cubic yards) 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 BX and SX tank farms. This large quantity of tank closure MLLW (approximately 1.01 million cubic meters [1.32 million cubic yards]) 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 confirming 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 79,903 cubic meters (104,513 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2042–2043), hazardous waste would be generated at 31,414 cubic meters (41,090 cubic yards) per year.

4.1.14.7.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 1,891 cubic meters (2,473 cubic yards). 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 9,691 liters (approximately 2,650 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 (12,086 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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 178,235 cubic meters (233,131 cubic yards) of ILAW generated by the four 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 radiological 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, 1,360 cubic meters (1,779 cubic yards) of CH-mixed and 1,940 cubic meters (2,538 cubic yards) 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 2,464 cubic meters (3,223 cubic yards); 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 (1,122 cubic yards). 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: Construction	Operations	Deactivation	Closure	Total	Peak Annual Generation: Year(s) of Peak	Waste Volume/Year	Total Waste Volume to IDF(s)/RPPDF
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	71,765	N/A	N/A	71,765	2018–2033	4,485	71,765 (IDF)
Bulk vitrification	N/A	36,595	N/A	N/A	36,595	2018–2033	2,287	36,595 (IDF)
Cast stone	N/A	50,041	N/A	N/A	50,041	2018–2033	3,128	50,041 (IDF)
Sulfate grout	N/A	19,835	N/A	N/A	19,835	2018–2033	1,240	19,835 (IDF)
CH-TRU waste	N/A	1,360	N/A	N/A	1,360	2009–2010	680	N/A
RH-TRU waste	N/A	1,940	N/A	N/A	1,940	2015–2019	389	N/A
WTP melters								
HLW melters (10 melters)	N/A	858	N/A	N/A	858	Various	245	N/A
LAW melters (10 melters)	N/A	2,464	N/A	N/A	2,464	Various	770	2,464 (IDF)
Secondary waste								
LLW	N/A	14,792	2,129	3,748	20,669	2020–2021	1,938	20,669 (IDF)
MLLW	N/A	14,643	4,288	3,665	22,596	2034	2,554	22,596 (IDF)
Closure MLLW[b]	N/A	N/A	3,058	N/A	3,058	2012–2022	278	3,058 (IDF)
Mixed TRU waste	N/A	183	N/A	N/A	183	2024–2033	10	N/A
Hazardous waste[c]	204	63,243	15,686	48	79,181	2033–2034	31,403	N/A
Nonradioactive-nonhazardous waste[d]	N/A	254	1,633	138	2,025	2035	409	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2012–2022	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 m^3, RPPDF 1,030,000 m^3; Waste Management Alternative 3, Disposal Group 1: IDF-E 1,080,000 m^3, IDF-W 90,000 m^3, RPPDF 1,080,000 m^3					Total waste to IDF(s)/RPPDF: 227,023 m^3/0 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 (239 cubic yards) 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 20,669 cubic meters (27,035 cubic yards) of LLW and 22,596 cubic meters (29,556 cubic yards) 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 (3,058 cubic meters [3,400 cubic yards]) 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 confirming 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 79,181 cubic meters (103,569 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2033–2034), hazardous waste would be generated at 31,403 cubic meters (41,075 cubic yards) per year.

4.1.14.8.5.5 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 2,025 cubic meters (2,649 cubic yards). 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 9,691 liters (2,650 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 dispositioned as HLW.

Tank closure waste that is not being 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, 203,060 cubic meters (265,603 cubic yards) of IHLW canisters, 400 cubic meters (523 cubic yards) of cesium and strontium canisters, and 337,264 cubic meters (441,141 cubic yards) 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 17,773 cubic meters (23,247 cubic yards) under both the Base Case and 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 3,064 cubic meters (4,007 cubic yards) under the Base Case and 17,895 cubic meters (23,407 cubic yards) under the Option Case. This amount is included in 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	203,060	N/A	N/A	203,060	2018–2162	1,411	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	337,264	337,264	2088–2099	6,413	N/A
WTP melters								
HLW melters (145 melters)	N/A	17,773	N/A	N/A	17,773	Various	613	N/A
PPF melters (25 melters)	N/A	N/A	N/A	3,064	3,064	Various	123	3,064 (IDF)
Secondary waste								
PPF glass (670 canisters)	N/A	N/A	N/A	1,540	1,540	2042–2162	13	1,540 (IDF)
LLW	N/A	17,917	5,205	70,292	93,415	2163	1,113	93,415 (IDF)
MLLW	N/A	15,909	21,056	72,851	109,816	2138–2140	3,161	109,816 (IDF)
Closure LLW[b]	N/A	N/A	N/A	4,071	4,071	c	194	4,071 (RPPDF)
Closure MLLW[d]	N/A	N/A	N/A	2,410,289	2,410,289	2054–2061	90,124	2,410,289 (RPPDF)
Mixed TRU waste	N/A	530	N/A	N/A	530	2013–2162	4	N/A
Hazardous waste[e]	2,771	64,186	15,686	317	82,960	2162–2163	31,394	N/A
Nonradioactive-nonhazardous waste[f]	N/A	254	13,608	2,576,490	2,590,351	2088–2099	44,060	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 3: IDF-E 425,000 m^3, RPPDF 8,330,000 m^3 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: 207,835 m^3/2,414,360 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 (171,300 canisters)	N/A	203,060	N/A	N/A	203,060	2018–2162	1,411	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	337,264	337,264	2088–2099	6,413	N/A
WTP melters								
HLW melters (145 melters)	N/A	17,773	N/A	N/A	17,773	Various	613	N/A
PPF melters (25 melters)	N/A	N/A	N/A	17,895	17,895	Various	735	17,895 (IDF)
Secondary waste								
PPF glass (670 canisters)	N/A	N/A	N/A	42,210	42,210	2042–2162	349	42,210 (IDF)
LLW	N/A	17,917	5,808	114,378	138,103	2138–2140	1,732	138,103 (IDF)
MLLW	N/A	15,909	20,454	116,507	152,869	2146–2148	3,182	152,869 (IDF)
Closure LLW[b]	N/A	N/A	N/A	5,428	5,428	2085–2087 2146–2148	420	5,428 (RPPDF)
Closure MLLW[c]	N/A	N/A	N/A	8,307,641	8,307,641	2054–2061	175,229	8,307,641 (RPPDF)
Mixed TRU waste	N/A	530	N/A	N/A	530	2013–2162	4	N/A
Hazardous waste[d]	2,771	64,186	15,686	430	83,073	2162–2163	31,394	N/A
Nonradioactive-nonhazardous waste[e]	N/A	254	13,608	3,237,069	3,250,930	2065–2076	52,123	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 3: IDF-E 425,000 m^3, RPPDF 8,330,000 m^3 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: 351,078 m^3/ 8,313,070 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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; 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 2007a, 2008.

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, 93,415 cubic meters (122,187 cubic yards) of LLW would be generated under the Base Case and 138,103 cubic meters (180,639 cubic yards) of LLW, under the Option Case; 4,071 cubic meters (5,325 cubic yards) of closure LLW would be generated under the Base Case and 5,428 cubic meters (7,100 cubic yards) of closure LLW, under the Option Case; and 109,816 cubic meters (143,639 cubic yards) of MLLW would be generated under the Base Case and 152,869 cubic meters (199,953 cubic yards) 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 3.15 million cubic yards) of MLLW under the Base Case and approximately 8.31 million cubic meters (approximately 10.87 million cubic yards) 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 1,540 cubic meters (2,014 cubic yards) of PPF glass under the Base Case and 42,210 cubic meters (55,210 cubic yards) 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 82,960 cubic meters (108,512 cubic yards) of hazardous waste under the Base Case and 83,073 cubic meters (108,660 cubic yards) under the Option Case would be generated during construction and operations. For two peak years (2039–2040), hazardous waste would be generated at 31,394 cubic meters (41,063 cubic yards) 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 3.39 million cubic yards) under the Base Case and approximately 3.25 million cubic meters (approximately 4.25 million cubic yards) 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 9,691 liters (2,650 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 under the 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 dispositioned as HLW.

Tank closure waste that is not being 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, 14,220 cubic meters (18,600 cubic yards) of IHLW canisters, 400 cubic meters (523 cubic yards) of cesium and strontium canisters, and 337,264 cubic meters (441,141 cubic yards) 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 (2,000 canisters)	N/A	14,220	N/A	N/A	14,220	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	214,610	N/A	N/A	214,610	2018–2043	8,254	N/A
Other HLW	N/A	N/A	N/A	337,264	337,264	2023–2051	11,129	N/A
WTP melters								
HLW melters (11 melters)	N/A	1,348	N/A	N/A	1,348	Various	245	N/A
LAW melters (31 melters)	N/A	8,007	N/A	N/A	8,007	Various	1,540	N/A
PPF melters (16 melters)	N/A	N/A	N/A	1,961	1,961	Various	123	1,961 (IDF)
Secondary waste								
PPF glass (670 canisters)	N/A	N/A	N/A	1,540	1,540	2023–2099	20	1,540 (IDF)
LLW	N/A	27,809	1,574	70,398	99,781	2040	2,912	99,781 (IDF)
MLLW	N/A	27,818	3,944	72,745	104,507	2040	2,978	104,507 (IDF)
Closure LLW[c]	N/A	N/A	N/A	4,071	4,071	d	388	4,071 (RPPDF)
Closure MLLW[e]	N/A	N/A	N/A	2,410,289	2,410,289	2035–2042	124,353	2,410,289 (RPPDF)
Mixed TRU waste	N/A	412	N/A	N/A	412	2013–2043	13	N/A
Hazardous waste[f]	1,013	63,864	15,686	317	80,880	2039–2040	31,431	N/A
Nonradioactive-nonhazardous waste[g]	N/A	254	976	2,479,172	2,480,402	2023–2028	68,393	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 2: IDF-E 425,000 m^3, RPPDF 8,330,000 m^3 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					Base Case total waste to IDF(s)/RPPDF: 207,789 m^3/ 2,414,360 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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	14,220	N/A	N/A	14,220	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	214,610	N/A	N/A	214,610	2018–2043	8,255	N/A
Other HLW	N/A	N/A	N/A	337,264	337,264	2023–2034	11,129	N/A
WTP melters								
HLW melters (11 melters)	N/A	1,348	N/A	N/A	1,348	Various	245	N/A
LAW melters (31 melters)	N/A	8,007	N/A	N/A	8,007	Various	1,540	N/A
PPF melters (93 melters)	N/A	N/A	N/A	11,399	11,399	Various	735	11,399 (IDF)
Secondary waste								
PPF glass (18,292 canisters)	N/A	N/A	N/A	42,212	42,212	2023–2099	548	42,212 (IDF)
LLW	N/A	27,809	1,574	114,378	143,761	2040	3,632	143,761 (IDF)
MLLW	N/A	27,818	3,944	116,507	148,269	2040	3,703	148,269 (IDF)
Closure LLW[c]	N/A	N/A	N/A	5,428	5,428	2097–2099	614	5,428 (RPPDF)
Closure MLLW[d]	N/A	N/A	N/A	8,307,641	8,307,641	2035–2042	226,520	8,307,641 (RPPDF)
Mixed TRU waste	N/A	412	N/A	N/A	412	2013–2043	13	N/A
Hazardous waste[e]	1,013	63,864	15,686	430	80,992	2039–2040	31,431	N/A
Nonradioactive-nonhazardous waste[f]	N/A	254	1,202	3,237,069	3,238,525	2050–2061	79,616	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 2: IDF-E 425,000 m^3, RPPDF 8,330,000 m^3 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					Option Case total waste to IDF(s)/RPPDF: 345,641 m^3/ 8,313,070 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 1,348 cubic meters (1,763 cubic yards) under both the Base Case and Option Case. The volume of LAW melters generated under this Tank Closure alternative would be 8,007 cubic meters (10,473 cubic yards) under both the Base Case and 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 1,961 cubic meters (2,565 cubic yards) under the Base Case and 11,399 cubic meters (14,910 cubic yards) under the Option Case. This amount is included in 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 99,781 and 143,761 cubic meters (130,514, and 188,040 cubic yards) of LLW; 4,071 and 5,428 cubic meters (5,325 and 7,100 cubic yards) of closure LLW; and 104,507 and 148,269 cubic meters (136,695 and 193,935 cubic yards) 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 3.15 million cubic yards) of MLLW under the Base Case and approximately 8.31 million cubic meters (approximately 10.87 million cubic yards) 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 1,540 cubic meters (2,014 cubic yards) of PPF glass under the Base Case and 42,212 cubic meters (55,213 cubic yards) 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 80,880 cubic meters (105,791 cubic yards) of hazardous waste under the Base Case and 80,992 cubic meters (105,938 cubic yards) under the Option Case would be generated during construction and operations. For two peak years (2039–2040), hazardous waste would be generated at 31,431 cubic meters (41,112 cubic yards) per year under either case.

4.1.14.10.5.6 Nonhazardous Waste

The estimated volume of nonhazardous waste would be approximately 2.48 million cubic meters (approximately 3.24 million cubic yards) under the Base Case and approximately 3.24 million cubic meters (approximately 4.24 million cubic yards) 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 9,691 liters (2,650 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, 14,220 cubic meters (18,600 cubic yards) of IHLW canisters and 400 cubic meters (523 cubic yards) 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	14,220	N/A	N/A	14,220	2018–2039	646	N/A
Cesium and strontium (340 canisters)[a]	N/A	400	N/A	N/A	400	2040	400	N/A
ILAW (92,500 canisters)[b]	N/A	212,891	N/A	N/A	212,891	2018–2043	8,188	N/A
WTP melters								
HLW melters (11 melters)	N/A	1,348	N/A	N/A	1,348	Various	245	N/A
LAW melters (31 melters)	N/A	8,007	N/A	N/A	8,007	Various	1,540	8,007 (IDF)
Secondary waste								
LLW	N/A	27,553	968	6,169	34,690	2040	2,818	34,690 (IDF)
MLLW	N/A	27,512	2,869	9,634	40,015	2040	3,022	40,015 (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	467,955	467,955	2032–2037	77,993	525,297 (RPPDF)
Mixed TRU waste	N/A	206	N/A	N/A	206	2029–2043	8	N/A
Hazardous waste[d]	635	63,304	15,686	106	79,732	2039–2040	31,410	N/A
Nonradioactive-nonhazardous waste[e]	N/A	254	1,342	677	2,273	2044	594	N/A
Liquid LLW (liters)	N/A	N/A	N/A	9,691	9,691	2018–2028	881	N/A
IDF and RPPDF capacities: Waste Management Alternative 2, Disposal Group 1: IDF-E 1,200,000 m^3, RPPDF 1,030,000 m^3 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: 82,713 m^3/468,008 m^3			

[a] Disposition of the cesium and strontium capsules will be determined under a separate National Environmental Policy Act process. However, for the purposes of analysis, they are 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 yards, multiply by 1.308; liters to gallons, by 0.26417.

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 2007a, 2008.

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 1,348 cubic meters (1,763 cubic yards). The volume of LAW melters generated under this Tank Closure alternative would be 8,007 cubic meters (10,473 cubic yards). DOE expects that the HLW melters would be stored on site. The LAW melters would be disposed of in an IDF. This amount is included in 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 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 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, 34,690 cubic meters (45,375 cubic yards) of LLW and 53 cubic meters (69 cubic yards) 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, 40,015 cubic meters (52,340 cubic yards) 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 (467,955 cubic meters [612,085 cubic yards]) 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 79,732 cubic meters (104,289 cubic yards) of hazardous waste would be generated during construction and operations. For two peak years (2039–2040), hazardous waste would be generated at 31,410 cubic meters (41,084 cubic yards) per year.

4.1.14.11.5.6 Nonhazardous Waste

The estimated volume of nonhazardous waste would be 2,273 cubic meters (2,973 cubic yards). 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 9,691 liters (2,650 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 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 (2.0) rate 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 is representative of all work conducted by the DOE. Table 4–97 provides a list of relevant TRC and fatality rates used in this analysis. These rates are the DOE Office of River Protection and DOE-wide data as reported in Computerized Accident/Incident Reporting System, and 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 100,000 employee years 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 incidence rates and the projected labor hours, occupational safety impacts associated with each of the alternatives were determined (see Table 4–98). The number of cases associated with alternatives having less construction activities could be slightly overstated. Conversely, the number of cases associated with alternatives having a larger component of construction activity (e.g., Alternatives 6A and 6B) could be slightly understated.

Table 4–98. Tank Closure Alternatives – Industrial Safety Impacts

Alternative	Labor Category	Million Labor Hours	Total Recordable Case Rate per 100 Workers per Year	Projected Total Recordable Cases	Fatality Rate per 100,000 Workers per Year	Projected Fatalities
1	Construction	8.80	2.0	88.0	0.26	0.0114
	Operations	4.52	2.0	45.2	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
1 Total		16.3		163		0.02
2A	Construction	183	2.0	1,830	0.26	0.24
	Operations	502	2.0	5,020	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
2A Total		704		7,040		0.92
2B	Construction	144	2.0	1,440	0.26	0.19
	Operations	235	2.0	2,350	0.26	0.31
	Deactivation	7.86	2.0	78.6	0.26	0.01
	Closure	7.48	2.0	74.8	0.26	0.01
2B Total		394		3,940		0.52
3A	Construction	128	2.0	1,280	0.26	0.17
	Operations	212	2.0	2,120	0.26	0.28
	Deactivation	9.41	2.0	94.1	0.26	0.01
	Closure	7.48	2.0	74.8	0.26	0.01
3A Total		357		3,570		0.46
3B	Construction	127	2.0	1,270	0.26	0.17
	Operations	209	2.0	2,090	0.26	0.27
	Deactivation	9.24	2.0	92.4	0.26	0.01
	Closure	7.48	2.0	74.8	0.26	0.01
3B Total		353		3,530		0.46
3C	Construction	130	2.0	1,300	0.26	0.17
	Operations	218	2.0	2,180	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
3C Total		365		3,650		0.47
4	Construction	156	2.0	1,560	0.26	0.20
	Operations	254	2.0	2,540	0.26	0.33
	Deactivation	10.3	2.0	103	0.26	0.01
	Closure	34.3	2.0	343	0.26	0.04
4 Total		455		4,550		0.58
5	Construction	128	2.0	1,280	0.26	0.17
	Operations	183	2.0	1,830	0.26	0.24
	Deactivation	10.1	2.0	101	0.26	0.01
	Closure	11.0	2.0	110	0.26	0.01
5 Total		332		3,320		0.43
6A Base	Construction	730	2.0	7,300	0.26	0.95
	Operations	1,730	2.0	17,300	0.26	2.25
	Deactivation	26.7	2.0	267	0.26	0.03
	Closure	59.7	2.0	597	0.26	0.08
6A Base Total		2,550		25,500		3.31
6A Option	Construction	730	2.0	7,300	0.26	0.95
	Operations	1,730	2.0	17,300	0.26	2.25
	Deactivation	26.7	2.0	267	0.26	0.03
	Closure	134	2.0	1,340	0.26	0.17
6A Option Total		2,620		26,200		3.40
6B Base	Construction	178	2.0	1,780	0.26	0.23
	Operations	277	2.0	2,770	0.26	0.36
	Deactivation	9.05	2.0	90.5	0.26	0.01
	Closure	54.8	2.0	548	0.26	0.07

Table 4–98. Tank Closure Alternatives – Industrial Safety Impacts *(continued)*

Alternative	Labor Category	Million Labor Hours	Total Recordable Case Rate per 100 Workers per Year	Projected Total Recordable Cases	Fatality Rate per 100,000 Workers per Year	Projected Fatalities
6B Base Total		519		5,190		0.67
6B Option	Construction	178	2.0	1,780	0.26	0.23
	Operations	277	2.0	2,770	0.26	0.36
	Deactivation	9.05	2.0	90.50	0.26	0.01
	Closure	112	2.0	1,120	0.26	0.15
6B Option Total		576		5,760		0.75
6C	Construction	145	2.0	1,450	0.26	0.19
	Operations	235	2.0	2,350	0.26	0.31
	Deactivation	7.86	2.0	78.6	0.26	0.01
	Closure	7.48	2.0	74.8	0.26	0.01
6C Total		395		3,950		0.52

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 greatest industrial safety impacts are associated with alternatives having the greatest number of labor hours.

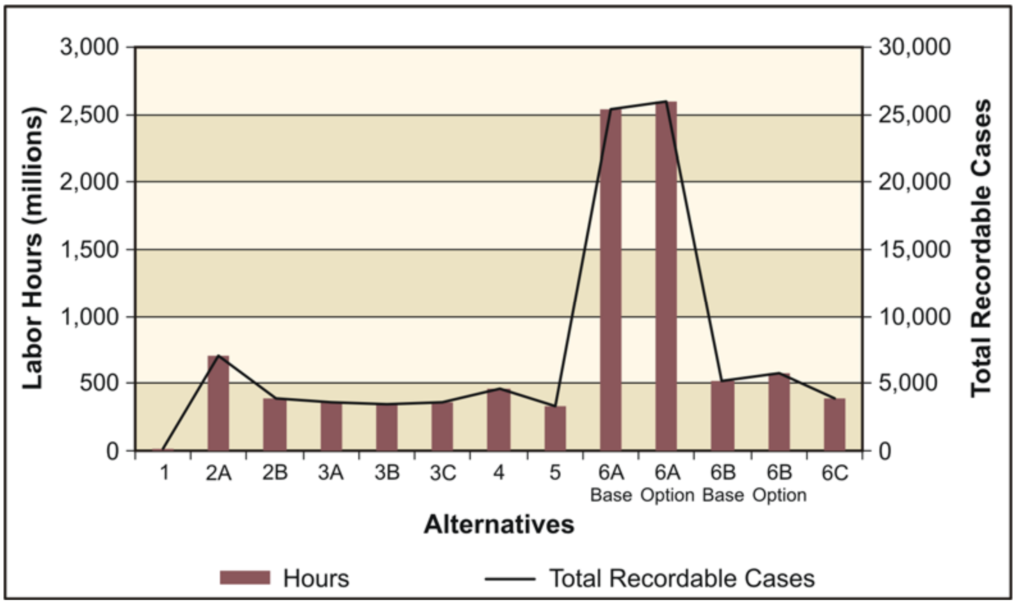


Figure 4–25. Total Recordable Cases and Labor Hours by Alternative

4.1.15.1 Alternative 1: No Action

It is anticipated that 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 7,040 TRCs. A fatality as a result of an occupation accident is not anticipated. A value greater than one in the "Projected Fatalities" column of Table 4–98 indicates a death is anticipated. This value is based on the incidence rates (deaths per 100,000 workers per year) recorded from 2001 through 2006. This alternative would require about 704 million labor hours, with the significant portion taking place during the peak periods of the construction and operations phases.

4.1.15.3 Alternative 2B: Expanded WTP Vitrification; Landfill Closure

During all phases of the alternative, the projected impact is 3,940 TRCs; no fatalities are anticipated. 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 357 million labor hours for this alternative during all phases (construction, operations, decommissioning, and closure) of the project. Using the selected TRC rate for illness and injury, 3,566 cases 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, 353 million hours of work would occur during the construction, operations, deactivation, and closure phases. Using the selected incidence rates for illness and injury, it is anticipated that 3,525 TRCs would occur; no fatalities are projected.

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

Using the selected incidence rates for illness and injury, it is anticipated that 3,650 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 identifies work requiring 455 million hours. It is anticipated that work under this alternative would generate approximately 4,550 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 332 million labor hours are identified under this alternative. It is anticipated that about 3,320 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 the impact are total labor hours and the historical incident rate. There are two variations under Alternative 6A, Base Case and Option Case. Estimates of the impacts are addressed separately.

4.1.15.9.1 Base Case

Alternative 6A, Base Case, identifies 2,550 million labor hours to complete the tasks identified in this alternative. It is projected that there would be 25,300 TRCs and three fatalities during the work.

4.1.15.9.2 Option Case

Alternative 6A, Option Case, requires 2,620 million labor hours that would generate 26,200 TRCs. Three fatalities are anticipated.

4.1.15.10 Alternative 6B: All Vitrification with Separations; Clean Closure

Alternative 6B would impact occupational safety. Factors influencing the impact are total labor hours and the historical incident rate. There are two variations under Alternative 6B, Base Case and Option Case. Estimates of the impacts are addressed separately.

4.1.15.10.1 Base Case

A total of 519 million labor hours are required to accomplish all tasks under Alternative 6B, Base Case. Using the incident rate and total labor hours, it is projected there would be 5,190 TRCs and no fatalities.

4.1.15.10.2 Option Case

Alternative 6B, Option Case, would require 576 million labor hours to complete. Using the total labor hours and incident rates for illness, injury, and fatalities, it is anticipated there would be 5,760 TRCs and no fatalities.

4.1.15.11 Alternative 6C: All Vitrification with Separations; Landfill Closure

Alternative 6C would require 395 million labor hours to complete the tasks identified. Applying the incident rate to the total labor hours indicates that there would be approximately 3,950 TRCs and no fatalities.

4.2 FAST FLUX TEST FACILITY DECOMMISSIONING ALTERNATIVES

This section describes the potential short-term environmental and human health impacts associated with implementation of alternatives considered to decommission the FFTF and auxiliary facilities at Hanford, to manage waste from the decommissioning process, including waste designated as RH-special components (SCs), and to disposition 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, including (1) FFTF Decommissioning Alternative 1: No Action, in which only certain deactivation activities at FFTF would be conducted, consistent with previous DOE National Environmental Policy Act actions and two action alternatives; (2) FFTF Decommissioning Alternative 2: Entombment; and (3) FFTF Decommissioning Alternative 3: Removal. FFTF Decommissioning Alternative 2 would involve removing all aboveground structures within the 400 Area Property Protected Area (PPA), with minimal removal of below-grade structures, equipment, and materials as necessary to comply with regulatory standards. FFTF Decommissioning Alternative 3 would consist of removing all above-grade structures within the 400 Area PPA and the additional removal of contaminated below-grade structures, equipment, and materials. Associated construction, operations, deactivation, closure, and decommissioning activities are assessed, as applicable, for each alternative.

For each action alternative (i.e., Alternatives 2 and 3), two options (a Hanford and an Idaho option) are 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 the proposed RTP at the Idaho National Laboratory (INL) Materials and Fuels Complex (MFC). Following treatment at the RTP, the FFTF components and residuals would be disposed of with other INL waste at the Nevada Test Site (NTS) 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 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 Reactor Containment Building (RCB), along with 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 4–2). Since 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). Since 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.

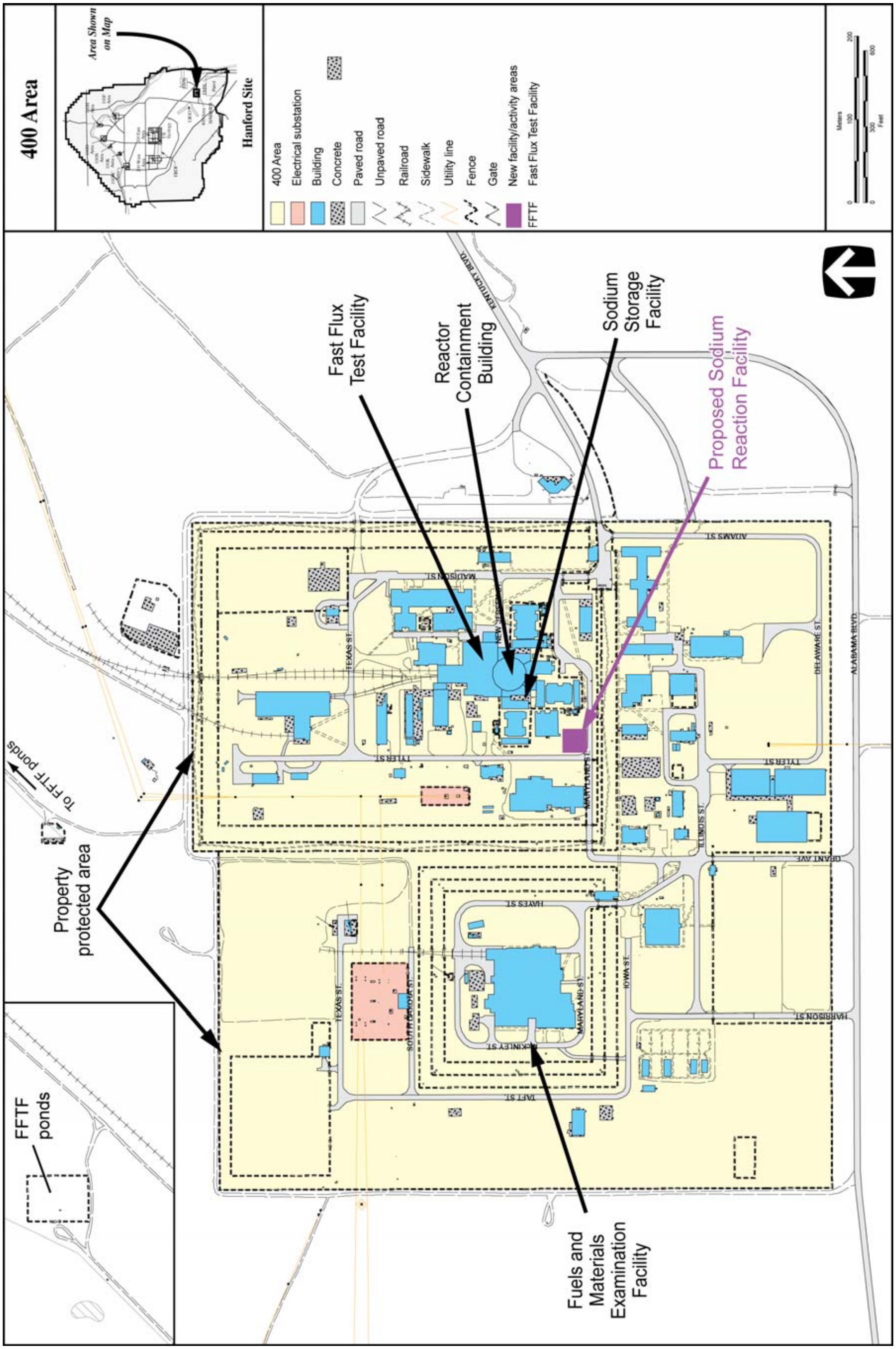


Figure 4–26. 400 Area Facility Locations

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. Since Borrow Area C has a land use designation of Conservation (Mining), the removal of this material would be consistent with 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. Since 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. Since 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 at a new RTP. The RTP, which would be located within developed portions of the MFC, is the only new facility to be built under this alternative. As is the case under the Hanford Option, once complete it would occupy 0.1 hectares (0.3 acre) of land. Since the proposed location of the RTP is currently industrial in nature, there would be no change to the existing land use. Treated components would be returned to Hanford or sent to NTS for disposal, where they would be placed within existing disposal facilities. Thus, there would be no impact on land use at Hanford, INL, or NTS 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. Since it would be constructed within the already highly developed 400 Area, an area 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 since 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 would be developed (2.8 hectares [7 acres]) 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. Since 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. Since 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. Since 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 at a new RTP. The RTP, which would be built within developed portions of the MFC and occupy 0.1 hectares (0.3 acre) when complete, is the only new facility to be built under this alternative. Since the MFC is currently industrial in nature, the RTP would be in keeping with the existing visual environment. Treated components would be returned to Hanford or sent to NTS for disposal, where they would be placed within 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 NTS 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 (0.3 acre) of land, would be constructed near the SSF. Since the SRF would be constructed within the already highly developed 400 Area, there would be minimal impact on visual resources. Storage of the treated sodium would be 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. Since 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. Also, there would be no change of visual impacts in the 400 Area and 200 Areas at Hanford from implementation of this option since 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 since the reactor vessel and other radioactively contaminated equipment would be removed. A 1-meter (3.3-foot) thick layer of soil would be used over the site and would 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 the 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. Since Borrow Area C has been 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 of the Entombment Alternative. Thus, impacts on land use from disposition-related activities would be the same as 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 are the same under this alternative as under the Entombment Alternative. Thus, impacts on land use would be the same as 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 the processing of bulk sodium under the Hanford Reuse Option of this alternative are identical to those of the Entombment Alternative. Thus, impacts on land use from processing activities would be the same as 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 are the same under this alternative as under the Entombment Alternative. Thus, impacts on land use would be the same as 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 (3.3-foot) thick layer of soil to permit the growth of vegetation. Overall, visual impacts of this alternative would be similar to those of the Entombment Alternative since disturbed areas would be recontoured and revegetated. As with 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 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 of the Entombment Alternative. Thus, impacts on visual resources of disposition-related activities would be the same as 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 are the same under this alternative as under the Entombment Alternative. Thus, impacts on visual resources would be the same as 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 are identical to those of the Entombment Alternative. Thus, impacts on visual resources of processing activities would be the same as 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 are the same under this alternative as under the Entombment Alternative. Thus, impacts on visual resources would be the same as 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 (e.g., construction, operations, deactivation, closure, and decommissioning).

Key underlying assumptions used in projecting utility infrastructure demands for 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 has been assumed for the purposes of analysis 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.

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 of 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	7,980
	Total[b]	0.60	0.0	0.11	7,980
	Peak (Year)	0.006 2008–2107)	N/A	0.0011 (2008–2107)	79.8 (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	0.21	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)
Disposition of RH-SCs (Hanford Option for remote treatment)	Construction	0.0	0.24	0.090	7.50
	Operations	0.00000071	0.00012	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)
Disposition of RH-SCs (Idaho Option for remote treatment)	Construction	0.0	0.24	0.090	7.49
	Operations	0.00000071	0.0019	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)	3.74 (2015–2016)
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)
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: M=million; N/A=not applicable; RH-SCs=remote-handled special components.
Source: SAIC 2007b.

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 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 as deactivation was ongoing.

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 also be a relatively small fraction (about 9.8 percent) of the approximately 816.6 million liters (215.7 million gallons) of water used annually at Hanford. The projected annual water demand of 79.8 million liters (21.1 million gallons) would be about 69 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

During the projected 8-year active decommissioning period under the Entombment Alternative, project planning 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 they could be used to support overall entombment activities, with their utility infrastructure remaining operational. As decommissioning activities would proceed, all equipment, piping, ducting, and electrical components would be removed by demolition personnel from building interiors prior to final demolition. Remaining underground utilities, including 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, associated with 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 1.84 million liters (0.49 million gallons) in 2021, primarily associated with 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

(3.0 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

Construction, operations, and deactivation of the RTP located near Hanford's T Plant, to treat RH-SCs, would be minimal compared with the FFTF facility disposition efforts. The new RTP would be located adjacent to the T Plant and would utilize existing utility tie-ins to the extent possible; operationally, the RTP would have a relatively short lifespan of one year. For facility construction, it is 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, associated with 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 with total estimated peak water requirements in the 2015–2016 timeframe of 3.75 million liters (0.99 million gallons), driven primarily by the need for dust control during facility construction.

IDAHO OPTION

Utility infrastructure demands for implementing this option would be very similar to those discussed above for the Hanford Option. The peak water demand of 3.74 million liters (0.99 million gallons) would occur in the 2015–2016 timeframe during facility construction. This requirement would be about 2.1 percent of the 182 million liters (48 million gallons) used annually at the MFC.

4.2.2.2.1.3 Disposition of Bulk Sodium

HANFORD REUSE OPTION

Construction, operations, and deactivation of the SRF in the 400 Area to process Hanford bulk sodium would require relatively small quantities of utility resources as compared with the facility disposition efforts.

It has been 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 (0.40 million gallons) annually, associated with 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 the Hanford Reuse Option because this option only involves modifications to the existing SPF at INL's MFC 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, overall.

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 would then be 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 for the Entombment Alternative (see Table 4–99). This similarity is attributable to the fact that while decommissioning requirements to disposition the FFTF complex would be greater under this alternative, most utility resource needs to support final site closure would be markedly lower because no surface barriers would need to be constructed as under the Entombment Alternative.

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 associated with 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 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 under Section 4.2.2.2.1.2 for the Hanford Option.

IDAHO OPTION

Utility resource demands under this option would be the same as those discussed under Section 4.2.2.2.1.2 for 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 under Section 4.2.2.2.1.3 for the Hanford Reuse Option.

IDAHO REUSE OPTION

Utility resource demands under this option would be the same as those discussed under Section 4.2.2.2.1.3 for 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 from 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 67 items of construction equipment were operating at FFTF during the regrading closure activity with a sound pressure level of 88 dBA at 15.2 meters (50 feet), the contribution to the sound level at the nearest site boundary would be 28 dBA (SAIC 2007b). If the equipment operates 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 limitation 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 threatened and endangered 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 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 that have been identified to have impacts on this facility are activities in which heavy vehicles or large construction equipment are used. It is expected that blasting would also have an impact on this facility if it is required for mining. Although DOE will coordinate vibration producing activities with LIGO, impacts of this type of activity associated with these FFTF Decommissioning alternatives 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 the peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. The increase in employee and truck traffic from the discussion of local traffic (see Section 4.2.9) was compared to the existing average traffic volume (see Chapter 3, Sections 3.2.9.4 and 3.3.9.4). For the purpose of comparison among 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).

4.2.3.2 Alternative 2: Entombment

4.2.3.2.1 Facility Disposition

The increase in the number of employee vehicle and truck trips under Alternative 2, facility disposition 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. 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 for 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 under FFTF Decommissioning Alternative 2, disposition of RH-SCs, 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 the 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 for Alternative 1 (see Section 4.2.3.1).

IDAHO OPTION

The increase in the number of employee vehicle and truck trips under FFTF Decommissioning Alternative 2, disposition of RH-SCs, 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 the peak traffic hours. An increase of less than 2 or 3 dBA would be barely discernible to many listeners. This assessment and conclusion are similar to that previously described for 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 under FFTF Decommissioning Alternative 2, disposition of bulk sodium, 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 the 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 for Alternative 1 (see Section 4.2.3.1).

IDAHO REUSE OPTION

The increase in the number of employee vehicle and truck trips under FFTF Decommissioning Alternative 2, disposition of bulk sodium, 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 the 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 for 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 under FFTF Decommissioning Alternative 3, facility disposition 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. 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 for Alternative 1 (see Section 4.2.3.1).

4.2.3.3.2 Disposition of Remote-Handled Special Components

HANFORD OPTION

The impact on traffic noise levels under this option would be the same as discussed in Section 4.2.3.2.2 for the Hanford Option.

IDAHO OPTION

The impact on traffic noise levels under this option would be the same as discussed in Section 4.2.3.2.2 for the Idaho Option.

4.2.3.3.3 Disposition of Bulk Sodium

HANFORD REUSE OPTION

The impact on traffic noise levels under this option would be the same as discussed in Section 4.2.3.2.3 for the Hanford Reuse Option.

IDAHO REUSE OPTION

The impact on traffic noise levels under this option would be the same as discussed in Section 4.2.3.2.3 for the Idaho Reuse Option.

4.2.4 Air Quality

Activities under the various FFTF Decommissioning alternatives would result in some air quality impacts of air pollutant emissions from employee vehicles, trucks, and construction equipment and, as applicable under some FFTF Decommissioning alternatives, 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 standards. The maximum concentrations that would result from these activities for each FFTF Decommissioning alternative would be below the ambient standards, except possibly for $PM_{2.5}$ 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 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).

Table 4–100. Incremental Criteria Pollutant Concentrations by FFTF Decommissioning Alternative at Hanford

Pollutant and Averaging Period	Standard[a] (micrograms per cubic meter)	Maximum Modeled Increment (micrograms per cubic meter)						
		Alternative 1	Alternative 2			Alternative 3		
			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]	0.000644	2.84	c	c	2.04	c	c
PM_{10}[d]								
Annual	50[e]	0.0000395	0.454	0.608	0.326	1.04	0.608	0.326
24-hour	150[b]	0.00272	31.3	41.9	22.5	72	41.9	22.5
Sulfur dioxide								
Annual	50[e]	0.0000332	0.0243	0.0000491	0.00552	0.0399	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	660[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 equal to or less than 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.

b Federal and Washington State standard.

c There is no disposition of remote-handled special components or bulk sodium in the peak year.

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 the purposes of analysis, concentrations are 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.

Key: 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.

Construction activities considered in estimating PM emissions include general construction equipment activity and windblown particulate 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 concentrations except possibly for $PM_{2.5}$ during construction of the RTP. 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 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 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 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 monitored concentrations are discussed in Chapter 3, Section 3.3.4.

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-sized projects in nonattainment areas. Hanford and INL are within areas currently designated as 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 51.850–51.860).

Both carcinogenic and noncarcinogenic toxic pollutant concentrations were evaluated. The exposure of members of the public to airborne pollutants would be from process emissions released during operations and from equipment used during construction, operations, and decommissioning. Selected air toxics were modeled because they are representative of 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 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 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 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 give the Hazard Index from noncarcinogenic chemicals associated with the alternative. A Hazard Index of less than 1.0 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 nonradiological toxic pollutant emissions for each alternative are summarized in Table 4–103.

Table 4–101. Incremental Toxic Chemical Concentrations by FFTF Decommissioning Alternative at Hanford

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	100	0.000132	0.196	0.0157	14.0	0.0264	0.0157	14.0
Benzene	Annual	0.12	0.00000319	0.0106	b	b	0.0106	b	b
1,3-Butadiene	Annual	0.0036	0.0000000179	0.000223	b	b	0.000116	b	b
Formaldehyde	Annual	0.077	0.00000107	0.00358	b	b	0.00358	b	b
Mercury	24-hour	0.17	0	0	0	0	0	0	0
Toluene	24-hour	400	0.00338	11.3	b	b	11.3	b	b
Xylene	24-hour	1,500	0.000954	3.18	b	b	3.18	b	b

[a] WAC 173-460.

[b] There is no disposition of RH-SCs or bulk sodium in the peak year.

Key: DBS=Disposition of Bulk Sodium; FD=Facility Disposition; RH-SCs=remote-handled special components.

Source: Appendix G, Section G.3.

Table 4–102. Nonradiological Airborne Toxic Chemical Hazard Index for the Nearest Noninvolved Worker at Hanford by FFTF Decommissioning Alternative

Chemical	Hazard Quotient						
	Alternative 1	Alternative 2			Alternative 3		
		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	1.67×10^{-8}	1.35×10^{-4}	1.99×10^{-6}	1.78×10^{-3}	1.17×10^{-4}	1.99×10^{-6}	1.78×10^{-3}
Mercury	0	0	0	0	0	0	0
Toluene	8.57×10^{-9}	2.94×10^{-5}	2.34×10^{-9}	1.76×10^{-6}	2.92×10^{-5}	2.34×10^{-9}	1.76×10^{-6}
Xylene	1.21×10^{-7}	4.17×10^{-4}	8.16×10^{-8}	2.51×10^{-5}	4.13×10^{-4}	8.16×10^{-8}	2.51×10^{-5}
Hazard Index	1.46×10^{-7}	5.81×10^{-4}	2.07×10^{-6}	1.80×10^{-3}	5.59×10^{-4}	2.07×10^{-6}	1.80×10^{-3}

Source: Appendix G, Section G.3.

Table 4–103. Nonradiological Airborne Toxic Chemical Cancer Risk for the Nearest Noninvolved Worker by FFTF Decommissioning Alternative

Chemical	Cancer Risk						
	Alternative 1	Alternative 2			Alternative 3		
		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	2.17×10^{-11}	8.16×10^{-8}	2.08×10^{-10}	5.83×10^{-9}	7.91×10^{-8}	2.08×10^{-10}	5.83×10^{-9}
1,3-Butadiene	4.69×10^{-13}	8.30×10^{-9}	3.35×10^{-11}	3.22×10^{-10}	5.21×10^{-9}	3.35×10^{-11}	3.22×10^{-10}
Formaldehyde	1.22×10^{-11}	5.43×10^{-8}	4.39×10^{-10}	5.45×10^{-9}	5.12×10^{-8}	4.39×10^{-10}	5.45×10^{-9}

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 occur from 2008–2107 for all criteria pollutants. The peak period concentration would result from administrative control activities.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–101. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–102 and 4–103.

4.2.4.2 Alternative 2: Entombment

Criteria pollutant concentrations from facility disposition, disposition of RH-SCs, and disposition of bulk sodium activities 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, and the contribution of major activities for these concentrations at Hanford.

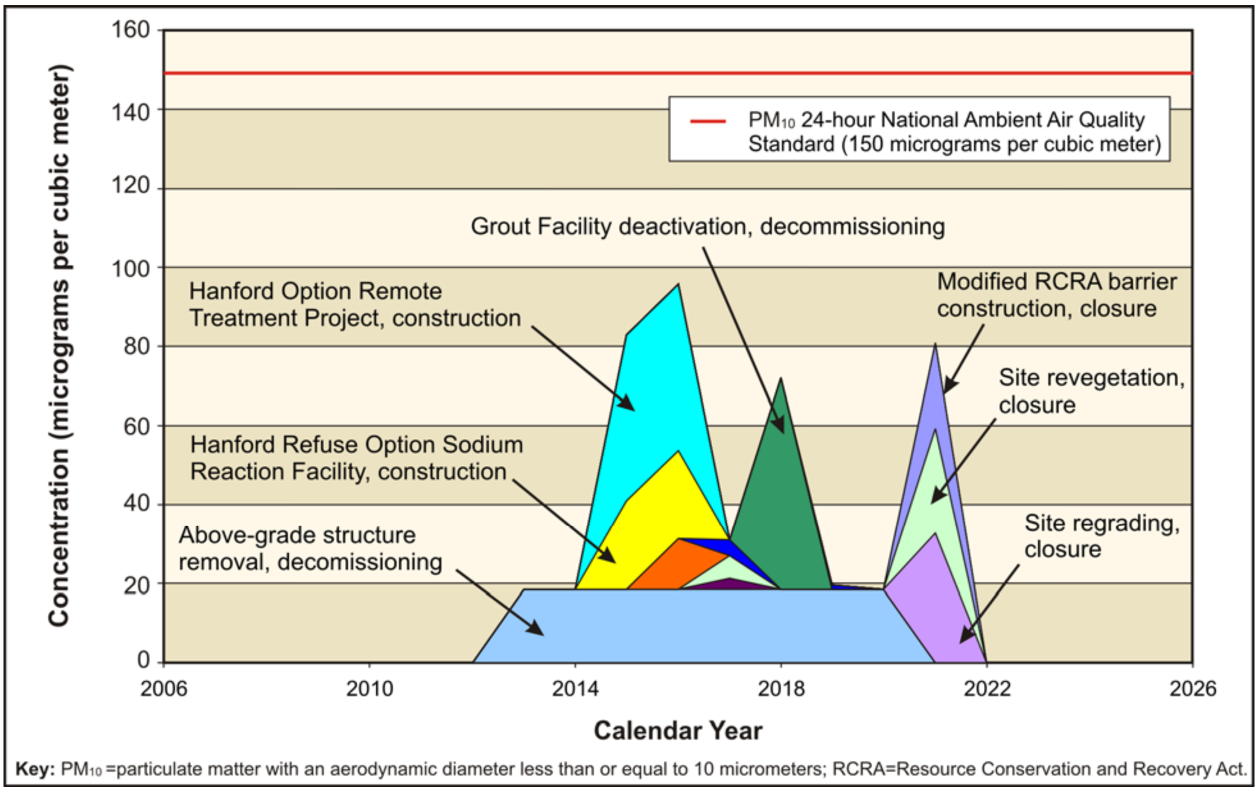


Figure 4–27. FFTF Decommissioning Alternative 2 PM_{10} Maximum 24-Hour Concentration at Hanford

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–101. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–102 and 4–103.

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 from facility disposition because of the amount of equipment used and earthmoving activity, as 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 of construction and operations of the RTP at Hanford, as shown in Tables 4–100 and 4–101.

IDAHO OPTION

Disposition of RH-SCs under the Idaho Option would result in air pollutant impacts of construction of the RTP at INL, as shown in Tables 4–104 and 4–105. Operation of the RTP would have no criteria or toxic air pollutants 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 of construction and operations of an SRF in the 400 Area, as 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 and operations of the existing SPF at INL, as shown in Tables 4–104 and 4–105. Operation of the SPF would have no criteria or toxic air pollutant emissions.

Table 4–104. Incremental Criteria Pollutant Concentrations by FFTF Decommissioning Alternative 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	
		Construction of INL Remote Treatment Project	Disposition of Bulk Sodium	Construction of INL Remote Treatment Project	Disposition of Bulk Sodium
Carbon monoxide					
8-hour	10,000[b]	7.56	46.6	7.56	46.6
1-hour	40,000[b]	10.8	66.6	10.8	66.6
Nitrogen dioxide					
Annual	100[b]	4	0.772	4	0.772
PM_{10}[c]					
Annual	50[d]	17.3	2.71	17.3	2.71
24-hour	150[b]	86.3	13.5	86.3	13.5
Sulfur dioxide					
Annual	80[b]	0.00136	0.00717	0.00136	0.00717
24-hour	365[b]	0.00681	0.0358	0.00681	0.0358
3-hour	1,300[b]	0.0153	0.0807	0.0153	0.0807

[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 equal to or less than 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.

[b] Federal and Idaho 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 purposes of analysis, concentrations were assumed to be the same as PM_{10}.

[d] Idaho State standard.

Note: NAAQS also includes standards for lead and ozone. No sources of lead emissions have been identified for the alternatives evaluated. Concentrations in bold indicate potential exceedance of the standard.

Key: INL=Idaho National Laboratory; 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.

Table 4–105. Incremental Toxic Chemical Concentrations by FFTF Decommissioning Alternative 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	
			Construction of INL Remote Treatment Project	Disposition of Bulk Sodium	Construction of INL Remote Treatment Project	Disposition of Bulk Sodium
Ammonia	24-hour	0.3	0.0315	0.007	0.0315	0.007
Benzene	Annual	0.12	0.000848	0.000805	0.000848	0.000805
1,3-Butadiene	Annual	0.0036	0.0000353	0.00000936	0.0000353	0.00000936
Formaldehyde	Annual	0.077	0.00107	0.000395	0.00107	0.000395
Mercury	24-hour	2.5	0	0	0	0
Toluene	24-hour	18,800	0.00185	0.0517	0.00185	0.0517
Xylene	24-hour	21,800	0.00129	0.0147	0.00129	0.0147

[a] IDAPA 58.01.01.585 and 58.01.01.586.
Key: INL=Idaho National Laboratory.
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. The peak concentrations occur in 2015 for carbon monoxide, PM, and nitrogen dioxide, and in 2012 for sulfur dioxide. The peak period concentration would result primarily from Hanford SRF construction and above-grade structure and equipment removal for carbon monoxide; from site regrading for nitrogen dioxide; from 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, and the contribution of major activities to these concentrations at Hanford.

Maximum concentrations of carcinogenic and noncarcinogenic toxic pollutants are presented in Table 4–101. Impacts on the public due to nonradiological toxic pollutant emissions would be acceptable. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–102 and 4–103.

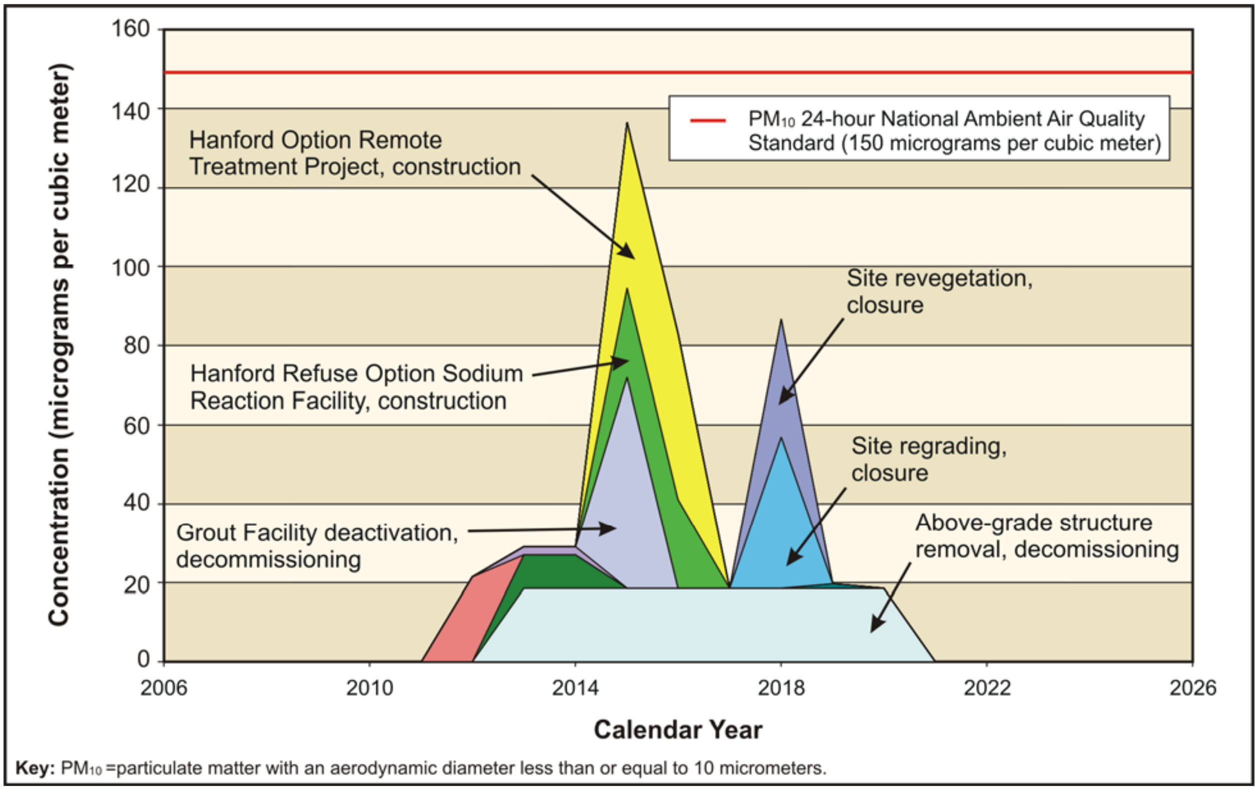


Figure 4–28. FFTF Decommissioning Alternative 3 PM_{10} Maximum 24-Hour Concentration at Hanford

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 air pollutant impacts of facility disposition because of the amount of equipment used and earthmoving activity, as 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 of construction and operations of the RTP at Hanford, as shown in Tables 4–100 and 4–101.

IDAHO OPTION

Disposition of RH-SCs under the Idaho Option would result in air pollutant impacts of construction of the RTP at INL, as shown in Tables 4–104 and 4–105. Operation of the RTP would have no 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 of construction and operations of an SRF in the 400 Area, as 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 and operations of the existing SPF at INL, as shown in Tables 4–104 and 4–105. Operation of the SPF would have no 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. Key underlying assumptions regarding analysis of potential environmental impacts on geology and soils and the acquisition and use of geologic resources in support of the FFTF Decommissioning alternatives and options are 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. Also, 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, as 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 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). Little or no damage is expected in reinforced structures such as the FFTF RCB. 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. 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 and for the evaluation, modification, and upgrade of existing structures, systems, and components so that DOE facilities safely withstand the effects of natural phenomena hazards, such as earthquakes. An analysis of potential effects of a beyond-design-basis earthquake on human health and the environment is 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	0.1	0.1	<0.1
Construction materials							
Concrete	0.0	0.0	0.0	2,900	2,920	79.9	31.7
Cement[b]	0.0	0.0	0.0	719	725	16.3	6.46
Sand[b]	0.0	0.0	0.0	1,410	1,420	38.8	15.4
Gravel[b]	0.0	0.0	0.0	1,840	1,850	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	1,280	112	0.0
Soil (specification backfill)	0.0	80,400	121,000	37.8	37.8	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
Landfill earthwork[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	4,580	202	35.5

[a] Reflects land area assumed to be permanently disturbed for new facilities. The value also includes land area excavated in 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: RH-SCs=remote-handled special components.

Source: SAIC 2007b.

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 to be consolidated 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. With the exception of 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 radiological 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 radiological 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 (6.9 acres) would also be excavated in Borrow Area C, for a total of 3.5 hectares (8.6 acres) of new, permanent land disturbance.

All other ancillary buildings within the 400 Area PPA would be demolished to grade as described above, except 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 regraded with topsoil, recontoured and then 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 serve to 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 would be 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 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 serve to 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 Hanford facilities have been evaluated. As stated in DOE Order 420.1B, DOE 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. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components and for the evaluation, modification, are upgrade of existing structures, systems, and components so that DOE facilities 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 this option, RH-SCs stored at Hanford would be shipped to INL for treatment at the new RTP to be constructed within the MFC of INL. Direct and indirect impacts on site geology and soil under this option would be very similar in nature to those described above for the Hanford Option. As under the Hanford Option, construction activities would permanently disturb no more than about 0.1 hectares (0.3 acres) of land for the new facility. At INL, the RTP would be constructed within a developed portion of the MFC. Across portions of INL, including the lava plain on which the MFC is situated, outcrops of basaltic bedrock are common and near-surface basalt is overlain by only a thin mantle of eolian silt usually less than 2 meters (6.6 feet) thick. Consequently, construction of the below-grade service level of the RTP at the MFC of INL may require blasting to excavate through the bedrock.

As described for the Hanford Option, adherence to standard best management practices for soil erosion and sediment control during construction would serve to minimize soil erosion and loss.

Total geologic resource requirements to support facility construction under this option are projected to be 4,580 cubic meters (5,990 cubic yards) (see Table 4–106). This volume would be supplied by one of a number of quarries at INL (see Chapter 3, Section 3.3.5.2).

As described in Chapter 3, Section 3.3.5.3, 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. To be specific, the Eastern Snake River Plain, on which INL is situated, is a region of relatively low seismicity, although higher rates of seismic activity are indicated for regions in the surrounding Basin and Range Physiographic Province. Ground shaking of MMI VI has been reported on the site in the recent past, associated with a major earthquake epicenter in the Borah Peak Range northwest of INL. Otherwise, relatively few and minor earthquakes have occurred in the area surrounding INL. MMI VI shaking typically causes only slight damage to structures, while MMI VII activity is expected to affect primarily the integrity of inadequately designed or nonreinforced structures, but damage to properly or specially designed or upgraded facilities is not expected. As stated in DOE Order 420.1B, DOE 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. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components and for the evaluation, modification, and upgrade of existing structures, systems, and components so that DOE facilities 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.

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 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 serve to 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 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. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components and for the evaluation, modification, and upgrade of existing structures, systems, and components so that DOE facilities safely withstand the effects of natural phenomena hazards, such as earthquakes. As the SRF would presumably 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 for the Hanford Reuse Option. Under this option, ground disturbing activity would be limited to modifications to the existing SPF at INL's MFC in order 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 and gravel for slab foundation construction. 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 for 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. Also, 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 for the Entombment Alternative. However, under this alternative, the RCB reactor vessel, along with internal piping and equipment, would first be filled with grout, removed, and packaged for transport to an IDF for onsite disposal rather than being left in place. Identical to the Entombment Alternative, an onsite grout facility would be constructed and operated to grout and stabilize the reactor vessel prior to its removal as well as to fill the below-grade spaces associated with the RCB and adjacent service buildings prior to backfilling them with soil. While no engineered barrier would be constructed under this alternative, decommissioning activities would have a higher demand for soil for use in backfilling than the Entombment Alternative. To support these activities about 3.2 hectares (7.9 acres) would be excavated in 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 then 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 serve to 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 under Section 4.2.5.2.2 for 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 under Section 4.2.5.2.2 for 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 under Section 4.2.5.2.3 for 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 under Section 4.2.5.2.3 for 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 to 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 that 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, as 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 and 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, stacked haybales, mulch) and spill prevention and waste management practices would be employed to minimize suspended sediment and other deleterious material transport and 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, 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 1 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 very localized and of short duration. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulch) and spill prevention and waste management practices would be employed to minimize suspended sediment and other deleterious material transport from the construction site, as well as 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, 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 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, such as for use in 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

Direct impacts on water resources associated with construction of the RTP within the MFC of INL would be very similar in nature to those described above for the Hanford Option. No natural surface-water features or surface-water drainages would be directly impacted because the facility would be constructed in a developed portion of the MFC. Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulch) and spill prevention practices and waste management would be employed as previously discussed for the Hanford 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 provides for measures and controls to prevent pollution of stormwater from construction activities at INL (see Chapter 3, Section 3.3.6.1.1).

During RTP operations, there would be no direct discharge of effluents to either surface water or groundwater at INL. 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 MFC. Radioactive liquid waste would be conveyed to the Radioactive Liquid Waste Treatment Facility, while nonhazardous process wastewater would flow to the MFC Industrial Waste Pond. Nonhazardous sanitary wastewater (sewage) would be managed via the existing site sanitary sewer system (ANL-W 2004:66, 67).

Groundwater is the source of water at the MFC and across INL. Water would be required during construction, operations, and deactivation as previously described for the Hanford Option. 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 RTP at the INL MFC. 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 are 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 very localized and of short duration. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulch) and spill prevention and waste management practices would be employed to minimize suspended sediment and other deleterious material transport from the construction site, as well as 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, 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, such as for use in 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 would be 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 very localized and of short duration. Regardless, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulch) and spill prevention practices and waste management would be employed as previously discussed for 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 provides for 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 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 impact on surface-water features or surface-water quality for the same reasons as previously described for 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 for the Entombment Alternative, except that 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 then 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 for 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 for 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 from the RCB, along with other contaminated debris, 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 under Section 4.2.6.2.1.2 for the Hanford Option.

IDAHO OPTION

Impacts of this option on water resources would be the same as those discussed under Section 4.2.6.2.1.2 for 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 under Section 4.2.6.2.1.3 for the Hanford Reuse Option.

IDAHO REUSE OPTION

Impacts of this option on water resources would be the same as those discussed under Section 4.2.6.2.1.3 for 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. Since 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 to be disposed of under this alternative would be placed in trenches 31 and 34 of LLBG 218-W-5 or in IDF-East. Since there would be no need to excavate geologic material from Borrow Area C under this alternative, there would be no impact on ecological resources within the tract area.

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 0.6-hectare (1.5-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. Since 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 a limited amount of geologic material to be excavated 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. Since 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 at a new RTP. The RTP would be built within a previously disturbed area of the MFC and would occupy 0.1 hectares (0.3 acres). Since this area is currently industrial in nature, the RTP would not impact terrestrial resources at the MFC or INL. Treated components would be returned to Hanford or sent to NTS for disposal. Since an existing waste site would be used at NTS 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 impact on terrestrial resources within the 400 Area or at Hanford. Since treated sodium would be stored in an existing facility within the 200 Areas, again there would be no impact 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 since 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 since 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 since 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 since 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 since 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 since 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 since 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 since 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 since 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, since none have been recorded within the 400 Area.

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. Since 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. Since 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 at a new RTP located within the MFC. Since this facility would be constructed in a disturbed portion of the MFC, its construction would not disturb any threatened or endangered species. Treated components would be returned to Hanford or sent to NTS for disposal. Since an existing waste site would be used at NTS, there would be no impact 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. Since 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 since none are found within the MFC. Also, there would be no impact on these species at Hanford since 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. Since 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 for 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 since the facility would no longer be contaminated. Future industrial development would be the determining factor with regard to long-term restoration of the site.

Under this alternative, debris and other waste would be handled in the same manner as 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 for this alternative are identical to those of the Entombment Alternative. Thus, impacts on terrestrial resources from disposition-related activities would be the same as 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 for this alternative are identical to those of the Entombment Alternative. Thus, impacts on terrestrial resources from processing activities would be the same as discussed under that alternative (see Section 4.2.7.2.1.3).

4.2.7.3.2 Wetlands

The steps involved in facility disposition, the disposition of RH-SCs, and the processing of bulk sodium under this alternative are identical to those of 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 impact on wetlands under this alternative or option cases.

4.2.7.3.2.1 Aquatic Resources

The steps involved in facility disposition, the disposition of RH-SCs, and the processing of bulk sodium under this alternative are identical to those of 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 impact on aquatic resources under this alternative or option cases.

4.2.7.3.3 Threatened and Endangered Species

4.2.7.3.3.1 Facility Disposition

This alternative would involve removing aboveground portions of the FFTF RCB and dismantling associated buildings and structures. Since 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.

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 since nearly the same land area would be affected.

4.2.7.3.3.2 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 are identical to those of the Entombment Alternative. Further, since there are no threatened or endangered species within affected areas there would be no impact on this group of organisms from disposition-related activities (see Section 4.2.7.2.4.2).

4.2.7.3.3.3 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 are identical to those of the Entombment Alternative. Further, since there are no threatened or endangered species within affected areas, there would be no impact 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 along with the other buildings in the FFTF PPA would remain in place. The current BLM Visual Resource Management Class IV rating for the 400 Area would not change, and there would be no change in appearance of the site. No geologic material would be excavated from Borrow Area C. Minimal volumes of waste to be disposed of 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 4.2.1.1.1.1.

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 impact 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 impact on prehistoric resources.

4.2.8.1.2 Historic Resources

As there would be no construction in areas not already in use, there would be no impact 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 impact 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 impact 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 impact 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 impact 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 impact 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 impact 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 impact 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 impact 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. Facility disposition activities would not impact known prehistoric resources.

An estimated 2.8 hectares (7 acres) of Borrow Area C would be excavated for 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. 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 at a new RTP to be constructed in a developed portion of the MFC. Treated components would be returned to Hanford or sent to NTS for disposal where they would be placed in existing facilities. There would be no impact on prehistoric resources under this option. If prehistoric resources were discovered during construction of a new RTP, appropriate guidance set forth in the *Idaho National Laboratory Cultural Resource Management Plan* (DOE 2005) would be implemented.

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. The treated sodium would be stored in an existing facility within the 200 Areas. There would be no impact on 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 impact on prehistoric resources under this option.

4.2.8.2.2 Historic Resources

4.2.8.2.2.1 Facility Disposition

Facility disposition activities described in Section 4.2.8.2.1.1 are not expected to impact historic resources. Disturbed areas within the PPA would be revegetated, providing an overall improvement in the appearance of the 400 Area. The BLM Visual Resource Management Class IV rating of the 400 Area would remain unchanged due to other development in the immediate area.

Within Borrow Area C, excavation activities would impact the view from State Route 240 and nearby higher elevations. The BLM visual resource management rating would change from Class II to Class III.

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. 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 removed from the FFTF RCB would be stored at Hanford prior to shipment to INL. A new RTP would be constructed in developed portions of the MFC. If historic resources were uncovered during construction, appropriate guidance set forth in the *Idaho National Laboratory Cultural Resource Management Plan* (DOE 2005) would be implemented.

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. Sodium would be stored in an existing facility within the 200 Areas. 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 impact on historic resources.

4.2.8.2.3 American Indian Interests

4.2.8.2.3.1 Facility Disposition

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. The BLM visual resource management rating would change from Class II to Class III.

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 removed from the FFTF RCB would be stored at Hanford prior to shipment to INL. A new RTP would be constructed in developed portions of the MFC. 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 and therefore 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 construction in areas not already in use at the MFC, there would be no impact on American Indian interests at INL.

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, as no such resources have been discovered within the affected areas. As is the case with other cultural resources, if any paleontological resources were discovered, procedures are in place to properly manage the discovery site.

4.2.8.2.4.2 Disposition of Remote-Handled Special Components

HANFORD OPTION

There would be no impact on paleontological resources under this alternative or options, as no such resources have been discovered within the affected areas. As is the case with other cultural resources, if any paleontological resources were discovered, procedures are in place to properly manage the discovery site.

IDAHO OPTION

There would be no impact on paleontological resources under this alternative or options, as no such resources have been discovered within the affected areas. As is the case with other cultural resources, if any paleontological resources were discovered, procedures are in place to properly manage the discovery site.

4.2.8.2.4.3 Disposition of Bulk Sodium

HANFORD REUSE OPTION

There would be no impact on paleontological resources under this alternative or options, as no such resources have been discovered within the affected areas. As is the case with other cultural resources, if any paleontological resources were discovered, procedures are in place to properly manage the discovery site.

IDAHO REUSE OPTION

There would be no impact on paleontological resources under this alternative or options, as no such resources have been discovered within the affected areas. As is the case with other cultural resources, if any paleontological resources were discovered, procedures are in place to properly manage the discovery site.

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.

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 are identical to those of the Entombment Alternative. Therefore, there would be no impact on prehistoric resources.

4.2.8.3.1.3 Disposition of Bulk Sodium

HANFORD REUSE OPTION AND IDAHO REUSE OPTION

Activities under these options are identical to those of the Entombment Alternative. Therefore, there would be no impact 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 for 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 4.2.8.2.2.1 for the Entombment Alternative.

4.2.8.3.3.2 Disposition of Remote-Handled Special Components

HANFORD OPTION AND IDAHO OPTION

There would be no impact on American Indian interests under these options for the same reasons as described in Section 4.1.8.2.3.2.

4.2.8.3.3.3 Disposition of Bulk Sodium

HANFORD REUSE OPTION AND IDAHO REUSE OPTION

There would be no impact on American Indian interests under these options for the same reasons as described in Section 4.2.8.2.3.3.

4.2.8.3.4 Paleontological Resources

There would be no impact 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 other cultural resources, if any paleontological resources were discovered, procedures are in place to properly manage the discovery site.

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.

Key underlying assumptions used in projecting changes in employment for each of the FFTF Decommissioning alternatives and associated options are similar to those described in Section 4.1.9 for the Tank Closure alternatives. Impacts on local commuter traffic are 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 facility 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)	46 (2015–2016)	46	Less than 1 (2015–2016)	2 (2015–2016)
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: RH-SCs=remote-handled special components.

Source: Appendix I; SAIC 2007b.

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 impact on regional economic characteristics, the demographic characteristics, or housing and community services. In addition, the one truck trip per year along with a single commuter vehicle would have little or no impact on the 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 truck load 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 46 FTEs from 2015 through 2016. By comparison, the labor force in the Idaho ROI is projected to be about 178,000 in 2015 (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 facility disposition, disposition of RH-SCs, and disposition of bulk sodium, the peak workforce required under this alternative would have little or no impact on the demand 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 46 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 125 offsite truck trips (less than 1 truck trip per day) in 2015 and 2016—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 2015 and 2016, with up to 540 trips per year (2 trips per day) as a result of the construction of the RTP.

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 55 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 52 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 truck load 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 46 FTEs from 2015 through 2016. By comparison, the labor force in the Idaho ROI is projected to be about 178,000 in 2015 (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 facility 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 facility disposition, disposition of RH-SCs, and disposition of bulk sodium, the peak workforce required under this alternative would have little or no impact on the demand 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 46 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 125 offsite truck trips per year (less than 1 truck trip per day) in 2015 and 2016—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 2015 and 2016, with up to 540 trips per year (2 trips per day) as a result of the construction of the RTP.

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 radiation 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. Radiation exposure occurs through inhalation, direct exposure to the radiological 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 radiological plume and material deposited on the ground. Doses are presented as the total effective dose equivalent.

In addition to members of the public, workers directly involved in the activities associated with each alternative and nearby noninvolved workers may receive radiological doses. Doses to an involved worker are calculated based on an FTE employee. It is 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 radiological air emissions associated with the alternatives considered. The noninvolved worker is assumed to be about 100 meters (110 yards) away or at a nearby facility and is assumed to be there on a daily basis.

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. Impacts of FFTF deactivation are assumed to occur independent of the actions evaluated in this EIS and are not included in the impacts of FFTF Decommissioning alternatives. However, deactivation impacts are discussed in the following section for perspective.

Very small radiological impacts on the public would be expected from any of the FFTF Decommissioning alternatives. The options to disposition RH-SCs and bulk sodium at Hanford would have slightly higher offsite impacts than the options to perform 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 vary only slightly between the options of performing the work at Hanford or 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.

In contrast to the FFTF deactivation activities, under the No Action Alternative's 100 years of administrative control, no equipment- or building-disturbing activities would occur, so no substantive radiological air emissions would be expected. Therefore, no doses to the public would be expected.

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 would be 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, which corresponds to a risk of 1×10^{-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)**	**Latent Cancer Fatalities[a]**	**Dose (millirem per year)**	**Latent Cancer Fatality Risk[b]**	**Dose (millirem per year)**	**Latent Cancer Fatality Risk[b]**
Administrative Control	1	0 (6×10^{-4})	50	3×10^{-5}	–	–

a The reported value is the projected number of latent cancer fatalities (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.1.1.3).

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.

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 would be expected as a result of the dose associate 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. There would be no potential dose to a noninvolved worker during the administrative control period because noninvolved workers would not be present in the area around FFTF and there would be no radiological air emissions related to maintaining FFTF that could affect workers in other areas of the site.

4.2.10.2 Alternative 2: Entombment

4.2.10.2.1 Radiological Impacts on the Public

Radiological impacts of deactivation activities, as discussed in Section 4.2.10.1, would occur independent of FFTF Decommissioning alternatives. Those activities are 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 dose in the table is for the entire duration of the activity, whereas the MEI dose is for the year of maximum impact.

Table 4–109. FFTF Decommissioning Alternative 2 Radiological Impacts on the Public

Activity	Offsite Population		Maximally Exposed Individual	
	Life-of-Project Dose (person-rem)	Latent Cancer Fatalities[a]	Maximum Annual Dose (millirem per year)	Latent Cancer Fatality Risk[b]
Facility Disposition	0.000001	0 (6×10^{-10})	0.00000003	2×10^{-14}
Disposition of Remote-Handled Special Components				
Hanford Option	0.00014	0 (8×10^{-8})	0.0000016	1×10^{-12}
Idaho Option	0.000011	0 (7×10^{-9})	0.0000014	8×10^{-13}
Disposition of Bulk Sodium				
Hanford Reuse Option	0.0072	0 (4×10^{-6})	0.00012	7×10^{-11}
Idaho Reuse Option	0.00042	0 (3×10^{-7})	0.000045	3×10^{-11}

a The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

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.

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 radiological air emissions. The population dose as a result of these emissions would be extremely small, 0.000001 person-rem. No excess LCFs would be 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 0.00000003 millirem, which would result in essentially no additional risk of an LCF (a risk of much less than 1 in a 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 radiological air emissions and a potential dose to the public, primarily from 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 0.00014 person-rem. This dose would be received over the 2-year period in which the RTP is operated and decommissioned. No additional LCFs would be expected in the offsite population as a result of this activity. The maximum annual dose to an MEI of 0.0000016 millirem would occur during the year in which the RH-SCs are processed. There would be essentially no risk of developing an LCF from this dose (a risk of much less than 1 in a 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).

IDAHO OPTION

Under the option of processing the RH-SCs at the INL RTP, the projected offsite population dose would be 0.000011 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 would be expected in the population as a result of this dose. The maximum annual dose to an MEI would be 0.0000014 millirem, which would result in essentially no additional risk of an LCF (a risk of much less than 1 in a 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, cesium-137, and uranium isotopes that occur as contaminants in the sodium. Under this option, the offsite population would receive a collective dose of 0.0072 person-rem over the 3 years of processing the sodium and decommissioning the facility. No additional LCFs would be expected in the offsite population as a result of this activity. The maximum annual dose to an MEI of 0.00012 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 in a 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 INL, 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 0.00042 person-rem. No additional LCFs would be expected in the offsite population as a result of this activity. The maximum annual MEI dose would be 0.000045 millirem; there would be essentially no risk of developing an LCF from this dose (a risk of much less than 1 in a 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 would be 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.

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 would be 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 6×10^{-5}, or about 1 chance in 17,000.

The dose to a noninvolved worker assumed to be in the Hanford 300 Area would be 0.00000000066 millirem for this activity. There would be essentially no risk of an LCF from this exposure.

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)	Latent Cancer Fatalities[a]	Dose (millirem per year)	Latent Cancer Fatality Risk[b]	Dose (millirem per year)	Latent Cancer Fatality Risk[b]
Facility Disposition	0.37	0 (2×10^{-4})	100	6×10^{-5}	0.00000000066	4×10^{-16}
Disposition of Remote-Handled Special Components						
Hanford Option	1.2	0 (7×10^{-4})	20	1×10^{-5}	0.00019	1×10^{-10}
Idaho Option	1.2	0 (7×10^{-4})	20	1×10^{-5}	0.0000011	7×10^{-13}
Disposition of Bulk Sodium						
Hanford Reuse Option	3.7	0 (2×10^{-3})	39	2×10^{-5}	0.0000037	2×10^{-12}
Idaho Reuse Option	3.6	0 (2×10^{-3})	39	2×10^{-5}	0.000055	3×10^{-11}

[a] The reported value is the projected number of latent cancer fatalities (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.1.1.3).

[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.

Source: Appendix K, Section K.2.2.

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 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 would be 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 1×10^{-5}, or less than 1 chance in 100,000.

The annual dose to a noninvolved worker assumed to be 100 meters (110 yards) away in the 200-West Area would be 0.00019 millirem for this activity. There would be essentially no risk of an LCF from this exposure.

IDAHO OPTION

Under the Idaho Option, in which RH-SCs are processed at the INL RTP, the involved worker doses and risks would be the same as those estimated for Hanford.

The annual dose to a noninvolved worker assumed to be about 100 meters (110 yards) away from the RTP at another facility in the MFC would be 0.0000011 millirem for this activity. 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, 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 would be expected in the worker population as a result of this activity. The maximum annual worker dose would occur during the 2 years in which the sodium is being processed. The average annual worker dose in those years would be 39 millirem; this dose corresponds to an increased risk of an LCF of 2×10^{-5}, or less than 1 chance in 50,000.

The annual dose to a noninvolved worker assumed to be in the Hanford 300 Area would be 0.0000037 millirem for this activity. 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 would be expected among the workers as a result of the dose, and the risk of an LCF in the average worker would be 2×10^{-5} (1 in 50,000).

The annual dose to a noninvolved worker assumed to be about 100 meters (110 yards) away at another facility in the MFC would be 0.000055 millirem for this activity. 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, occur independent of all FFTF Decommissioning alternatives. Those activities are 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 dose 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.

4.2.10.3.1.1 Facility Disposition

Facility disposition would result in minimal releases of radioactivity and therefore negligible doses to the offsite public and the MEI. 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 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 under Alternative 2, Entombment.

Table 4–111. FFTF Decommissioning Alternative 3 Radiological Impacts on the Public

Activity	Offsite Population		Maximally Exposed Individual	
	Life-of-Project Dose (person-rem)	Latent Cancer Fatalities[a]	Maximum Annual Dose (millirem per year)	Latent Cancer Fatality Risk[b]
Facility Disposition	Negligible	0	Negligible	0
Disposition of Remote-Handled Special Components				
Hanford Option	0.00014	0 (8×10^{-8})	0.0000016	1×10^{-12}
Idaho Option	0.000011	0 (7×10^{-9})	0.0000014	8×10^{-13}
Disposition of Bulk Sodium				
Hanford Reuse Option	0.0072	0 (4×10^{-6})	0.00012	7×10^{-11}
Idaho Reuse Option	0.00042	0 (3×10^{-7})	0.000045	3×10^{-11}

a The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

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.
Source: Appendix K, Section K.2.2.

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 same under this alternative as under Alternative 2, Entombment.

IDAHO REUSE OPTION

Doses and risks to members of the public from processing the bulk sodium at INL would be same under this alternative as under Alternative 2, Entombment.

4.2.10.3.2 Radiological Impacts on Workers

Radiological doses and risks under Alternative 2 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.

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 would be 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 6×10^{-5}, or about 1 chance in 17,000 of an LCF.

Table 4–112. FFTF Decommissioning Alternative 3 Radiological Impacts on Workers

Activity	Life-of-Project Worker Population		Average Annual Worker Dose		Annual Noninvolved Worker	
	Dose (person-rem)	Latent Cancer Fatalities[a]	Dose (millirem per year)	Latent Cancer Fatality Risk[b]	Dose (millirem per year)	Latent Cancer Fatality Risk[b]
Facility Disposition	6.3	0 (4×10^{-3})	100	6×10^{-5}	–	–
Disposition of Remote-Handled Special Components						
Hanford Option	1.2	0 (7×10^{-4})	20	1×10^{-5}	0.00019	1×10^{-10}
Idaho Option	1.2	0 (7×10^{-4})	20	1×10^{-5}	0.0000011	7×10^{-13}
Disposition of Bulk Sodium						
Hanford Reuse Option	3.7	0 (2×10^{-3})	39	2×10^{-5}	0.0000037	2×10^{-12}
Idaho Reuse Option	3.6	0 (2×10^{-3})	39	2×10^{-5}	0.000055	3×10^{-11}

a The reported value is the projected number of latent cancer fatalities (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.1.1.3).

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.

Source: Appendix K, Section K.2.2.

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 same under this alternative as 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 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 same under this alternative as under Alternative 2, Entombment.

IDAHO REUSE OPTION

Worker doses and risks associated with processing the bulk sodium at INL would be same under this alternative as 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 dispositioning RH-SCs and for processing Hanford bulk sodium. For each FFTF Decommissioning alternative and applicable option, radiological impacts of postulated accident scenarios are quantified for an MEI living near Hanford, the offsite population as a whole, and a noninvolved worker. Hazardous chemical impacts are also evaluated. For an involved worker, accident consequences have not been quantified because the number and location of personnel relative to a postulated accident are not known. 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 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, 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.

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 would be expected in the population; the risk to the offsite population would be an increase of 3×10^{-9} per year in the likelihood of an LCF (i.e., about 1 in 300 million per year of a single LCF occurring in the population). For the offsite MEI, the increase in the likelihood of an LCF would be 3×10^{-13} per year (i.e., about 1 in 3 trillion per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be 7×10^{-13} per year (i.e., about 1 in 1.4 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 and an LCF would depend on the distance and other factors, but would generally be higher.

Table 4–113. FFTF Decommissioning Alternatives – Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[b]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatality[c]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatality[c]
Sodium Storage Facility fire (SSF1)	0.000001	6×10^{-10}	0.048	0 (3×10^{-5})	0.00000034	2×10^{-10}
Hanford sodium storage tank failure (HSTF1)	0.0000011	6×10^{-10}	0.048	0 (3×10^{-5})	0.00000087	5×10^{-10}
Hallam Reactor sodium fire (HSF1)	0.00000000046	3×10^{-13}	0.0000059	0 (4×10^{-9})	0.00000000025	2×10^{-13}
Sodium Reactor Experiment sodium fire (SRE1)	0.000000045	3×10^{-11}	0.00058	0 (3×10^{-7})	0.00000011	7×10^{-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 Based on populations of 357,391 persons residing within 80 kilometers (50 miles) of the 400 Area (SSF1 and HSTF1) and 488,897 persons residing within 80 kilometers (50 miles) of the 200-West Area (HSF1 and SRE1).
c Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.
d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).
Source: Appendix K, Section K.3.7.2.

Table 4–114. FFTF Decommissioning Alternatives – 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]
Sodium Storage Facility fire (SSF1)	1×10^{-6}	6×10^{-16}	0 (3×10^{-11})	2×10^{-16}
Hanford sodium storage tank failure (HSTF1)	1×10^{-5}	6×10^{-15}	0 (3×10^{-10})	5×10^{-15}
Hallam Reactor sodium fire (HSF1)	2×10^{-5}	5×10^{-18}	0 (7×10^{-14})	3×10^{-18}
Sodium Reactor Experiment sodium fire (SRE1)	1×10^{-2}	3×10^{-13}	0 (3×10^{-9})	7×10^{-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 357,391 persons residing within 80 kilometers (50 miles) of the 400 Area (SSF1 and HSTF1) and 488,897 persons residing within 80 kilometers (50 miles) of the 200-West Area (HSF1 and SRE1).
d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).
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 3×10^{-8}, the risk of an LCF to the MEI would be 6×10^{-13}, and the risk of an LCF to the noninvolved worker would be 5×10^{-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 significant 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 significant 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 is assumed to come off as 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. Since 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 to 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 is slightly exceeded beyond the site boundary. For the remaining scenarios, the ERPG-2 and ERPG-3 thresholds are not 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.

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 involve sodium stored at Hanford and could occur under any of the FFTF Decommissioning alternatives.

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	141	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; pounds to kilograms, by 2.2046.

Key: ERPG=Emergency Response Planning Guideline; kg/hr=kilograms per hour; mg/m^3=milligrams per cubic meter.

Source: Appendix K, Section K.3.9.2.

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 is 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, 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[b]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatality[c]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatality[c]
Remote-handled special component fire (RHSC1) at Hanford	0.00011	7×10^{-8}	4.4	0 (3×10^{-3})	0.0009	5×10^{-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 357,391 persons residing within 80 kilometers (50 miles) of the 400 Area.

c Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.

d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

Key: Hanford=Hanford Site.

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	1×10^{-2}	7×10^{-10}	0 (3×10^{-5})	5×10^{-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 357,391 persons residing within 80 kilometers (50 miles) of the 400 Area.

d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

Key: Hanford=Hanford Site.

Source: Appendix K, Section K.3.7.2.

For this accident, no LCFs would be expected in the population; the risk to the offsite population would be an increase of 3×10^{-5} per year in the likelihood of an LCF (i.e., about 1 in 33,000 per year of a single LCF occurring in the population). For the offsite MEI, the increase in the likelihood of an LCF would be 7×10^{-10} per year (i.e., about 1 in 1.4 billion per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be 5×10^{-9} per year (i.e., about 1 in 200 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 and 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 one 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 (1×10^{-4}) in the number of LCFs occurring in the offsite population, a 3×10^{-9} increase in the likelihood of an LCF for the MEI, and a 3×10^{-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 is assumed to involve the RH-SC containing the largest inventory of radioactivity, and the location of the accident is the MFC 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, 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

Accident[a]	Maximally Exposed Individual		Offsite Population[b]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatality[c]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatality[c]
Remote-handled special component fire (RHSC1) at Idaho National Laboratory	0.0001	6×10^{-8}	0.25	0 (2×10^{-4})	0.0036	2×10^{-6}

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 205,962 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 latent cancer fatalities (LCFs) in 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.1.1.3).

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	1×10^{-2}	6×10^{-10}	0 (2×10^{-6})	2×10^{-8}

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 205,962 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) in 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.1.1.3).

Source: Appendix K, Section K.3.7.2.

For this accident, no LCFs would be expected in the population; the risk to the offsite population would be an increase of 2×10^{-6} per year in the likelihood of an LCF (i.e., about 1 in 500,000 per year of a single LCF occurring in the population). For the offsite MEI, the increase in the likelihood of an LCF would be 6×10^{-10} per year (i.e., about 1 in 1.6 billion per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be 2×10^{-8} per year (i.e., about 1 in 50 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 and 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 one 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 8×10^{-6} in the likelihood of a single LCF occurring in the offsite population, an increase of 3×10^{-9} in the likelihood of an LCF for the MEI, and an increase of 1×10^{-7} 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 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. Table 4–114 shows the accident risks, 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 4×10^{-9}, the risk of an LCF to the MEI would be 8×10^{-14}, and the risk of an LCF to the noninvolved worker would be 7×10^{-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 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. Table 4–121 shows the accident risk, 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)	Latent Cancer Fatality[c]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatality[c]
INL Sodium Processing Facility storage tank failure (INLSPF1)	0.000000055	3×10^{-11}	0.0002	0 (1×10^{-7})	0.00000034	2×10^{-10}

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 205,962 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 latent cancer fatalities (LCFs) in 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.1.1.3).
Key: INL=Idaho National Laboratory.
Source: Appendix K, Section K.3.7.2.

For this accident no LCFs would be expected in the population; the risk to the offsite population would be an increase of 1×10^{-12} per year in the likelihood of an LCF (i.e., about 1 in 1 trillion per year of a single LCF occurring in the population). For the offsite MEI, the increase in the likelihood of an LCF would be 3×10^{-16} per year (i.e., about 1 in 3,000 trillion per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be 2×10^{-15} per year (i.e., about 1 in 500 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 and an LCF would depend on the distance and other factors, but would generally be higher.

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)	1×10^{-5}	3×10^{-16}	0 (1×10^{-12})	2×10^{-15}

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 205,962 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) in 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.1.1.3).
Key: INL=Idaho National Laboratory.
Source: Appendix K, Section K.3.7.2.

Under the 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 3×10^{-9}, the risk of an LCF to the MEI would be 5×10^{-14}, and the risk of an LCF to the noninvolved worker would be 5×10^{-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 2×10^{-12}, the risk of an LCF to the MEI would be 6×10^{-16}, and the risk of an LCF to the noninvolved worker would be 4×10^{-15}.

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, 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 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 in Section 4.2.11.1.2 under the No Action Alternative.

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 involves the same inventory of radioactive material (RHSC1, remote-handled special component fire). The resulting offsite population dose was estimated to be 12 person-rem, with no (7×10^{-3}) additional LCFs. The MEI dose would be 0.00029 rem, which corresponds to an increased risk of an LCF of 2×10^{-7}. The noninvolved worker dose would be 0.0096 rem, which corresponds to an increased risk of an LCF of 6×10^{-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

A number of factors affect the risk of transporting radioactive materials. These factors 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 normal, or 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.

The impacts of incident-free, or routine, transportation and transportation accidents comprise transportation impacts. The impacts of 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 NTS 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]
1: No Action	0	0	0	0	0	0	0	NA
2: Entombment	78	191	9	13	191	5	0	6,310
3: Removal	78	191	9	13	191	5	1	6,329

[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 IDF and to sanitary and hazardous landfills.

Key: IDF=Integrated Disposal 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 are 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. FFTF Decommissioning Alternatives – Risks of Transporting Radioactive Waste

Disposition Activity	Location (Transport Mode)	Number of Shipments	Incident-Free: Crew Dose (person-rem)	Incident-Free: Crew Risk[a]	Incident-Free: Population Dose (person-rem)	Incident-Free: Population Risk[a]	Accident: Radiological Risk[a, b]	Accident: Non-radiological Risk[a]	Accident: One-Way Offsite Travel (10^5 km)
Facility disposition	Hanford (2)	6,310	c	c	c	c	c	0.00417	N/A
	Hanford (3)	6,330	0.033	2.0×10^{-5}	0.0025	1.5×10^{-6}	7.6×10^{-11}	0.00418	N/A
Disposition of RH-SCs	INL (T)	9	0.839	5.0×10^{-4}	0.330	2.0×10^{-4}	4.5×10^{-8}	0.00019	0.096
	INL (R)	5	0.170	1.0×10^{-4}	0.074	4.4×10^{-5}	4.5×10^{-8}	0.00035	0.060
	Hanford	5	0.032	1.9×10^{-5}	0.0048	2.9×10^{-6}	1.3×10^{-10}	0.0000029	N/A
Disposition of bulk sodium	INL (T)	269	3.52	2.1×10^{-3}	0.945	5.7×10^{-4}	4.2×10^{-8}	0.0052	2.60
	INL (R)	135	0.157	9.4×10^{-5}	0.171	1.0×10^{-4}	3.5×10^{-8}	0.022	1.43
	Hanford	204	0.115	6.9×10^{-5}	0.0112	6.7×10^{-6}	4.2×10^{-12}	0.000084	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. Values presented in the table have been rounded to no more than three significant digits, where appropriate.

Key: 2=Alternative 2; 3=Alternative 3; Hanford=Hanford Site; INL=Idaho National Laboratory; km=kilometers; N/A=not applicable; R=rail transport; RH-SCs=remote-handled special components; T=truck transport.

Source: Appendix H, Section H.7.2.

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 0.074 person-rem, which is associated with the transport of RH-SCs to INL for treatment and disposal at NTS[4] using rail transport, and the highest expected dose of about 0.945 person-rem, 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 4.5×10^{-5} to 5.7×10^{-4}. Similarly, the range of expected doses to the workers (see column 4 of Table 4–124: INL rows) would be 0.170 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 (DOE Standard 1098-99). 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.

[4] These materials could also be returned to Hanford. Use of NTS would maximize the impact.

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.

Table 4–125. FFTF Decommissioning Alternatives – Estimated Impacts of Construction and Operational Material Transport

Alternatives/Options	Total Distance Traveled (kilometers)	Number of Accidents	Number of Fatalities
1: No Action	0.031×10^6	0.0038	0.0003
2: Entombment			
Facility disposition	1.83×10^6	0.23	0.015
Options at Hanford	0.35×10^6	0.043	0.003
Disposition of bulk sodium	0.039×10^6	0.005	0.0003
Disposition of RH-SCs	0.31×10^6	0.04	0.0026
Options at INL	0.18×10^6	0.02	0.0015
Disposition of bulk sodium	0.018×10^6	0.002	0.0001
Disposition of RH-SCs	0.16×10^6	0.020	0.0013
3: Removal			
Facility disposition	2.06×10^6	0.25	0.017
Options at Hanford[a]	0.35×10^6	0.043	0.003
Options at INL[b]	0.18×10^6	0.022	0.0015

[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.

Note: To convert kilometers to miles, multiply by 0.6214. 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; INL=Idaho National Laboratory; RH-SCs=remote-handled special components.

Source: Appendix H, Section H.8.

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 (0.0038) traffic accidents, and 0 (0.0003) traffic fatalities (see Table 4–125).

4.2.12.2 Alternative 2: Entombment

Under this alternative, if the treatment of RH-SCs and bulk sodium were to be performed at INL, about 140 offsite rail shipments would occur (see Table 4–124, INL (R) rows 4 and 7). If these materials were to be transported using trucks, about 278 offsite shipments would be made (see Table 4–124, INL (T) rows). In addition, 6,310 truck shipments would be made to transport decommissioning waste to onsite storage and burial grounds. The total distance traveled on public roads or rail 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 6,519 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) has been estimated to range from 0.33 to 4.36 person-rem for treatment at INL and 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 0.25 to 1.28 person-rem for treatment at INL and 0.016 person-rem for treatment at Hanford. Accordingly, incident-free transportation of radioactive material would result in maximums of 0 (2.6×10^{-3}) LCFs among transportation workers and 0 (7.7×10^{-4}) 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 need about 6,310 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 are considered: treatment at Hanford or treatment at INL with the option of returning the treated material to Hanford or shipping it to NTS 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 for onsite product reuse. This option would entail five onsite truck shipments, with a potential exposure of 0.032 person-rem to transportation workers and 0.0048 person-rem to the population. Accordingly, this option would result in 0 (1.9×10^{-5}) LCFs among transportation workers and 0 (2.9×10^{-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 NTS for disposal. Transport to NTS would result in higher transportation risks, and therefore was included in the values presented in Table 4–124. This option would also require one truck 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 are estimated to be 0.17 and 0.074 person-rem, respectively. Potential doses to transportation workers and the general population from truck shipments are estimated to be 0.84 and 0.33 person-rem, respectively. Accordingly, this option would result in a maximum of 0 (5.0×10^{-4}) additional LCFs among workers and 0 (2.0×10^{-4}) additional LCFs among the exposed population.

4.2.12.2.1.3 Disposition of Bulk Sodium

Two options for disposition of bulk sodium are 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 204 onsite shipments of bulk sodium and caustic sodium hydroxide solution, with a potential exposure of about 0.12 person-rem to transportation workers and 0.011 person-rem to the population. Accordingly, this option would result in 0 (6.9×10^{-5}) LCFs among transportation workers and 0 (6.7×10^{-6}) LCFs in the affected population.

IDAHO REUSE OPTION

This option would require 269 truck shipments or 135 rail shipments to transport bulk sodium to INL and return the caustic product to Hanford for reuse. The potential exposure to transportation workers and the general population is estimated to be about 0.16 and 0.17 person-rem, respectively, using rail shipments and about 3.52 and 0.945 person-rem, respectively, using truck shipments. Accordingly, this option would result in a maximum of 0 (2.1×10^{-3}) additional LCFs among workers and 0 (5.7×10^{-4}) 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 accident (total transportation accidents) severities, irrespective of their 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 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 are 0.22, 1.20, and 5.60 person-rem, respectively. The likelihood of occurrence of such consequences per transport is less than 1.3×10^{-6}, 2.5×10^{-7}, and 2.8×10^{-8} in rural, suburban, and urban zones, respectively. This accident could result in a dose of 0.0015 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 9.0×10^{-7}.

Estimates of the total transportation accident risks under this alternative are a maximum radiological dose risk to the population of 0.00014 person-rem, resulting in 8.7×10^{-8} 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 accident risks are very small.

For treatment options at Hanford, the consequences of the most severe accidents are enveloped by those of facility accidents. Estimates of the total transportation accidents from onsite shipments are very small (see Table 4–124); the population dose is estimated to be 2.2×10^{-7} person-rem, resulting in 1.3×10^{-10} LCFs, and traffic accidents resulting in 0 (0.000087) fatalities (see Table 4–124, rows 5 and 8).

4.2.12.2.2.1 Facility Disposition

It is estimated that the accident risks during transport of decommissioning waste would have the potential to result in 0 (0.0042) traffic fatalities.

4.2.12.2.2.2 Disposition of Remote-Handled Special Components

HANFORD OPTION

Under this option, estimates of the total transportation accident risks are a maximum radiological dose risk to the population of 2.2×10^{-7} person-rem, resulting in 1.3×10^{-10} LCFs, and traffic accidents resulting in 0 (0.0000029) fatalities. These results indicate that accident risks are very small.

IDAHO OPTION

Under this option, estimates of the total transportation accident risks are a maximum radiological dose risk to the population of 0.000075 person-rem, resulting in 4.5×10^{-8} LCFs, and traffic accidents resulting in 0 (0.00035) fatalities. Nearly all of the radiological risks would result from shipping caustic solution to Hanford. These results indicate that accident risks are very small.

4.2.12.2.2.3 Disposition of Bulk Sodium

HANFORD REUSE OPTION

Under this option, estimates of the total transportation accident risks are a maximum radiological dose risk to the population of 7.0×10^{-9} person-rem, resulting in 4.2×10^{-12} LCFs, and traffic accidents resulting in 0 (0.000084) fatalities. These results indicate that accident risks are very small.

IDAHO REUSE OPTION

Under this option, estimates of the total transportation accident risks are a maximum radiological dose risk to the population of 0.00007 person-rem, resulting in 4.2×10^{-8} LCFs, and traffic accidents resulting in 0 (0.022) fatalities. Most of the radiological risks would result from shipping caustic solution to Hanford. These results indicate that accident risks are 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, and piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, and canisters) were evaluated. The range of transportation impacts under this alternative would be 2.01 to 2.18 million kilometers (1.25 to 1.36 million miles) traveled, 0 (0.25 to 0.27) accidents, and 0 (0.017 to 0.018) fatalities over the entire duration, 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 1.83 million kilometers (1.14 million miles) traveled, 0 (0.23) accidents, and 0 (0.015) 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 in support of treatment of RH-SCs would be about 310,000 kilometers (about 190,000 miles) traveled, 0 (0.04) accidents, and 0 (0.0026) fatalities.

IDAHO OPTION

The impacts of transporting construction and operational material in support of treatment of RH-SCs would be about 160,000 kilometers (about 100,000 miles) traveled, 0 (0.020) accidents, and 0 (0.0013) fatalities.

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 39,000 kilometers (about 24,000 miles) traveled, 0 (0.005) accidents, and 0 (0.0003) fatalities.

IDAHO REUSE OPTION

The impacts of transporting construction and operational material in support of bulk sodium disposition would be about 18,000 kilometers (about 11,000 miles) traveled, 0 (0.002) accidents, and 0 (0.0001) fatalities.

4.2.12.3 Alternative 3: Removal

The majority of activities under this alternative are 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 the treatment of sodium metals and RH-SCs were to be performed at INL, about 140 offsite rail shipments would occur (see Table 4–124, INL (R) rows). If these materials were to be transported using trucks, about 278 offsite shipments would be made (see Table 4–124, INL (T) rows). In addition, 6,330 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 would be 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 6,539 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 occurs at INL, and onsite only if treatment occurs at Hanford) has been estimated to range from 0.36 to 4.39 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 0.25 to 1.28 person-rem for treatment at INL and would be 0.019 person-rem for treatment at Hanford. Accordingly, incident-free transportation of radioactive material would result in a maximum of 0 (2.6×10^{-3}) LCFs among transportation workers and 0 (7.7×10^{-4}) 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 need about 6,330 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 are the same as those under Alternative 2.

IDAHO OPTION

Transportation risks for activities under this option are the same as those under Alternative 2.

4.2.12.3.1.3 Disposition of Bulk Sodium

Two options for disposition of bulk sodium are 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 are the same those under Alternative 2.

IDAHO REUSE OPTION

Transportation risks for activities under this option are 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 this Alternative 3 (with a probability of occurrence of more than 1 in 10 million per year) is similar to that provided 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 are very small.

For treatment options at Hanford, the consequences of the most severe transportation accident are enveloped by those of facility accidents. Estimates of the total transportation accidents from onsite shipments are very small (see Table 4–124); the population dose is estimated to be 3.5×10^{-7} person-rem, resulting in 2.1×10^{-10} LCFs.

4.2.12.3.2.1 Facility Disposition

It is estimated that the transport of decommissioning and irradiated component wastes would have the potential to result in 0 (0.0042) traffic fatalities. The total population dose from accidents involving irradiated materials is estimated to be 1.27×10^{-7} person-rem, resulting in 7.6×10^{-11} 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 are the same as to those under Alternative 2.

IDAHO OPTION

Transportation risks for activities under this option are 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 are the same as those under Alternative 2.

IDAHO REUSE OPTION

Transportation risks for activities under this option are 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, and piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, and canisters) were evaluated. The range of transportation impacts under this alternative would be 2.24 to 2.41 million kilometers (1.28 to 1.30 million miles) traveled, 0 (0.28 to 0.30) accidents, and 0 (0.019 to 0.020) fatalities over the entire duration, 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 2.06 million kilometers (1.28 million miles) traveled, 0 (0.25) accidents, and 0 (0.017) 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 are the same as those under Alternative 2.

IDAHO OPTION

Transportation risks for activities under this option are 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 are the same as those under Alternative 2.

IDAHO REUSE OPTION

Transportation risks for activities under this option are 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. Because access to Hanford is restricted to the public, 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, and air quality.

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 radiologically contaminated produce and animal products.

Under this alternative, radiological impacts on the public from normal operations would be minimal. Deactivation activities are expected to result in an insubstantial dose to the offsite population. The dose to the MEI is estimated to be 0.00026 millirem per year. Similarly, any dose received by an MEI located at the Yakama Reservation boundary would essentially be zero. Since the impacts on the offsite population would be negligible, Alternative 1 would not pose disproportionately high and adverse impacts on minority and low-income populations due to normal operations. These impacts would be common to all FFTF Decommissioning alternatives.

Section 4.2.11.1.1 discusses the radiological impacts of airborne releases for facility accidents under Alternative 1. Examination of the risks shows that there would be essentially no LCFs per year for 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 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 would not be 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 minority or low-income populations. 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; 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 4.2.12.1 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. Because access to Hanford is restricted to the public, 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, and air quality.

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 radiologically contaminated produce and animal products.

Under this alternative, radiological impacts on the public from normal operations would be minimal. Impacts from deactivation activities would be the same as those described under the No Action Alternative in Section 4.2.13.1. For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the average individual dose to a member of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project is compared to the average individual dose to a member of the remainder of the population over the life of the project. These results are presented in Appendix J. There are no appreciable differences in cumulative average individual 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 of 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 maximum annual dose received by the MEI from the general population as a result of facility disposition activities would be about 3.0×10^{-8} millirem, which equates to no additional risk of an LCF. The dose to an MEI located at the boundary of the Yakama Reservation would be approximately two orders of magnitude lower than that of 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.

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 for 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 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 slightly exceeding the site boundary to the east of the 400 Area, but it would not be 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 minority or low-income populations. 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; 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 4.2.12.2.2.1 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 would not be 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the average individual dose to a member of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project is compared to the average individual dose to a member of the remainder of the population over the life of the project. There are no appreciable differences in cumulative average individual 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.

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 from 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 maximum annual dose to the offsite MEI from disposition of RH-SCs would be about 1.6×10^{-6} millirem, which equates to essentially no additional risk of an LCF. The dose to an MEI located at the boundary of the Yakama Reservation would be approximately one order of magnitude lower than that of 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 for facility accidents associated with disposition of RH-SCs at Hanford under the Entombment Alternative. Examination of the risks shows that the chance of an LCF in the offsite population would be low (approximately 2.6×10^{-5} per year). This risk includes 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to 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 from 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; 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 4.2.12.2.1.2 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 would not be 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the average individual dose to a member of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project is compared to the average individual dose to a member of the remainder of the population over the life of the project. There are no appreciable differences in cumulative average individual 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.

Section 4.2.10.2.1.2 discusses impacts on the offsite MEI located south-southeast of the MFC as a result of normal operations from 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 maximum annual dose to the offsite MEI from disposition of RH-SCs would be about 1.4×10^{-6} millirem, which equates to essentially no additional risk of an LCF. The dose to an MEI located at the boundary of the Fort Hall Reservation would be approximately two orders of magnitude lower than that of 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 for facility accidents associated with disposition of RH-SCs at INL under the Entombment Alternative. Examination of the risks shows that the chance of an LCF in the offsite population would be low (approximately 1.5×10^{-6} per year). This risk includes 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 radiological impacts from 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 from 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; 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 4.2.12.2.1.2 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 NTS, and caustic sodium hydroxide solution from INL to Hanford for product reuse under this option would not be 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the average individual dose to a member of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project is compared to the average individual dose to a member of the remainder of the population over the life of the project. There are no appreciable differences in cumulative average individual 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.

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 from 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 maximum annual dose to the offsite MEI from disposition of bulk sodium would be about 1.2×10^{-4} millirem, which equates to essentially no additional risk of an LCF. The dose to an MEI located at the boundary of the Yakama Reservation would be approximately one order of magnitude lower than that of 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 for facility accidents associated with disposition of bulk sodium at Hanford under the Entombment Alternative. Examination of the risks shows that the chance of an LCF in the offsite population would be low (approximately 3.5×10^{-9} per year). This risk includes 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to radiological impacts from 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 from 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; 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 4.2.12.2.1.3 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 would not be 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the average individual dose to a member of the minority, American Indian, Hispanic or Latino, and low-income populations over the life of the project is compared to the average individual dose to a member of the remainder of the population over the life of the project. The cumulative average individual dose to minority, American Indian, Hispanic or Latino, and low-income individuals slightly exceeds the cumulative average individual dose to the remainder of the population; however there are no appreciable differences in cumulative average individual 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.

Section 4.2.10.2.1.3 discusses impacts on the offsite MEI located south-southeast of the MFC as a result of normal operations from 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 maximum annual dose to the offsite MEI from disposition of bulk sodium would be about 4.5×10^{-5} millirem, which equates to essentially no additional risk of an LCF. The dose to an MEI located at the boundary of the Fort Hall Reservation would be approximately one order of magnitude lower than that of 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 for facility accidents associated with disposition of bulk sodium at INL under the Entombment Alternative. Examination of the risks shows that the chance of an LCF in the offsite population would be low (approximately 1.2×10^{-12} per year). This risk includes 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 radiological impacts from 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. Potential impacts under this option would be encompassed by those analyzed in Section 4.2.13.2.1 under facility disposition.

Air quality impacts from 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; 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 4.2.12.2.1.3 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, and caustic sodium hydroxide solution from INL back to Hanford for product reuse under this option would not be 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. Because access to Hanford is restricted to the public, 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, and air quality.

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 for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to radiological impacts from 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; 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 4.2.12.3.1.1 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 would not be 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 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 for facility disposition and 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 routine operations, deactivation, decommissioning, and disposition of the SRF, the SPF, and the RTP associated with the action alternatives and options and 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. Using a combination of on- and offsite capabilities, secondary MLLW would be treated to meet an 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 (408,186 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 related to facility disposition activities or treatment facility construction, operations, or deactivation 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 would be generated by FFTF facility 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 is 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 and 100 years of administrative controls of the FFTF complex.

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 4–126 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 4–126. 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	1,699	N/A	1,699	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	622,925	N/A	622,925	2008–2017	6,229
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	181,699	N/A	181,699	2017	181,699
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	323,788	N/A	323,788	2013–2014	161,894
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 4–126. 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	10	N/A	N/A	10	2017–2018	5
Mixed low-level radioactive waste	1	N/A	399	N/A	400	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; N/A=not applicable; RH-SCs=remote-handled special components.

Source: SAIC 2007b, 2008.

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 at a new RTP. Treated components would be returned to Hanford or sent to NTS for disposal, where they would be placed within 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 300,000 gallons [1.14 million liters]) 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. Two options are 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 made to the current facility. Construction, operations, and deactivation of the modifications would generate a small amount of waste.

Table 4–126 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 that 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 since 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 are identical to those of 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 are the same under this alternative as 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 are identical to those of 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 are the same under this alternative as under the Entombment Alternative, as discussed under the Idaho Reuse Option in Section 4.2.14.2.4.

Table 4–126 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 TRC of illness, injury and death. This section addresses potential impacts of illness, injury, and death 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 the referenced incidence rates and the projected labor hours for the FFTF Decommissioning alternatives and related options, occupational safety impacts associated with each of the alternatives and options were determined and are tabulated in Table 4–127. The number of cases associated with alternatives having less construction activities could be slightly overstated. Conversely, alternatives having a larger component of construction activity (e.g., Alternative 2, facility disposition, and disposition of RH-SCs, Idaho Option) could be slightly understated.

As shown in Figure 4–29, the greatest industrial safety impacts are associated with alternatives having the greatest number of labor hours.

Table 4–127. FFTF Decommissioning Alternatives – Industrial Safety Impacts

Alternative	Labor Category	Million Labor Hours	Total Recordable Case Rate per 100 Workers per Year	Projected Total Recordable Cases	Fatality Rate per 100,000 Workers per Year	Projected Fatalities
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
1 Total		0.042		0.42		0.00005
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
2 Total		0.81		8.10		0.001
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
3 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
Hanford Option Total		0.47		4.70		0.0006
Disposition of RH-SCs: Idaho Option	Construction	0.30	1.5	2.25	0.26	0.0004
	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
Idaho Option Total		0.42		3.15		0.0005
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
Hanford Reuse Option 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
Idaho Reuse Option 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: RH-SCs=remote-handled special components.

Source: Labor hours compiled from Appendix I.

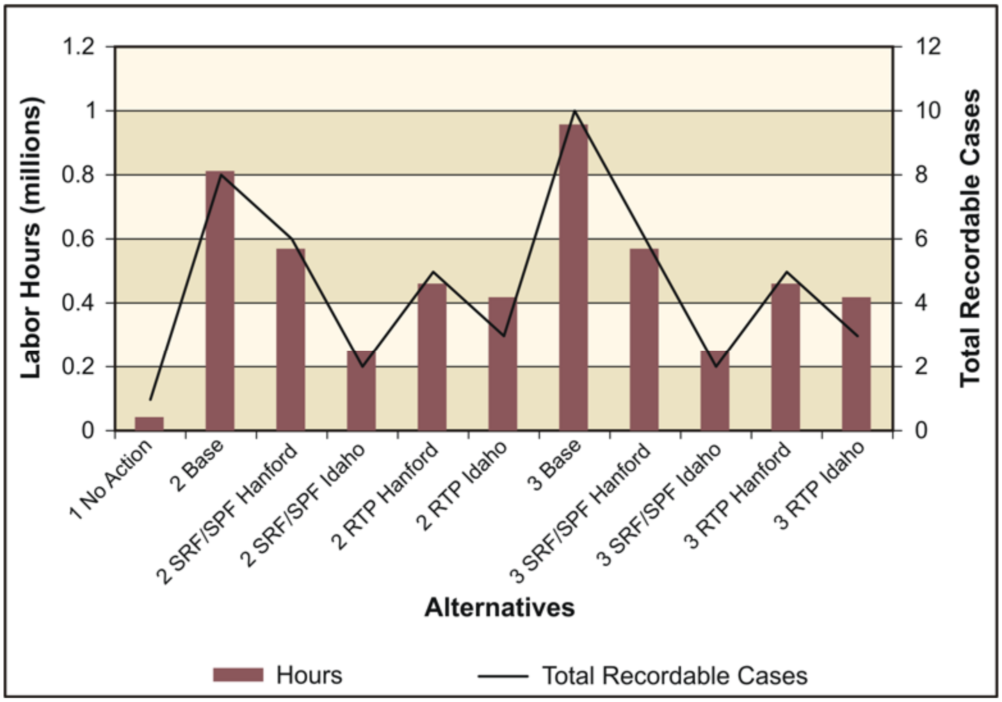


Figure 4–29. Total Recordable Cases and Labor Hours by Alternative

4.2.15.1 Alternative 1: No Action

Approximately one TRC and no fatalities are projected. Work under this alternative includes administrative controls for 100 years.

4.2.15.2 Alternative 2: Entombment

4.2.15.2.1 Facility Disposition

Completing the work identified in 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 are projected. No fatalities are projected.

IDAHO OPTION

Approximately three TRCs are projected over the period this work is conducted. No fatalities are anticipated during this time period.

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. It is anticipated that approximately six TRCs will be generated during this alternative. No fatalities are projected during any phase of this alternative.

IDAHO REUSE OPTION

This option would require the 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 for this option. To calculate the number of potential TRCs, the rate for Idaho operations averaged 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

It is anticipated there would be no more than 10 TRCs for work conducted under this alternative. No fatalities are projected for the same period.

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 under Section 4.2.15.2.2 for the Hanford Option.

IDAHO OPTION

Industrial safety consequences from implementation of this option would be the same as those discussed under Section 4.2.15.2.2 for 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 under Section 4.2.15.2.3 for the Hanford Reuse Option.

IDAHO REUSE OPTION

Industrial safety consequences from implementation of this option would be the same as those discussed under Section 4.2.15.2.3 for the Idaho Reuse Option.

4.3 WASTE MANAGEMENT ALTERNATIVES

This section of Chapter 4 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 as 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 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 onsite and offsite wastes; this section also includes analysis of associated storage, disposal, and closure activities as well as facility-specific construction, operations, deactivation, and closure activities.

Three Waste Management alternatives are considered and analyzed, including (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, 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, and 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 waste, waste management, and offsite waste from other DOE sites would be disposed of at IDF-East. A new RPPDF would be provided for disposal of equipment and soils that are not highly contaminated but result from tank farm clean closure activities.

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 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 waste, waste management, 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 groupings are analyzed: Disposal Group 1, Disposal Group 2, and Disposal Group 3. These disposal groupings encompass the sizing requirements and associated construction, operations, and closure requirements for the IDF(s) and RPPDF 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 upon closure of any of these facilities or trenches. Thus, there would be no change in land use within the 200 Areas under this alternative. Since this alternative would not require that geologic material 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 associated with the No Action Alternative within the 200 Areas, and barriers would not be used upon 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 from 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 allowed to naturally return over time. 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 at the T Plant, a new CWC storage facility, and two expansions of WRAP (both 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 as 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 those associated with 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 combinations of alternatives. 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). Since 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, along with land requirements for IDF-East and the RPPDF, are addressed below. Since Borrow Area C has been designated Conservation (Mining), use of the area for this purpose would be inconsistent 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, in order to support activities under this disposal grouping, 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 the modified RCRA Subtitle C barrier, for 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 requirement 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 requirement 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 barrier over IDF-East and the RPPDF would require an additional 7.7 hectares (19 acres) of land, for a total land commitment of approximately 409 hectares (1,010 acres).

4.3.1.2.2 Visual Resources

Since 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 from 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 allowed to naturally return over time. 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 a modified RCRA Subtitle C barrier over both IDF-East and the RPPDF. Their barriers would be slightly larger than the disposal sites and would be 2.7 meters (9 feet) high. The area would be revegetated with native grasses, thus improving its postclosure appearance.

To supply geologic material under this disposal group, 41.7 hectares (103 acres) within 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 pre-disturbance setting.

4.3.1.2.2.2 Disposal Groups 2 and 3

Disposal Groups 2 and 3 would require that 240 hectares (592 acres) of undeveloped land be used 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 a modified RCRA Subtitle C barrier over both facilities. Their barriers would be slightly larger than the disposal sites and would be about 2.7 meters (9 feet) high. The area would be revegetated with native grasses, thus improving its 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 I 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, since all work would take place within the area designated as Industrial-Exclusive, there would be no change in land use under this alternative.

Also, 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 not be in conformity 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) within 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 with a modified RCRA Subtitle C barrier would require an additional 15 hectares (37 acres) of land, for 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, Borrow Area C would need to be 157 hectares (388 acres) 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 under either of these disposal groups. Final closure of the disposal facilities with a modified RCRA Subtitle C barrier would require an additional 12.5 hectares (31 acres) of land, for a total land commitment of approximately 413 hectares (1,020 acres).

4.3.1.3.2 Visual Resources

Impacts on the visual environment from 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 is the case 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 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, 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 the amount 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, 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 Waste Management alternatives and associated disposal groupings 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 disposal group as well as for applicable component project phases (e.g., 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 groupings under each action alternative, utility infrastructure demands would vary primarily in direct relation to the size, number, and required lifespan of disposal facilities (i.e., the IDF(s) and RPPDF) that would be constructed, operated, and ultimately closed under each disposal scenario.

Key underlying assumptions used in projecting utility infrastructure demands for each of the Waste Management alternatives and disposal groups are similar to those described in Section 4.1.2 for the Tank Closure alternatives. For example, it has been assumed for the purposes of analysis 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.

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 4–128 summarizes the projected utility infrastructure resource requirements for the Waste Management alternatives and associated disposal groups. Projected demands for key utility infrastructure resources and impacts on the respective utility systems from implementation of each of the alternatives and disposal groups are further discussed in the following sections.

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 4–128). This demand is negligible compared to the 1.74 million megawatt-hour annual capacity (based on a peak load capacity of 199 megawatts) of the Hanford electric 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 associated with ongoing operations of the LLBGs coinciding with deactivation of IDF-East. Gasoline consumption would not peak until 2036 and is projected to remain constant at 0.012 million liters (0.003 million gallons) annually, associated with mobile equipment operations during the 100-year postclosure care period for the LLBGs. 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.

Table 4–128. 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)
Alternative 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)
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)

Table 4–128. 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 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-generated waste through facility deactivation.
[d] Disposal Groupings 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 2007c.

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 associated with 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 is 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 4–128).

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 (6.3 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 4–128). For facility construction, it is 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 demand is 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, as 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 with a modified RCRA Subtitle C barrier. 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 Section 4.3.2.2.1.1 for Alternative 2, Disposal Group 1.

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 under Section 4.3.2.2.1.1. Otherwise, activities under this Alternative 2 disposal grouping 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 discussed under Alternative 2, Disposal Group 2 (see Section 4.3.2.2.1.2 and Table 4–128), 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 groupings 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 groupings. 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 4–128) with total and peak electrical requirements under Alternative 3, Disposal Group 1, the same as 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 with 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 4–128) with total and peak electrical requirements under Alternative 3, Disposal Group 2, the same as 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 in 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 4–128), with total and peak electrical requirements under Alternative 3, Disposal Group 3, the same as previously described under Alternative 2, Disposal Group 1 (see Section 4.3.2.2.1.1). Nonetheless, activities under this Alternative 3 disposal grouping 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 are projected to be the same as discussed under Alternative 3, Disposal Group 2 (see Section 4.3.2.3.1.2), but peak demands would be shifted to the 2166–2167 timeframe (see Table 4–128).

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 from employee vehicles, trucks, construction equipment, generators, and other equipment as compared to 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. Heavy diesel equipment used for construction and closure 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 15.2 meters (50 feet), the contribution to the sound level at the nearest site boundary would be 21 dBA (SAIC 2007c). If the equipment operates 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 limitation of 60 dBA for industrial sources impacting residential receptors (WAC 173-60). Noise levels from deactivation, construction, operations, and closure are expected to be less than those from this construction activity.

Some disturbance of wildlife near the 200 Areas could occur as a result of noise from construction-type activities during construction, operations, deactivation, and closure, 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 for various phases of waste management activities will vary over the duration of the project and by alternative. The increase in the number of employee vehicle and truck trips is discussed below for each alternative.

Activities at Hanford associated with the Waste Management alternatives that 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 that have been identified to have impacts on this facility are activities in which heavy vehicles or large construction equipment are 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, impacts of this type of activity associated with these 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 of less than 1 dBA in traffic noise levels 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 2007c). 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 among 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).

4.3.3.2 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 Solid Waste Operations Complex (SWOC) WRAP facility 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 for Alternative 1 (see Section 4.3.3.1). The highest number of employee trips is expected to occur in various years due to RPPDF and IDF-East closure.

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 2019–2050 from SWOC WRAP (SAIC 2007c). 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 for Alternative 1 (see Section 4.3.3.1). The highest number of employee trips is expected to occur in various years due to RPPDF closure under Disposal Groups 2 and 3 due to 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 of 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 associated with 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 4–129 and compared with the ambient standards. The maximum concentrations that would result from these activities for each alternative would be below the ambient standards except the annual standard for concentrations of PM under Disposal Groups 1, 2, and 3 and the 24-hour standard under all alternatives and disposal groups. The peak period identified for 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 include general construction equipment activity and windblown particulate from disturbed areas, resuspension of road dust, and fuel combustion in construction equipment.

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.

Table 4–129. Incremental Criteria Pollutant Concentrations by Waste Management Alternative at Hanford

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]	70.6	2,240	7,880	**41,200**	**41,200**	2,240	8,190	**41,000**	**41,000**
1-hour	40,000[b]	451	12,200	**49,800**	**257,000**	**257,000**	12,200	**51,200**	**256,000**	**256,000**
Nitrogen Dioxide										
Annual	100[b]	1.24	3.47	19.2	92.1	92.1	3.47	20.1	92.0	92.0
PM_{10}[c]										
Annual	50[d]	4.54	3.93	27.1	**128**	**128**	4.59	27.2	**128**	**128**
24-hour	150[b]	**507**	**717**	**3,360**	**17,200**	**17,200**	**717**	**3,420**	**17,300**	**17,300**
Sulfur Dioxide										
Annual	50[d]	0.000442	0.00826	0.0380	0.182	0.182	0.00826	0.0388	0.181	0.181
24-hour	260[d]	0.048	1.29	4.70	24.5	24.5	1.29	4.88	24.4	24.4
3-hour	1,300[b]	0.254	6.36	23.7	120	120	6.36	24.5	120	120
1-hour	660[d]	0.705	16.5	68.4	353	353	16.5	70.5	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, 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 equal to or less than 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.

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 purposes of analysis, concentrations are assumed to be the same as PM_{10}.

d 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; Hanford=Hanford Site; 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 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 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-sized projects in nonattainment areas. Hanford is within an area currently designated as 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 51.850–51.860).

Both carcinogenic and noncarcinogenic toxic pollutant concentrations were evaluated. The exposure of members of the public to airborne pollutants would be from process emissions released during operations and from equipment used during construction and operations. Selected air toxics were modeled because they are representative of 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 4–130. 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 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 the alternative. A Hazard Index of less than 1.0 indicates that adverse health effects of non-cancer-causing agents are not expected. Hazard Indices for each alternative are summarized in Table 4–131. For carcinogens, the highest annual concentration was used to estimate the increased cancer risk from a chemical. Cancer risks from nonradiological toxic pollutant emissions for each alternative are summarized in Table 4–132.

Table 4–130. Incremental Toxic Chemical Concentrations by Waste Management Alternative at Hanford

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	100	0.210	0.874	3.84	20.0	20.0	0.874	4.09	20.0	20.0
Benzene	Annual	0.12	0.000264	0.00116	0.00698	0.0334	0.0334	0.00116	0.00721	0.0334	0.0334
1,3-Butadiene	Annual	0.0036	0.0000110	0.0000605	0.000182	0.000872	0.000872	0.0000605	0.000190	0.000871	0.000871
Formaldehyde	Annual	0.077	0.000332	0.00223	0.00600	0.0288	0.0288	0.00223	0.00625	0.0287	0.0287
Mercury	24-hour	0.17	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Toluene	24-hour	400	0.0265	1.84	6.00	31.2	31.2	1.84	6.20	31.1	31.1
Xylene	24-hour	1,500	0.00973	0.526	1.78	9.27	9.27	0.526	1.84	9.25	9.25

[a] WAC 173-460.

Key: DG=Disposal Group; Hanford=Hanford Site; T&S=treatment and storage.

Source: Appendix G, Section G.3.

Table 4–131. Nonradiological Airborne Toxic Chemical Hazard Index for the Nearest Noninvolved Worker by Waste Management Alternative at Hanford

Chemical	Hazard Quotient								
	Alternative 1	Alternative 2				Alternative 3			
		T&S	DG1	DG2	DG3	T&S	DG1	DG2	DG3
Ammonia	1.19×10^{-3}	5.45×10^{-3}	2.00×10^{-2}	8.08×10^{-2}	8.08×10^{-2}	5.45×10^{-3}	2.34×10^{-2}	8.54×10^{-2}	8.53×10^{-2}
Mercury	0	0	0	0	0	0	0	0	0
Toluene	3.25×10^{-6}	1.07×10^{-4}	4.82×10^{-4}	1.94×10^{-3}	1.94×10^{-3}	1.07×10^{-4}	4.80×10^{-4}	1.95×10^{-3}	1.95×10^{-3}
Xylene	7.50×10^{-5}	1.63×10^{-3}	7.27×10^{-3}	2.93×10^{-2}	2.93×10^{-2}	1.63×10^{-3}	7.32×10^{-3}	2.95×10^{-2}	2.95×10^{-2}
Hazard Index	1.27×10^{-3}	7.18×10^{-3}	2.78×10^{-2}	1.12×10^{-1}	1.12×10^{-1}	7.18×10^{-3}	3.12×10^{-2}	1.17×10^{-1}	1.17×10^{-1}

Key: DG=Disposal Group; Hanford=Hanford Site; T&S=treatment and storage.
Source: Appendix G, Section G.3.

Table 4–132. Nonradiological Airborne Toxic Chemical Cancer Risk for the Nearest Noninvolved Worker by Waste Management Alternative at Hanford

Chemical	Cancer Risk								
	Alternative 1	Alternative 2				Alternative 3			
		T&S	DG1	DG2	DG3	T&S	DG1	DG2	DG3
Benzene	1.30×10^{-7}	7.63×10^{-7}	3.18×10^{-6}	1.28×10^{-5}	1.28×10^{-5}	7.63×10^{-7}	3.51×10^{-6}	1.33×10^{-5}	1.33×10^{-5}
1,3-Butadiene	2.02×10^{-8}	1.07×10^{-7}	3.49×10^{-7}	1.41×10^{-6}	1.41×10^{-6}	1.07×10^{-7}	4.06×10^{-7}	1.49×10^{-6}	1.48×10^{-6}
Formaldehyde	2.66×10^{-7}	1.58×10^{-6}	4.89×10^{-6}	1.97×10^{-5}	1.97×10^{-5}	1.58×10^{-6}	5.63×10^{-6}	2.07×10^{-5}	2.07×10^{-5}

Key: DG=Disposal Group; Hanford=Hanford Site; 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 4–129. The peak concentrations occur in 2009 for all criteria pollutants. The peak period concentration would result primarily from IDF deactivation activities. The period of PM_{10} exceeding the 24-hour standard occurs in 2009. The periods of $PM_{2.5}$ exceeding the 24-hour standard extend 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 4–130. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–131 and 4–132.

Criteria pollutant concentrations from activities under Waste Management Alternative 2 treatment and storage and activities related to the three disposal groups are presented in Table 4–129. The peak concentrations occur from 2011–2012 for carbon monoxide and sulfur dioxide, from 2013–2018 for nitrogen dioxide, and from 2019–2050 for PM under Alternative 2 (treatment and storage). The peak period concentration for 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. The period during which PM_{10} exceeds the 24-hour standard would occur from 2011 through 2050. The period of $PM_{2.5}$ exceeding the 24-hour standard would occur from 2011 through 2051. Figure 4–31 shows the 24-hour PM_{10} concentrations over the project duration and the contribution of major activities.

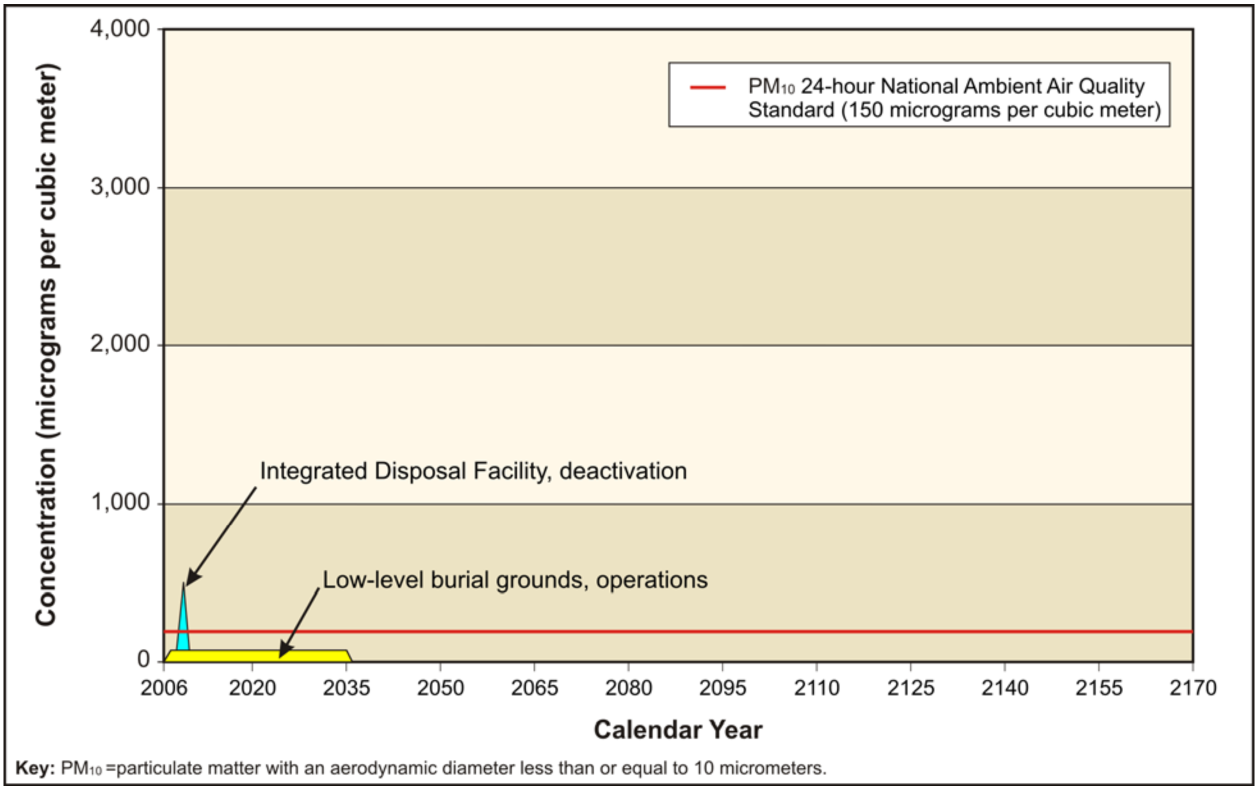


Figure 4–30. Waste Management Alternative 1 PM_{10} Maximum 24-hour Concentration

4.3.4.2 Alternative 2: Disposal in IDF, 200-East Area Only

For Disposal Group 1, the peak concentrations occur from 2051–2052 for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and from 2019–2021 for PM. The peak period concentration for 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. The period during which PM_{10} and $PM_{2.5}$ exceed the 24-hour standard would occur from 2006 through 2052. Figure 4–32 shows the 24-hour PM_{10} concentrations over the project duration and the contribution of major activities.

For Disposal Group 2, the peak concentrations occur from 2101–2102 for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and from 2019–2021 for PM. The 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. The period during which PM_{10} and $PM_{2.5}$ exceed the 24-hour standard would occur from 2006 through 2102. Figure 4–33 shows the 24-hour PM_{10} concentrations over the project duration and the contribution of major activities.

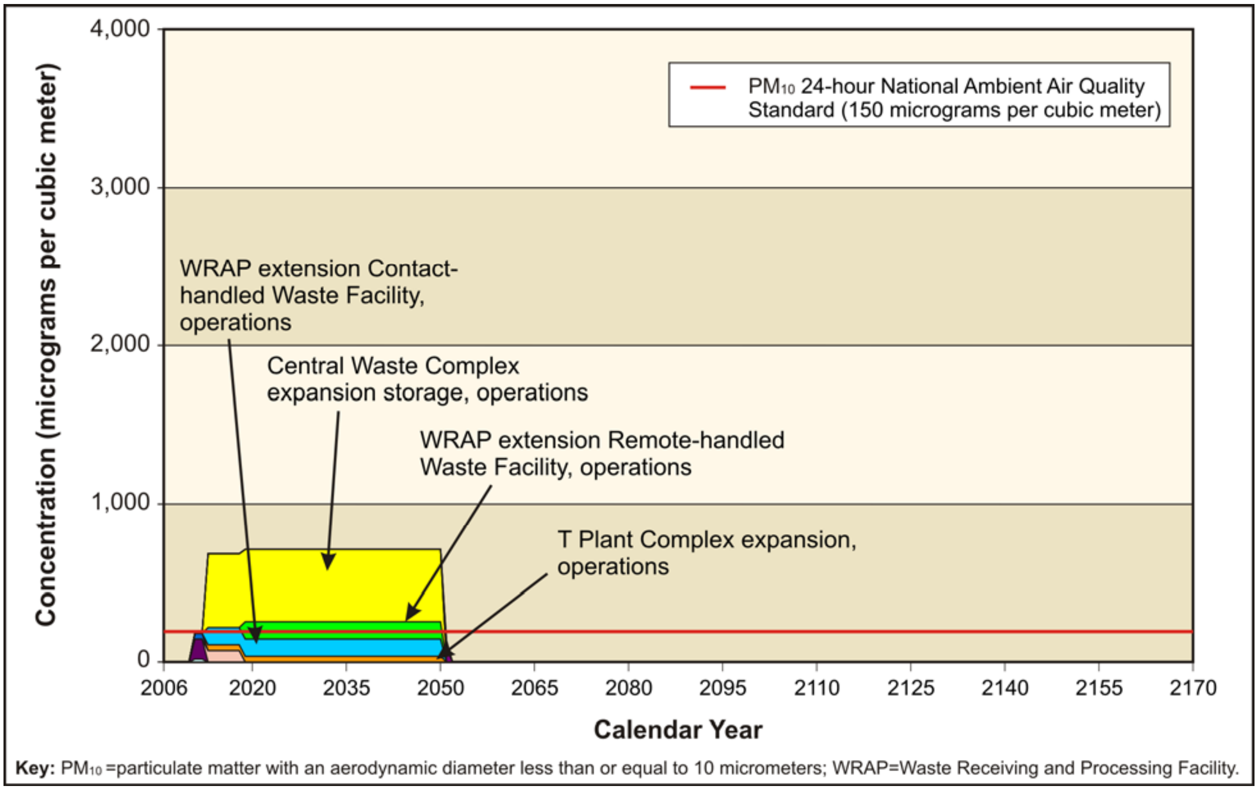


Figure 4–31. Waste Management Alternative 2 (Treatment and Storage) PM_{10} Maximum 24-hour Concentration

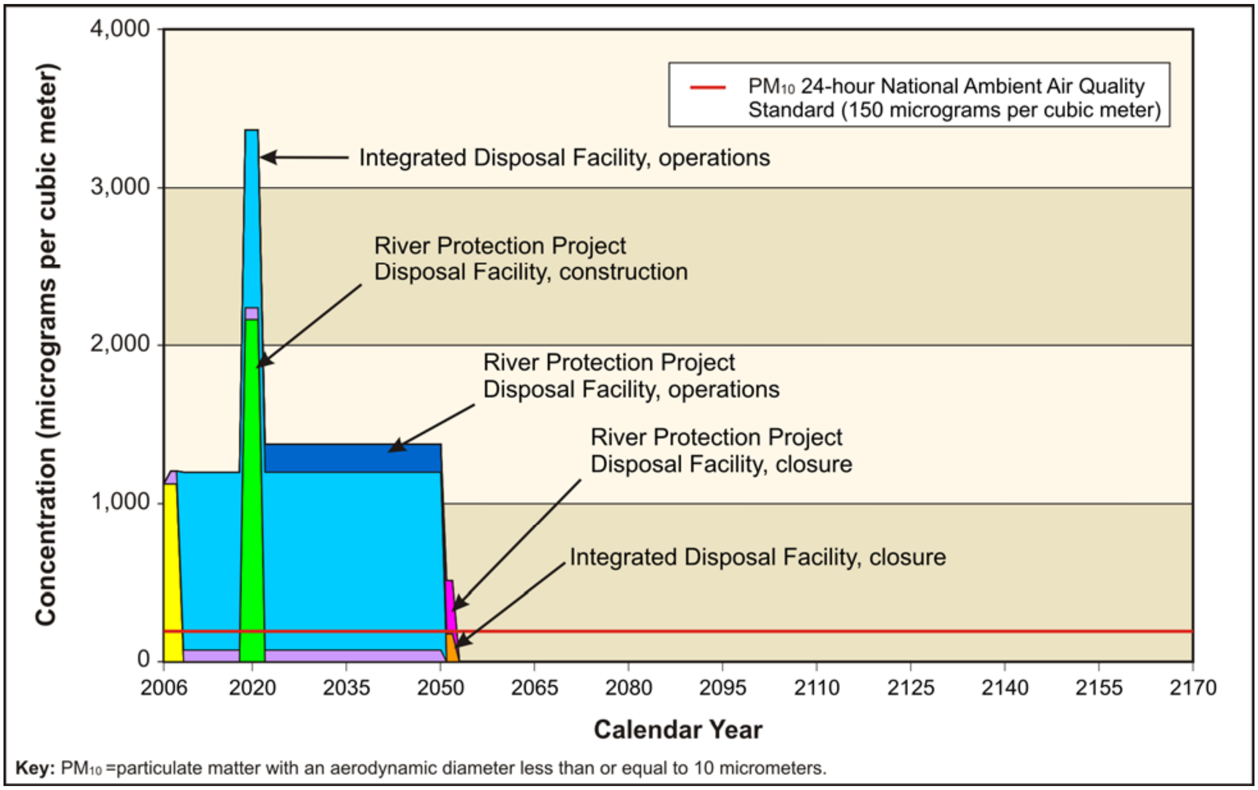


Figure 4–32. Waste Management Alternative 2, Disposal Group 1, PM_{10} Maximum 24-hour Concentration

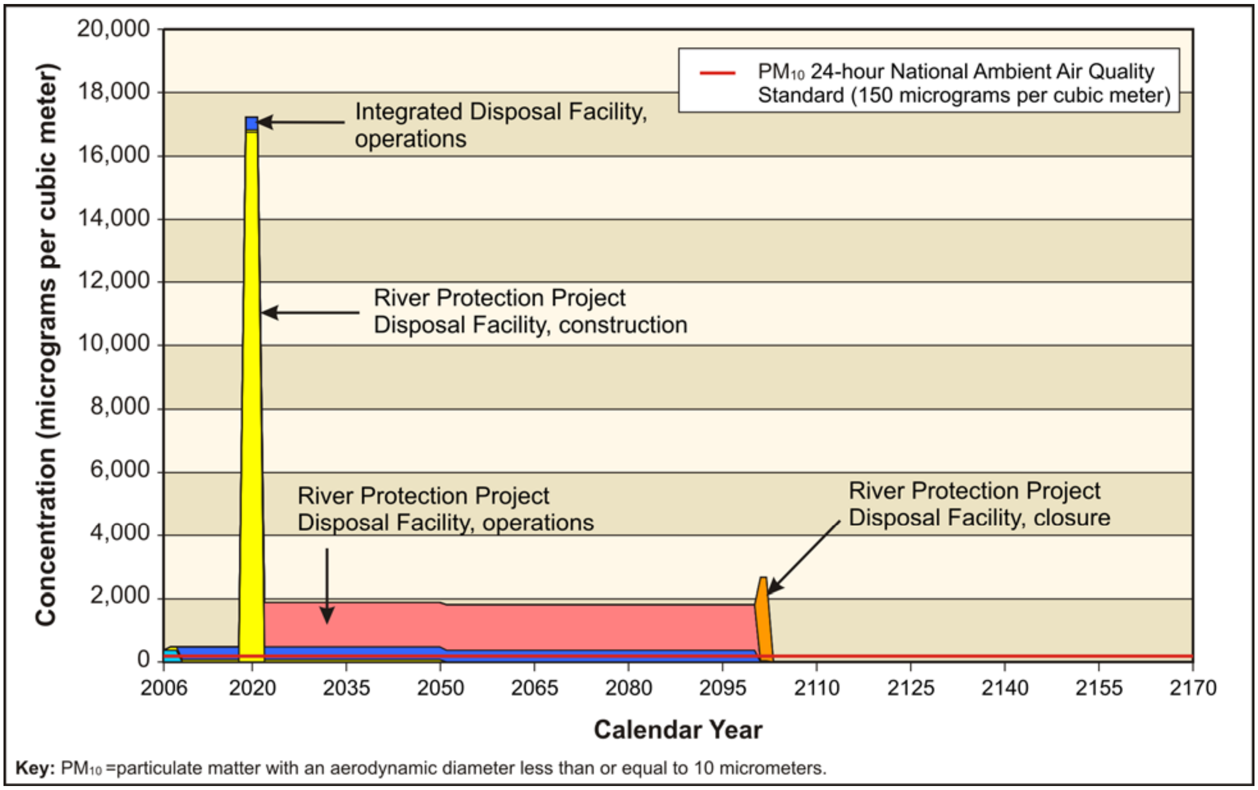


Figure 4–33. Waste Management Alternative 2, Disposal Group 2, PM_{10} Maximum 24-hour Concentration

For Disposal Group 3, the peak concentrations occur from 2166–2167 for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and from 2019–2021 for PM. The peak concentrations would result from the same activities as Disposal Group 2. The period during which PM_{10} and $PM_{2.5}$ exceed the 24-hour standard would occur 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 4–130. The guidelines would not be exceeded. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–131 and 4–132.

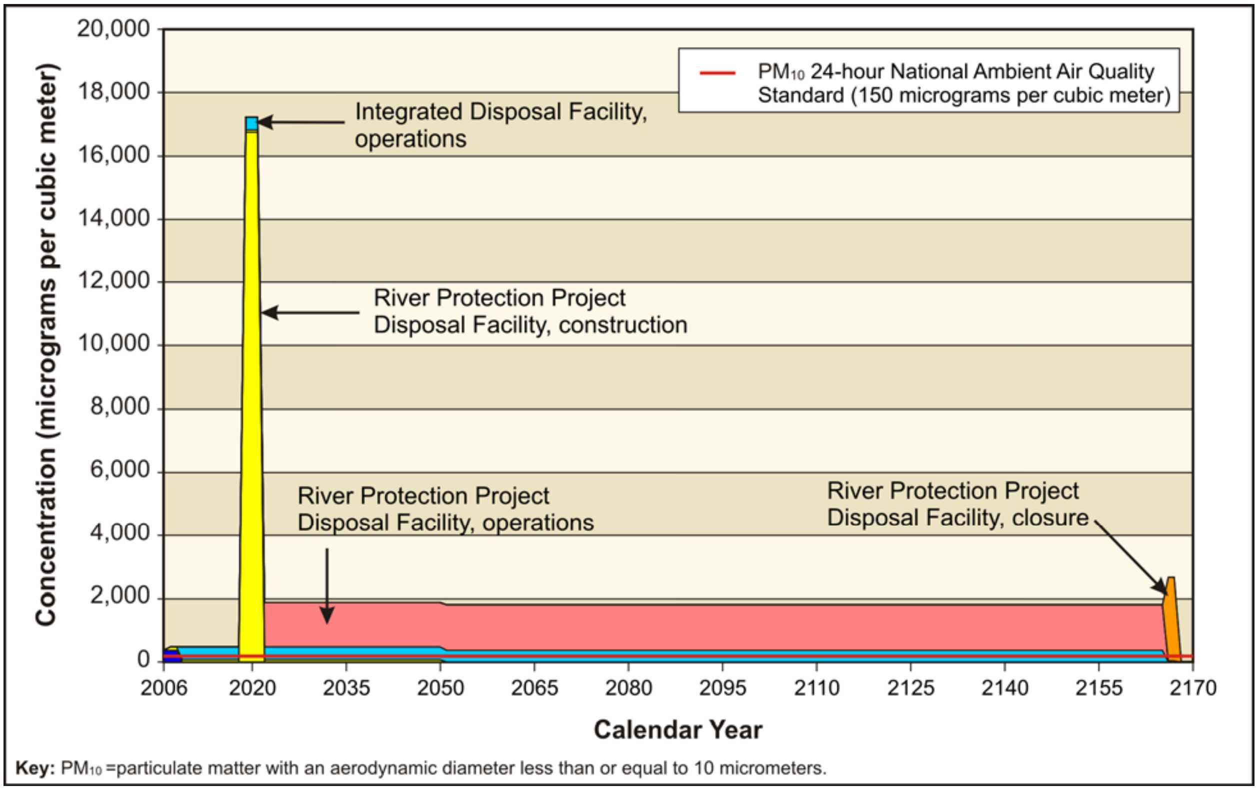


Figure 4–34. Waste Management Alternative 2, Disposal Group 3, PM_{10} Maximum 24-hour Concentration

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 4–129. The peak concentrations occur in the same years and arise from the same activities as Waste Management Alternative 2, treatment and storage and Disposal Groups 2 and 3. The period during which PM_{10} exceeds the 24-hour standard would occur for the same durations as 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.

For Disposal Group 1, the peak concentrations occur from 2051–2052 for carbon monoxide, nitrogen dioxide, and sulfur dioxide, and from 2019–2021 for PM. 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 4–130. The guidelines would not be exceeded. Hazardous chemical health effects on noninvolved workers are summarized in Tables 4–131 and 4–132.

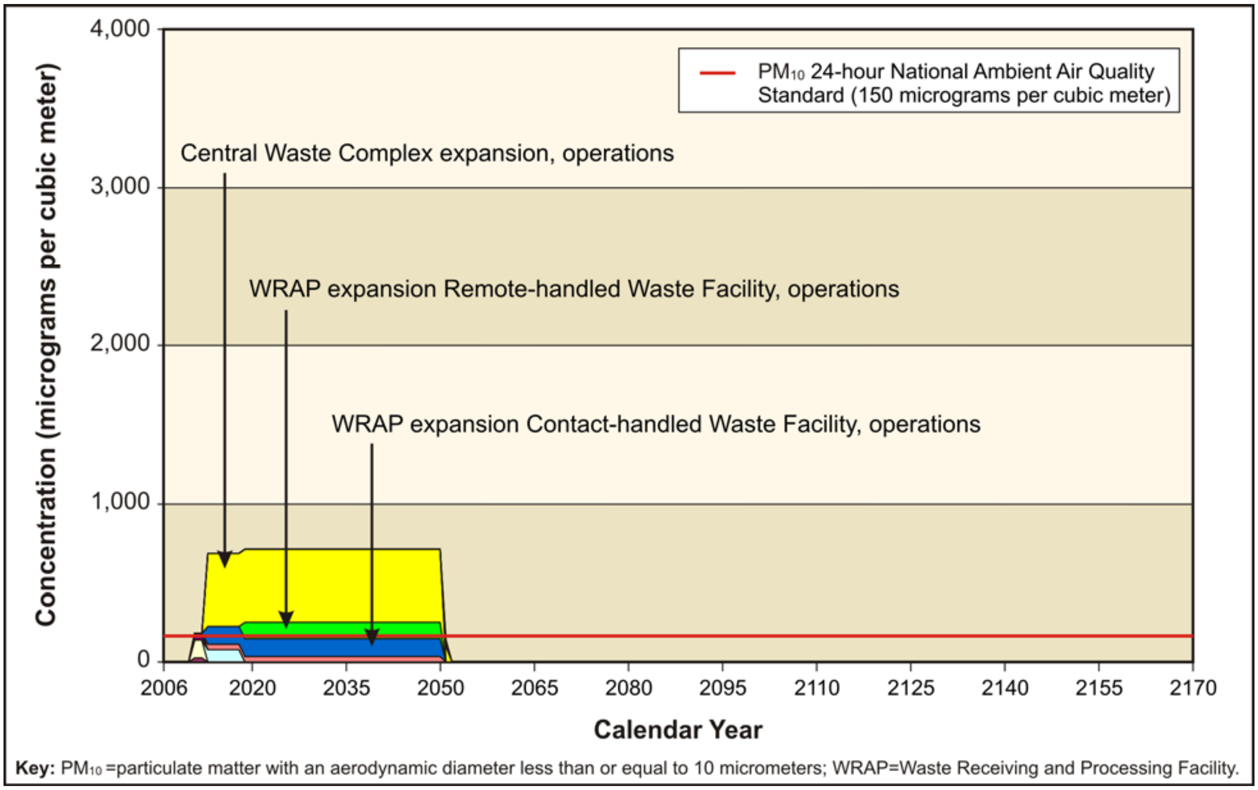


Figure 4–35. Waste Management Alternative 3 (Treatment and Storage) PM_{10} Maximum 24-hour Concentration

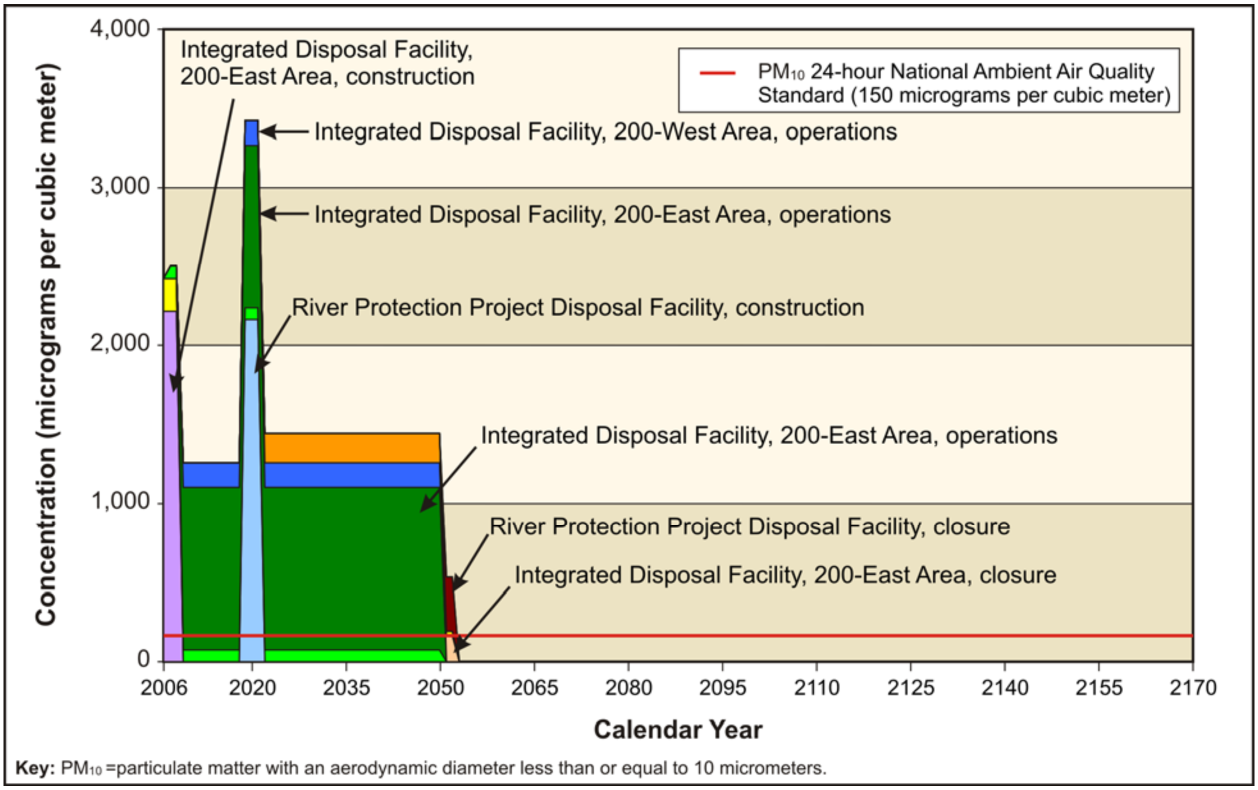


Figure 4–36. Waste Management Alternative 3, Disposal Group 1, PM_{10} Maximum 24-hour Concentration

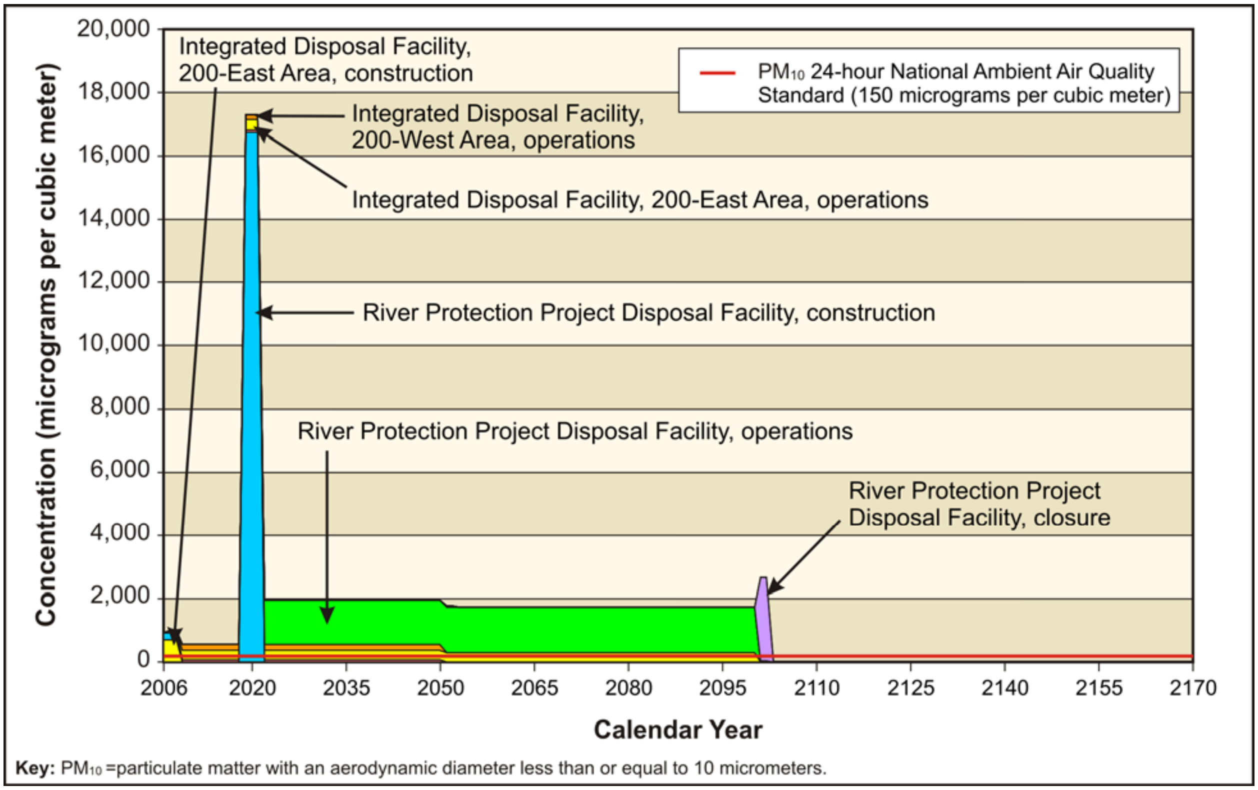


Figure 4–37. Waste Management Alternative 3, Disposal Group 2, PM_{10} Maximum 24-hour Concentration

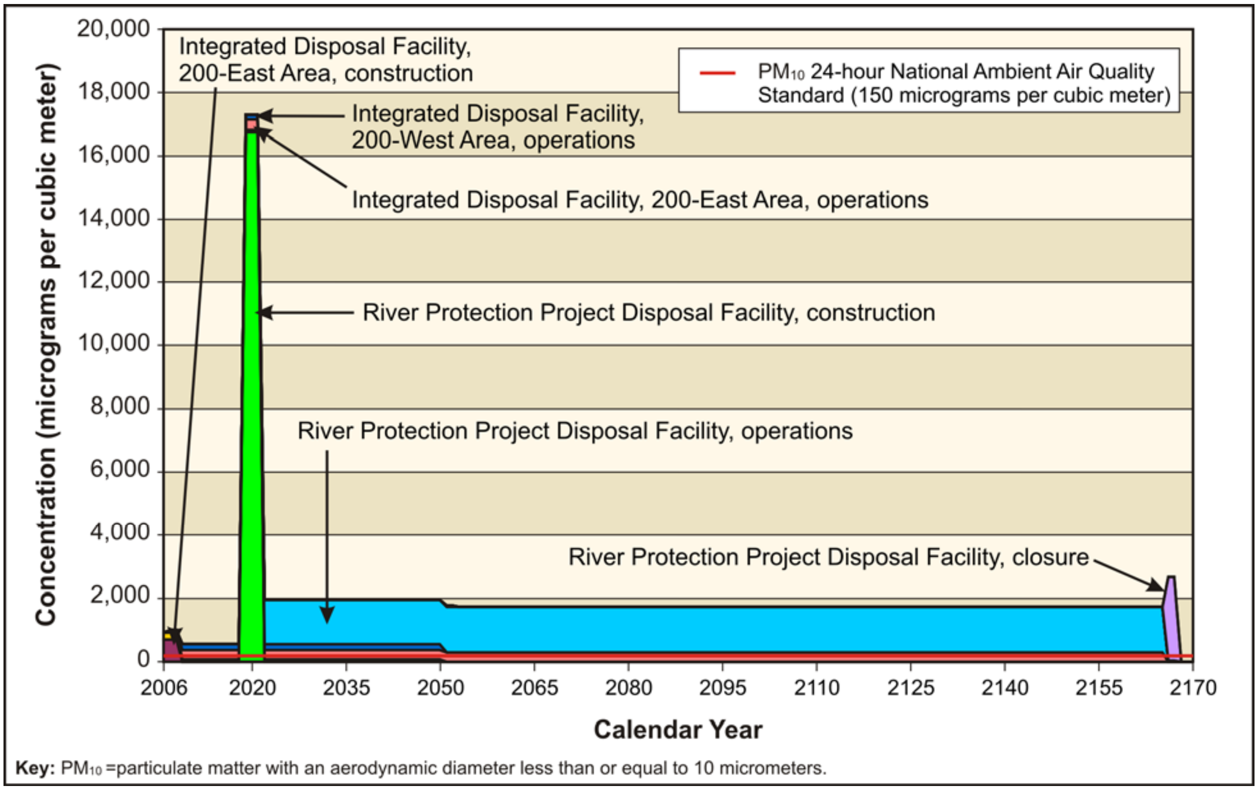


Figure 4–38. Waste Management Alternative 3, Disposal Group 3, PM_{10} Maximum 24-hour Concentration

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, operations, deactivation, and closure associated with waste management treatment, storage, and waste 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 4–133 for each of the Waste Management alternatives and disposal groupings. In general, Hanford waste treatment and storage activities and commensurate geologic resource requirements would be identical for Alternatives 2 and 3. For the three disposal groupings 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 disposal facilities (i.e., the IDF[s] and RPPDF) that would be constructed, operated, and ultimately closed under each disposal scenario. For disposal facility operations, it has been assumed that uncontaminated soils and sediments excavated during facility construction would typically be stockpiled on site for backfill or for other uses. Other key underlying assumptions regarding analysis of potential environmental impacts on geology and soils and the acquisition and use of geologic resources are similar to those described in Section 4.1.2 for 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 4–133). 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 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 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. 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 and for the evaluation, modification, and upgrade of existing structures, systems, and components so that DOE facilities safely withstand the effects of natural phenomena hazards, such as earthquakes. An analysis of potential effects of a beyond-design-basis earthquake on existing facilities and activities under this alternative and the potential consequences on human health and the environment is provided in Section 4.3.11.1.

Table 4–133. Waste Management Alternatives – Summary of Major Geologic and Soil Resource Impact Indicators and Requirements

Parameter/ Resource	Alternatives and Disposal Groupings							
	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	104	398	398	98.7	397	397
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 in 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 2007c.

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 serve to 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 4–133). 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.

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 have been evaluated. As stated in DOE Order 420.1B, DOE 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. DOE Standard 1020-2002 implements DOE Order 420.1B and provides criteria for the design of new structures, systems, and components and for the evaluation, modification, and upgrade of existing structures, systems, and components so that DOE facilities safely withstand the effects of natural phenomena hazards, such as earthquakes. An analysis of 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 is provided in Section 4.3.11.2.1.

4.3.5.2.1 Disposal Group 1

Excavation work associated with constructing an expanding 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 as 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 in constructing drainage layers 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 in 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 serve to 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 as the areas would either lie within the footprint of the completed structures or the temporarily disturbed areas would have been 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 is also used as operational cover of emplaced waste, until 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, and 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 64.5 hectares (159 acres), slightly larger than the footprints of 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 in the region and at Hanford. However, relatively large quantities of geologic resources would be required, as described, to support facility construction and, most substantially, to construct engineered barriers to effect final landfill closure of IDF-East and the RPPDF. Total geologic resource requirements for Alternative 2, Disposal Group 1, are projected to be 1,980,000 cubic meters (2,590,000 cubic yards) (see Table 4–133). 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.

Design consideration of hazards with the potential to affect new and existing facilities under this alternative case from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions would be substantially the same as those described in Section 4.3.5.2. An analysis of potential effects of a beyond-design-basis earthquake affecting the disposal facilities and related activities and the potential consequences on human health and the environment is 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 above in Section 4.3.5.2.1 for Alternative 2, Disposal Group 1. Under this alternative and disposal grouping, the RPPDF that would be 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 grouping would only be about one-third of the size of that constructed under Alternative 2, Disposal Group 1. On the whole, the total scale of direct impacts associated with new facility disposal construction would be greater under this disposal grouping. 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 in Section 4.3.5.2.1 for Alternative 2, Disposal Group 1. An additional 159 hectares (392 acres) would also be excavated in Borrow Area C, for 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 with 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 for 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 4–133). 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**.

4.3.5.2.3 Disposal Group 3

Direct impacts on geology and soils from disposal facility construction, operations, and closure and 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 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 **Section 4.3.5.2** for Waste Management Alternative 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 in Section 4.3.5.2.1 for Alternative 2, Disposal Group 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 operation of the two IDFs under this alternative and disposal group would be the same as that associated with the single IDF under Alternative 2, Disposal Group 1. Elements associated with construction and operation of the RPPDF under this alternative group and disposal operations in LLBG 218-W-5 would likewise be identical to Alternative 2, Disposal Group 1 (see Section 4.3.5.2.1). In total, the two IDFs and new

RPPDF would occupy about 61.8 hectares (153 acres) of land. Following completion of disposal activities in the IDF(s) and RPPDF, each facility would be closed with 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 in Borrow Area C, for 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 1,760,000 cubic meters (2,302,000 cubic yards), with the demand mainly driven by construction of the engineered barriers for landfill closure of the two IDFs and RPPDF (see Table 4–133). 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.

Design consideration of hazards with the potential to affect new and existing facilities under this alternative case from large-scale geologic conditions (such as earthquakes) and site-specific geologic conditions would be substantially the same as those described in Section 4.3.5.2. An analysis of potential effects of a beyond-design-basis earthquake affecting the disposal facilities and related activities and the potential consequences on human health and the environment is 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 referenced above in Section 4.3.5.3.1 for Alternative 3, Disposal Group 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 only be about one-third of the size of those constructed under Alternative 3, Disposal Group 1. On the whole, the total scale of direct impacts associated with new facility disposal construction would be greater under this disposal grouping. In total, the completed facilities would occupy about 240 hectares (593 acres) of land.

IDF-East and the RPPDF would operate until 2100, while IDF-West would operate until 2050 under this alternative and disposal grouping. Disposal operations in LLBG 218-W-5 would be identical to those described in Section 4.3.5.2.1 and for Alternative 2, Disposal Group 1. An additional 157 hectares (388 acres) would also be excavated in Borrow Area C, for 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 with 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 for Alternative 3, Disposal Group 2, are projected to be 7,550,000 cubic meters (9,880,000 cubic yards), with the demand largely driven by construction of the engineered barriers (see Table 4–133). 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.

4.3.5.3.3 Disposal Group 3

Direct impacts on geology and soils from disposal facility construction, operations, and closure and 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 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 with a barrier upon the cessation of waste disposal, it would be subject to a 100-year postclosure care period, to 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, and 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 is low. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulch) and spill prevention and waste management practices would be employed to minimize suspended sediment and other deleterious material transport and 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 very localized and of short duration. Nevertheless, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulch) and 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, 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 so as 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, as well as the potable and sanitary needs of the operations workforce and other uses. Some water would also be required during deactivation, such as for use in facility decontamination. Projected water use under Waste Management Alternative 2 for these activities 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, as 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 by infrequent, heavy rainfall or by 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 is low, and both disposal area locations are more than 11 kilometers (7 miles) from the Columbia River. Regardless, appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked haybales, mulching and seeding temporarily disturbed areas) and spill prevention and waste management practices would be employed to minimize suspended sediment and other deleterious material transport and potential water quality impacts. Also, 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 a current NPDES and appropriate state waste discharge general permits for stormwater discharges associated with construction and industrial activities, 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, in addition to IDF-East and the RPPDF, are not expected to have any additional direct impact on water resources. Trenches 31 and 34 are lined, an 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, so as to minimize water-quality impacts during operations including run-on of stormwater and precipitation that could otherwise infiltrate emplaced waste. To be specific, the 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 with 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 above in Section 4.3.6.2.1 for Alternative 2, Disposal Group 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 in Section 4.3.6.2.1 for Alternative 2, Disposal Group 1. Following completion of disposal activities in IDF-East and the RPPDF, each facility would be closed with a modified RCRA Subtitle C barrier, 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 bound any potential impacts on water resources from disposal facility construction, operations, and closure over the short term, but would generally be similar in nature to those described in Section 4.3.6.2.1 for Alternative 2, Disposal Group 1. The size of IDF-East and the RPPDF constructed under this alternative and 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 occur much later as a consequence under this alternative and disposal grouping. 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 Section 4.3.6.2 for Waste Management Alternative 2.

4.3.6.3.1 Disposal Group 1

No direct impact on water resources is 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, as 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 described for Alternative 2, Disposal Group 1 (see Section 4.3.6.2.1).

As further 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 described for Alternative 2, Disposal Group 1 (see Section 4.3.6.2.1) as both 200-East and 200-West IDFs and the RPPDF would operate through 2050 under this alternative and disposal grouping 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 for 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 group (see Section 4.3.5.3.2). Also, IDF-East and the RPPDF would operate until 2100 instead of 2050 under this alternative and disposal grouping. 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 with a modified RCRA Subtitle C barrier, 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 for Alternative 3, Disposal Group 2 (see Section 4.3.6.3.2). Although the sizes of the two IDFs and 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 used upon closure of any of the facilities or trenches. Thus, there would be no additional impact on ecological resources within the 200 Areas under this alternative. Since this alternative would not require that geologic material be excavated from Borrow Area C there would be no impact 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 at 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 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 be 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 require 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. 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 be taken in connection with mitigating 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 specific impacts on ecological resources of developing Borrow Area C since 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 significant 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

Since 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 upon 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 be taken in connection with mitigating 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 placement of barriers which 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 impact 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 since none have been recorded within the areas where these facilities would be built (Sackschewsky and Downs 2007:3).

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. Operations of new facilities within the 200 Areas is 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, which 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. Since the same areas would be used for these facilities under these disposal groups as noted above for Disposal Group 1, 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 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 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, with sagebrush having 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 grouping, 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, 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, impacts related to Disposal Groups 2 and 3 would be the same (see Section 4.3.7.2.1.2). As is the case for Disposal Group 1, two IDFs would be constructed under Disposal Groups 2 and 3. IDF-West would be located in the same area and be the same size as is the case for Disposal Group 1. However, IDF-East would be smaller (i.e., 9.3 hectares [23 acres] versus 29.9 hectares [74 acres]). Thus, impacts of construction and operations of IDF-East under Disposal Groups 2 and 3 would be somewhat less than those described for 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.

Since 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] for Alternative 3 versus 159 hectares [392 acres] for Alternative 2) would need to be excavated within Borrow Area C. Thus, the impacts on terrestrial resources of developing the site would be as 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 impact on wetlands or aquatic resources under this alternative.

4.3.7.3.3 Threatened and Endangered Species

As noted under "Terrestrial Resources," there would be no difference in the number and size of expanded or new facilities required under Waste Management Alternative 3 as compared to Alternative 2 (see Section 4.3.7.2.3). Since 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.

4.3.7.3.3.1 Disposal Group 1

Impacts resulting from construction of the RPPDF on threatened and endangered species would be the same as described above under Waste Management Alternative 2 since the facility would be located in the same area and be the same size. Also, impacts resulting from construction of IDF-East would be similar to Alternative 2 since the area to be disturbed would be only slightly smaller (2.8 hectares [7 acres]) (see Section 4.3.7.2.3). 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 (see Chapter 3, Section 3.2.7.4). Although mitigation would not be required for this species, it should be considered during project planning.

Since 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 within Borrow Area C. Thus, the impacts on threatened and endangered species of developing the site would be as described in Section 4.3.7.2.3.1.

4.3.7.3.3.2 Disposal Groups 2 and 3

Impacts resulting from construction of the RPPDF on threatened and endangered species would be the same as described above under Waste Management Alternative 2 since the facility would be located in the same area and be the same size. Also, impacts resulting from construction of IDF-East would be similar to Alternative 2 since 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 with the possibility that the stalked-pod milkvetch could be disturbed. While this species should be considered during project planning, mitigation would not be required.

Since 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 within Borrow Area C. Thus, the impacts on threatened and endangered species of developing the site would be as 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 with disposal continuing 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, as discussed above in Section 4.3.8.1, would not be disturbed under this alternative.

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 impact 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, as 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 are in place to properly manage the discovery site. 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 4.2.8.2.1, 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, as 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 are in place to properly manage the discovery site. This condition applies to all disposal groups.

4.3.8.2.2.1 Disposal Groups 1, 2, and 3

Potential impacts on prehistoric resources are described in Section 4.2.8.2.2, 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.

4.3.8.2.3.1 Disposal Group 1

Under Waste Management Alternative 2, Disposal Group 1, expansion of the IDF and construction of the RPPDF would affect 62.3 hectares (154 acres) of land in the 200 Areas. The BLM visual resource management rating would not change. 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 having cultural importance to American Indians. An additional 41.7 hectares (103 acres) of Borrow Area C would be excavated for geologic material. The rating for this area would change from Class II to Class IV. Excavation would change the viewscape from State Route 240 and 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 in 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, as no such resources have been discovered in the 200 Areas. As is the case with other 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 4.2.8.2.3, 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, as 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 are in place to properly manage the discovery site. This construction 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 4.2.8.3.1, 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, as 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 are in place to properly manage the discovery site.

4.3.8.3.2.1 Disposal Groups 1, 2, and 3

Potential impacts on historic resources are described in Section 4.2.8.3.1, 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.

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 geologic material would be nearly the same as under Alternative 2. Therefore, the visual impact on Rattlesnake Mountain would be the same as those 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 add minimally 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, as no such resources have been discovered in the 200 Areas. As is the case with other 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. 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 4.2.8.3.4, 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 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, public services, and local transportation in the region.

Key underlying assumptions used in projecting changes in employment for each of the Waste Management alternatives and associated options are similar to those described in Section 4.1.9 for the Tank Closure alternatives. Waste Management alternatives consist of the storage and treatment of both onsite and offsite waste, along with three disposal options located in the 200-East Area (Waste Management Alternative 2) and three disposal options located in both the 200-East and 200-West Areas (Waste Management Alternative 3) in addition to the No Action Alternative. Table 4–134 summarizes the indicators used to analyze the socioeconomic impacts under each alternative.

Table 4–134. 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 2007c.

4.3.9.1 Alternative 1: No Action

Because construction activities would be minimal under Alternative 1, the No Action Alternative, the peak workforce is 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 the local transportation in the ROI.

4.3.9.2 Alternative 2: Disposal in IDF, 200-East Area Only

Under Alternative 2, employment activity, at a peak of 449 FTEs from 2019 through 2050 (see Table 4–134), would be dominated by the workforce required to operate WRAP. The existence of these direct jobs would be 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 the onsite truck traffic (1,880 truck loads, or approximately 7 trips per day). The socioeconomic impacts below would be affected by this workforce and local vehicles in addition to any workers and vehicles needed for each of the disposal group options 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 peak estimate of 1,180 FTEs is less than 1 percent of the projected labor force of about 211,000 (in 2051) in the ROI (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 peak estimate of 4,540 FTEs would be approximately 1.4 percent of the projected labor force of about 314,000 (in 2101), compared with approximately 10 percent in 2006 in the ROI (BEA 2007). An additional 3,400 indirect jobs would be created in the ROI during those peak years.

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 estimate of 4,540 FTEs would be approximately 1 percent of the projected labor force of about 447,000 (in 2166), compared with approximately 10 percent in 2006 in the ROI (BEA 2007). The 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

4.3.9.2.3.1 Disposal Groups 1, 2, and 3

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 impact on the demand 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 predicted offsite truck activity, up to 7,210 truck trips per year (28 trips per day) in 2051 and 2052, 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 also peak in 2051 and 2052, with up to 111,000 truck trips per year (approximately 428 trips per day) moving concrete aggregate materials and other borrow materials on site to construct 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 (2101 through 2102 for Disposal Group 2, and 2166 through 2167 for Disposal Group 3). Based on predicted offsite truck activity, up to 8,840 truck trips (34 trips per day) in the 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 392,000 truck trips per year (approximately 1,500 trips per day) moving concrete aggregate materials and other borrow materials on site 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 for Alternative 3 would be affected by the workforce and local vehicles needed for the treatment and storage of the waste, in addition to any workers and vehicles needed for each of the disposal group options below (see Table 4–134).

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 that would be needed for construction of the barriers over IDF-East and the RPPDF would dominate the total workforce for two years, beginning in 2051. The peak estimate of 1,170 FTEs is 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 2101), compared with approximately 10 percent in 2006 in the ROI (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 estimate of 4,500 FTEs would be approximately 1 percent of the projected labor force of about 447,000 (in 2166), compared with approximately 10 percent in 2006 in the ROI (BEA 2007). The existence of these jobs would be 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) 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.

4.3.9.3.3 Housing and Community Service

4.3.9.3.3.1 Disposal Groups 1, 2, and 3

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 impact on the demand 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 predicted offsite truck activity, up to 7,180 truck trips per year (28 trips per day) in 2051 and 2052, 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 also peak in 2051 and 2052, with up to 97,000 truck trips per year (approximately 372 trips per day) moving concrete aggregate materials and other borrow materials on site to construct 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 through 2102 for Disposal Group 2, and 2166 through 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) moving concrete aggregate materials and other borrow materials on site to construct 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 radiation 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 or LIGO. Impacts on the general population are evaluated for a residential scenario whereby people are exposed to radioactive materials emitted from project facilities. Radiation exposure occurs through inhalation, direct exposure to the radiological 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 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 an individual who works at the Columbia Generating Station or LIGO would be from inhalation and exposure to the plume and material deposited on the ground. Doses are presented as the total effective dose equivalent.

In addition to members of the public, workers directly involved in the activities associated with Waste Management alternatives and nearby noninvolved workers may receive radiological doses. Doses to an involved worker are calculated based on an FTE worker. It is 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 radiological air emissions associated with the alternatives considered. The noninvolved worker is assumed to be about 100 meters (110 yards) away or at a nearby facility on a daily basis.

Small operational impacts on members of the public would be expected from all of the Waste Management alternatives. Routine radiological air emissions as a result of LLBG operations would be expected to be negligible; the more likely source of emissions from waste management operations would be from waste processing facilities, where waste containers are opened and waste is sorted, reduced in size or otherwise treated, and repackaged. Consequently, impacts analysis on the public are based on radiological air emissions projected to occur from waste processing facilities such as a new facility at the T Plant or 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 offsite radiological 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 4–135 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 who received the average annual radiation dose over the 29 years of this activity would receive a dose of 5,800 millirem, which corresponds to a risk of about 3×10^{-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 is estimated to be 37 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, no LCFs due to occupational radiation exposure would be expected in the worker population.

Table 4–135. 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	1×10^{-4}
Impact over life of project[c]	2007–2035	5,800 millirem	3×10^{-3}
Life-of-Project Worker Population	2007–2035	37 person-rem	0 (2×10^{-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.1.1.3).

[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 radiological 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 4–136 presents estimated doses to the general population and the MEI under Alternative 2. Activities resulting in radiological air emissions would occur from 2013 to 2051. Over the operational life of the project, the population within 80 kilometers (50 miles) of the 200 Areas would receive a dose of 0.00067 person-rem and the MEI would receive a dose of 0.0000082 millirem. Using the risk factor of 0.0006 LCFs per person-rem (DOE 2003h:9), no LCFs would be expected in the general population as a result of 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 from the 300 Area. Radiological air emissions would remain fairly constant over the duration of the alternative, with an annual population dose of 0.000018 person-rem and an annual MEI dose of 0.00000021 millirem.

Table 4–136. 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	0.00067	0 (4×10^{-7})	0.000018	0 (1×10^{-8})
	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	0.0000082	5×10^{-12}	0.00000021	1×10^{-13}
Maximally exposed onsite individual	0.0000022	1×10^{-12}	0.000000057	3×10^{-14}

[a] Impacts accrued over the operational life of the project analyzed in this alternative, 2013 through 2051.

[b] The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

[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.

Radiological air emissions from the 200 Area solid waste management facilities could also impact a member of the public who works on the Hanford Site. The annual radiological dose to an individual at LIGO exposed while at work would be 0.000000057 millirem. Over the 39-year period during which there would be radiological emissions from waste management activities, a worker at LIGO would receive a dose of 0.0000022 millirem, with a corresponding risk of developing an LCF of essentially zero (about 1 chance in a trillion).

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 4–137 presents dose and risk estimates for an involved and a noninvolved worker receiving an average exposure from activities at the waste processing facilities. Radiological doses to workers from LLBG operations of different durations are addressed in the following sections. The three different durations reflect the time 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 4–137. 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	1×10^{-4}
Impact over life of project[c]	2013–2051	7,800 millirem	5×10^{-3}
Life-of-Project Worker Population	2013–2051	3,000 person-rem	2
Noninvolved Worker–Year of Maximum Impact			
100-meter distance	2013–2051	0.00023 millirem	1×10^{-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.1.1.3).

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 who received the average annual radiation dose over the 39 years of this activity would receive a dose of 7,800 millirem, which corresponds to a risk of 5×10^{-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 is 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 total 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 94 percent) is associated with operation of WRAP.

The potential dose to a noninvolved worker would result from exposure to, and inhalation of, radiological contaminants released to the atmosphere from waste processing activities. The potential dose to a noninvolved worker would be 2.3×10^{-4} 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 in 7 billion).

4.3.10.2.2.1 Disposal Group 1

Table 4–138 presents dose and risk estimates for a radiation worker involved in LLBG operations who would receive an average radiation 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, which corresponds to a risk of 5×10^{-3} (1 chance in 200) of developing an LCF.

Table 4–138. 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	1×10^{-4}
Impact over life of project[c]	2007–2050	8,000 millirem	5×10^{-3}
Life-of-Project Worker Population	2007–2050	360 person-rem	0 (2×10^{-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.1.1.3).

[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 is estimated to be 360 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, no LCFs due to occupational radiation exposure would be 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 total 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 4–139 presents dose and risk estimates for a radiation worker involved in LLBG operations who would receive an average radiation 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 dose of 8,000 millirem, which corresponds to a risk of 5×10^{-3} (1 chance in 200) of developing an LCF.

Table 4–139. 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	1×10^{-4}
Impact over the life of project[c]	2007–2100	8,000 millirem	5×10^{-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.1.1.3).

[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 is estimated to be 3,600 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, 2 LCFs due to occupational radiation 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 total 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 4–140 presents dose and risk estimates for a radiation worker involved in LLBG operations who would receive an average radiation 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 under Disposal Group 2—an average annual dose of 200 millirem and a project 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 5×10^{-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 is estimated to be 6,400 person-rem. Applying the risk factor of 0.0006 LCFs per person-rem, 4 LCFs due to occupational radiation 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) is associated with operation of the RPPDF.

Table 4–140. 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	1×10^{-4}
Impact over life of project[c]	2007–2165	8,000 millirem	5×10^{-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.1.1.3).

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 total 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 under Alternative 2. Doses to the public would result from radiological 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 would be the same as under Alternative 2, discussed in Section 4.3.10.2.1.

4.3.10.3.2 Radiological Impacts on Workers

Radiological impacts on workers would be the same as under Waste Management Alternative 2, discussed in 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, are 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 potential impacts on workers and the public associated with potential accidents under the Waste Management alternatives and associated disposal groupings. For each Waste Management alternative, radiological impacts of postulated accident scenarios are quantified for an MEI living near Hanford, the offsite population as a whole, and a noninvolved worker. Hazardous chemical impacts are also evaluated. For an involved worker, accident consequences have not been 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 not known. 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 SWOC FIR-4 (large fire of waste containers outside 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 4–141 shows the consequences of the accidents associated with the No Action Alternative. Table 4–142 shows the annual cancer risks for the accidents.

Table 4–141. Waste Management Alternative 1 Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatality[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatality[b]
Single-drum deflagration (SWOC FIR-1)	0.00079	5×10^{-7}	3.6	0 (2×10^{-3})	0.84	5×10^{-4}
Medium fire inside facility (SWOC FIR-6)	0.015	9×10^{-6}	66	0 (4×10^{-2})	16	9×10^{-3}
Glovebox or greenhouse fire (SWOC FIR-8)	0.028	2×10^{-5}	130	0 (8×10^{-2})	30	4×10^{-2}
Large fire of waste containers outside facility (SWOC FIR-4)	0.25	2×10^{-4}	1,100	1	260	3×10^{-1}
Handling spill of single waste container (SWOC SP-2)	0.00015	9×10^{-8}	0.66	0 (4×10^{-4})	0.16	9×10^{-5}
Large handling spill of boxes or multiple waste containers (SWOC SP-3A)	0.00072	4×10^{-7}	3.3	0 (2×10^{-3})	0.77	5×10^{-4}
Spill of single large-diameter container (SWOC SP-4)	0.007	4×10^{-6}	32	0 (2×10^{-2})	7.5	4×10^{-3}
Design-basis seismic event (SWOC NPH-1)	0.0068	4×10^{-6}	31	0 (2×10^{-2})	7.3	4×10^{-3}
Beyond-design-basis accident (SWOC NPH-2)	0.026	2×10^{-5}	120	0 (7×10^{-2})	28	3×10^{-2}
Range fire (SWOC EE-1)	0.12	7×10^{-5}	560	0 (3×10^{-1})	130	2×10^{-1}
Aircraft crash (SWOC EE-2)	0.28	2×10^{-4}	1,300	1	300	4×10^{-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 Increased likelihood of latent cancer fatality for an individual, assuming the accident occurs.
c Based on populations of 451,556 and 488,897 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) in 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.1.1.3).
Key: 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 4–142) is the large fire of waste containers outside a facility (SWOC FIR-4). For this accident, no LCFs would be expected in the offsite population; there would be an increased risk of an LCF of 7×10^{-3} per year (i.e., about 1 in 140 per year of a single LCF occurring in the population). For the MEI, the increase in the likelihood of an LCF would be 2×10^{-6} per year (i.e., about 1 in 500,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be 3×10^{-3} per year (i.e., about 1 in 330 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 and an LCF would depend on the distance and other factors, but would generally be higher. The accident that would have the highest consequences were it to occur 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 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 radioactivity from an accident. For the highest-risk accident (accident SWOC FIR-4) in Table 4–142, the risk to the offsite population and onsite workers during this 29-year project period would be no (2×10^{-1}) increase in the number of LCFs in the offsite population, a 4×10^{-5} increased likelihood of an LCF for the MEI, and a 9×10^{-2} increased likelihood of an LCF for the noninvolved worker.

Table 4–142. 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)	1×10^{-2}	5×10^{-9}	0 (2×10^{-5})	5×10^{-6}
Medium fire inside facility (SWOC FIR-6)	1×10^{-2}	9×10^{-8}	0 (4×10^{-4})	9×10^{-5}
Glovebox or greenhouse fire (SWOC FIR-8)	1×10^{-2}	2×10^{-7}	0 (8×10^{-4})	4×10^{-4}
Large fire of waste containers outside facility (SWOC FIR-4)	1×10^{-2}	2×10^{-6}	0 (7×10^{-3})	3×10^{-3}
Handling spill of single waste container (SWOC SP-2)	1×10^{-2}	9×10^{-10}	0 (4×10^{-6})	9×10^{-7}
Large handling spill of boxes or multiple waste containers (SWOC SP-3A)	1×10^{-2}	4×10^{-9}	0 (2×10^{-5})	5×10^{-6}
Spill of single large-diameter container (SWOC SP-4)	1×10^{-2}	4×10^{-8}	0 (2×10^{-4})	4×10^{-5}
Design-basis seismic event (SWOC NPH-1)	1×10^{-3}	4×10^{-9}	0 (2×10^{-5})	4×10^{-6}
Beyond-design-basis accident (SWOC NPH-2)	1×10^{-3}	2×10^{-8}	0 (7×10^{-5})	3×10^{-5}
Range fire (SWOC EE-1)	1×10^{-2}	7×10^{-7}	0 (3×10^{-3})	2×10^{-3}
Aircraft crash (SWOC EE-2)	3×10^{-5}	5×10^{-9}	0 (2×10^{-5})	1×10^{-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 451,556 and 488,897 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) in 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.1.1.3).
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 significant 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 have been 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 and indicate that, with the exception of sodium metal mentioned above, none of the chemicals listed were found to 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 chemical hazards in the waste management containers are generally mixed together with the radiological hazards. Radiological accident scenarios are expected to release both radioactive materials and toxic chemicals. The scenario most likely to release a significant 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 other fire scenarios analyzed range 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), which were 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 the 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 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 4–143 shows the consequences of the accidents associated with Alternative 2. Table 4–144 shows the annual cancer risks for the accidents. Two accident scenarios in addition to those evaluated under Alternative 1 are possible under Alternative 2. The new scenarios involve ILAW containers disposed of in IDF-East.

The accident with the highest radiological risk to the offsite population and onsite workers (see Table 4–144) is the large fire of waste containers outside facility (SWOC FIR-4). For this accident, no LCFs would be expected in the offsite population; there would be an increased risk of an LCF of 7×10^{-3} per year (i.e., about 1 in 140 per year of a single LCF occurring in the population). For the MEI, the increase in the likelihood of an LCF would be 2×10^{-6} per year (i.e., about 1 in 500,000 per year). For a noninvolved worker 100 meters (110 yards) from the accident, the increase in the likelihood of an LCF would be 3×10^{-3} per year (i.e., about 1 in 330 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 and an LCF would depend on the distance and other factors, but would generally be higher. The accident that would have the highest consequences were it to occur 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 facility.

Table 4–143. Waste Management Alternative 2 Radiological Consequences of Accidents

Accident[a]	Maximally Exposed Individual		Offsite Population[c]		Noninvolved Worker	
	Dose (rem)	Latent Cancer Fatality[b]	Dose (person-rem)	Latent Cancer Fatalities[d]	Dose (rem)	Latent Cancer Fatality[b]
Single-drum deflagration (SWOC FIR-1)	0.00079	5×10^{-7}	3.6	0 (2×10^{-3})	0.84	5×10^{-4}
Medium fire inside facility (SWOC FIR-6)	0.015	9×10^{-6}	66	0 (4×10^{-2})	16	9×10^{-3}
Glovebox or greenhouse fire (SWOC FIR-8)	0.028	2×10^{-5}	130	0 (8×10^{-2})	30	4×10^{-2}
Large fire of waste containers outside facility (SWOC FIR-4)	0.25	2×10^{-4}	1,110	1	260	3×10^{-1}
Handling spill of single waste container (SWOC SP-2)	0.00015	9×10^{-8}	0.66	0 (4×10^{-4})	0.16	9×10^{-5}
Large handling spill of boxes or multiple waste containers (SWOC SP-3A)	0.00072	4×10^{-7}	3.3	0 (2×10^{-3})	0.77	5×10^{-4}
Spill of single large-diameter container (SWOC SP-4)	0.007	4×10^{-6}	32	0 (2×10^{-2})	7.5	4×10^{-3}
Design-basis seismic event (SWOC NPH-1)	0.0068	4×10^{-6}	31	0 (2×10^{-2})	7.3	4×10^{-3}
Beyond-design-basis accident (SWOC NPH-2)	0.026	2×10^{-5}	120	0 (7×10^{-2})	28	3×10^{-2}
Range fire (SWOC EE-1)	0.12	7×10^{-5}	560	0 (3×10^{-1})	130	2×10^{-1}
Aircraft crash (SWOC EE-2)	0.28	2×10^{-4}	1,300	1	300	4×10^{-1}
Earthmover shears tops off six ILAW containers (ILAW1)	0.0000034	2×10^{-9}	0.016	0 (9×10^{-6})	0.0036	2×10^{-6}
Crushing of ILAW containers by falling crane boom (ILAW2)	0.000031	2×10^{-8}	0.14	0 (8×10^{-5})	0.033	2×10^{-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 likelihood of latent cancer fatality for an individual, assuming the accident occurs.

c Based on populations of 451,556 and 488,897 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively (see Appendix K, Section K.2.1.3.1.2).

d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

Key: ILAW=immobilized low-activity waste; 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 4–144 (SWOC FIR-4), there would be no (3×10^{-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 6×10^{-5} (1 in 11,000) and an increased risk of an LCF for the noninvolved worker of 1×10^{-1} (1 in 10).

Table 4–144. Waste Management Alternative 2 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)	1×10^{-2}	5×10^{-9}	0 (2×10^{-5})	5×10^{-6}
Medium fire inside facility (SWOC FIR-6)	1×10^{-2}	9×10^{-8}	0 (4×10^{-4})	9×10^{-5}
Glovebox or greenhouse fire (SWOC FIR-8)	1×10^{-2}	2×10^{-7}	0 (8×10^{-4})	4×10^{-4}
Large fire of waste containers outside facility (SWOC FIR-4)	1×10^{-2}	2×10^{-6}	0 (7×10^{-3})	3×10^{-3}
Handling spill of single waste container (SWOC SP-2)	1×10^{-2}	9×10^{-10}	0 (4×10^{-6})	9×10^{-7}
Large handling spill of boxes or multiple waste containers (SWOC SP-3A)	1×10^{-2}	4×10^{-9}	0 (2×10^{-5})	5×10^{-6}
Spill of single large-diameter container (SWOC SP-4)	1×10^{-2}	4×10^{-8}	0 (2×10^{-4})	4×10^{-5}
Design-basis seismic event (SWOC NPH-1)	1×10^{-3}	4×10^{-9}	0 (2×10^{-5})	4×10^{-6}
Beyond-design-basis accident (SWOC NPH-2)	1×10^{-3}	2×10^{-8}	0 (7×10^{-5})	3×10^{-5}
Range fire (SWOC EE-1)	1×10^{-2}	7×10^{-7}	0 (3×10^{-3})	2×10^{-3}
Aircraft crash (SWOC EE-2)	3×10^{-5}	5×10^{-9}	0 (2×10^{-5})	1×10^{-5}
Earthmover shears tops off six ILAW containers (ILAW1)	1×10^{-1}	2×10^{-10}	0 (9×10^{-7})	2×10^{-7}
Crushing of ILAW containers by falling crane boom (ILAW2)	1×10^{-1}	2×10^{-9}	0 (8×10^{-6})	2×10^{-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 451,556 and 488,897 persons residing within 80 kilometers (50 miles) of the 200-East and 200-West Areas, respectively (see Appendix K, Section K.2.1.3.1.2).

d The reported value is the projected number of latent cancer fatalities (LCFs) in 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.1.1.3).

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 4–144 (SWOC FIR-4), there would be a risk of about 1 (6.3×10^{-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 1×10^{-4} (1 in 10,000) and an increased risk of an LCF for the noninvolved worker of 3×10^{-1} (1 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 4–144 (SWOC FIR-4), there would be a risk of 1 (1.1) 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 2×10^{-4} (1 in 5,000) and an increased risk of an LCF for the noninvolved worker of 5×10^{-1} (1 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 under Alternative 2. The consequences and annual risks of the accidents are presented in Tables K–143 and K–144.

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 larger aircraft, more fuel, and damage to a larger 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 24,000 person-rem, which would result in 14 additional LCFs. The MEI dose would be 5.1 rem, which corresponds to an increased risk of an LCF of 3×10^{-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

A number of factors affect the risk of transporting radioactive materials. These factors 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 normal, or 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.

The impacts of incident-free, or routine, transportation and transportation accidents comprise transportation impacts. The impacts of 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 4–145 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 4–145 are the estimated number of shipments for transporting about 82,000 cubic meters (107,000 cubic yards) of LLW and MLLWs from DOE facilities. This activity is common to both Alternatives 2 and 3. The values presented for the offsite waste shipments in Table 4–145 are estimated truck transports. Offsite rail shipments were assumed to be one-half of the values given.

Table 4–145. Waste Management Alternatives – Estimated Number of Shipments

Alternative	Number of Shipments			
	Offsite Shipments[a]		Onsite Shipments	
	LLW[b]	MLLW[b]	LLW[b]	MLLW[b]
1	0	0	807	196
2	15,300	1,320	807	196
3	15,300	1,320	807	196

a These are estimates for truck transports. Rail transports would be one-half of the values given.
b These include both the contact-handled and remote-handled wastes.

Note: Values presented in the table have been rounded to no more than three significant digits, where appropriate.

Key: LLW=low-level radioactive waste; MLLW=mixed low-level radioactive waste.

Source: Appendix H, Section H.7.3.

Table 4–146 summarizes the risks of transportation under each alternative. This table shows that the dose to the population along the routes (see column 6 of Table 4–146: off site) is expected to be between the lowest expected dose of about 135 person-rem, which is associated with the rail transport of offsite waste to Hanford, and the highest expected dose of about 352 person-rem, associated with the 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 8.1×10^{-2} to 2.1×10^{-1}. Rail transport would lead to lower doses to the general population, due to the smaller number of transports and lower exposure to 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 are from exposures at rest areas, gas stations, and stops along the route.

The lowest expected dose to the workers transporting wastes (see column 4 of Table 4–146: off site) would be about 53 person-rem for offsite rail shipments, and the highest would be 2,620 person-rem for offsite truck shipments. The additional LCF among the exposed crew would range from 0 to 2 (1.57). Rail transport results in lower doses to rail crews because they are farther away from the waste packages than truck crews. Note that the maximum annual dose to a transportation crew member 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-1098-99). The potential for a trained radiation worker to develop a latent fatal cancer from the maximum annual exposure of 2 rem is 0.0012. 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 4–146. Waste Management Alternatives – Risks of Transporting Radioactive Waste

Alternative	Location (transport mode)	Number of Shipments	Incident-Free				Accident		
			Crew		Population				
			Dose (person-rem)	Risk[a]	Dose (person-rem)	Risk[a]	Radiological Risk[a, b]	Non-Radiological Risk[a]	One-Way Offsite Travel (10^6 km)
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	1.6×10^{-3}	0.083	5.0×10^{-5}	2.1×10^{-9}	0.00026	N/A
2	Off site (T)	16,600	2,620	1.57	352	2.1×10^{-1}	6.0×10^{-5}	1.10	53.8
	Off site (R)	8,290	52.7	3.2×10^{-2}	135	8.1×10^{-2}	2.9×10^{-5}	4.28	27.4
	On site	1,000	4.3	2.6×10^{-3}	0.138	8.0×10^{-5}	3.6×10^{-9}	0.00041	N/A
3	Off site (T)	16,600	2,620	1.57	352	2.1×10^{-1}	6.0×10^{-5}	1.10	53.8
	Off site (R)	8,290	52.7	3.2×10^{-2}	135	8.1×10^{-1}	2.9×10^{-5}	4.28	27.4
	On site	1,000	2.6	1.6×10^{-3}	0.083	5.0×10^{-5}	2.1×10^{-9}	0.00026	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. Values presented in the table have been rounded to no more than three significant digits, where appropriate.

Key: km=kilometers; N/A=not applicable—no offsite waste would be accepted at Hanford; R=rail transport; 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 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 for all 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 1, for truck shipments, and 4, for rail shipments. Considering that the duration of accepting offsite waste is about 30 years and the average number of traffic fatalities in the U.S. is about 40,000 per year, the expected risk of traffic fatality under all alternatives is small.

Table 4–147 summarizes the impacts of transporting 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 total number of kilometers, accidents, and fatalities for all alternatives. The results in Table 4–147 indicate that for the Waste Management alternatives, potential for traffic fatalities are the largest under Disposal Group 3. However, the absolute risk is small, considering that the operational period for this disposal group is over 120 years.

Table 4–147. Waste Management Alternatives – Estimated Impacts of Construction and Operational Material Transport

Alternatives/Disposal Groups	Total Distance Traveled (kilometers)	Number of Accidents	Number of Fatalities
1	0.40×10^6	0.05	0.003
2	4.15×10^6	0.51	0.03
Disposal Group 1	8.40×10^6	1.03	0.07
Disposal Group 2	29.7×10^6	3.66	0.25
Disposal Group 3	38.0×10^6	4.67	0.32
3	4.15×10^6	0.51	0.03
Disposal Group 1	7.65×10^6	0.94	0.06
Disposal Group 2	29.9×10^6	3.68	0.25
Disposal Group 3	38.1×10^6	4.68	0.32

Note: To convert kilometers to miles, multiply by 0.6214. Values presented in the table have been rounded to no more than three significant digits, where appropriate.
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-generated 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 4–145). These transports would mostly occur using 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 0.083 person-rem. Accordingly, incident-free transportation of radioactive material would result in 0 (1.6×10^{-3}) LCFs among transportation workers and 0 (5.0×10^{-5}) LCFs among the exposed population (see Table 4–146).

4.3.12.1.2 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 accident (total transportation accidents) severities, irrespective of their likelihood of occurrence.

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 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 in 1 billion per year.

Estimates of the total transportation accident risks under this alternative are a radiological dose risk to the population of 3.5×10^{-6} person-rem, resulting in 2.1×10^{-9} LCFs, and traffic accidents resulting in 0 (0.00026) fatalities (see Table 4–146).

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, and piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, and canisters) were evaluated. The impacts of transport activities under this alternative would be

400,000 kilometers (250,000 miles) traveled, 0 (0.05) accidents, and 0 (0.003) fatalities over the entire duration, from construction through deactivation and closure (see Table 4–147). No disposal groups are 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 8,290 rail shipments or about 16,600 truck shipments. In addition, about 1,000 truck shipments would be made to transport onsite-generated waste to storage locations and burial grounds. The total distance traveled carrying radioactive materials would be 27.4 million kilometers (17 million miles) on public rail or 53.8 million kilometers (33.4 million miles) on public roads.

4.3.12.2.1 Impacts of Incident-Free Transportation

The dose to transportation workers from offsite transportation activities has been estimated to be about 53 person-rem for rail shipments and 2,620 person-rem for truck shipments. The additional LCF among the transportation workers would range from 0 (3.2×10^{-2}) to 2 (1.57). The dose to transportation workers from onsite transport activity has been estimated to be 4.3 person-rem, resulting in 0 (2.6×10^{-3}) additional LCFs (see Table 4–146). 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 1098-99). 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 352 person-rem, resulting in 0 (2.1×10^{-1}) additional LCFs. The expected doses to the general population during offsite transportation of waste by rail would be about 135 person-rem, resulting in 0 (8.1×10^{-2}) additional LCFs. Rail transport would lead to lower doses to the general population, due to the smaller number of transports and lower exposure to 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 are from exposures at rest areas, gas stations, and stops along the route.

4.3.12.2.1.1 Disposal Group 1

The estimates of incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1 of this chapter.

4.3.12.2.1.2 Disposal Group 2

The estimates of incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1 of this chapter.

4.3.12.2.1.3 Disposal Group 3

The estimates of incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1 of this chapter.

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 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 1.62, 25.24, and 120.9 person-rem, respectively. The likelihood of occurrence of such consequences per shipment is less than 2.5×10^{-7}, 2.8×10^{-8}, and 5.3×10^{-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 1.9×10^{-7}.

Estimates of the total transportation accident risks (both off site and on site) under this alternative are a radiological dose risk to the population ranging from 0.048 to 0.1 person-rem, resulting in 2.9×10^{-5} to 6.0×10^{-5} LCFs, and traffic accidents resulting in 1 (1.10) to 4 (4.28) fatalities, for rail or truck shipments, respectively (see Table 4–146). All of the risks would result from offsite shipment of wastes to Hanford. These results indicate that the annual accident risks are small, considering that the duration of these activities is 35 years.

4.3.12.2.2.1 Disposal Group 1

The estimates of accident risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1 of this chapter.

4.3.12.2.2.2 Disposal Group 2

The estimates of accident risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1 of this chapter.

4.3.12.2.2.3 Disposal Group 3

The estimates of accident risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.2.1 of this chapter.

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, and piping) and feed materials for the production and transport of waste (e.g., grout, fly ash, containers, boxes, and canisters) were evaluated. In addition, under this alternative, three different combinations of waste capacities 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—disposal groups—are 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 4–147). The impacts of transport activities for the disposal groups would range from 8.40 to 38.0 million kilometers (5.22 to 23.6 million miles) traveled, from 1 (1.03) to 5 (4.67) accidents and would result in 0 (0.07 to 0.32) fatalities over the entire duration, from construction through deactivation and closure. The impacts of transport activities within the alternative would be 4.15 million kilometers (2.58 million miles) traveled, 1 (0.51) accident, and 0 (0.03) fatalities over the entire duration, from construction through deactivation and closure (see Table 4–147).

4.3.12.2.3.1 Disposal Group 1

The impacts of transport activities for this disposal group would be 8.40 million kilometers (5.22 million miles) traveled, 1 (1.03) accident, and 0 (0.07) fatalities over the entire duration, from construction through deactivation and closure.

4.3.12.2.3.2 Disposal Group 2

The impacts of transport activities for this disposal group would be 29.7 million kilometers (18.5 million miles) traveled, 4 (3.66) accidents, and 0 (0.25) fatalities over the entire duration, from construction through deactivation and closure.

4.3.12.2.3.3 Disposal Group 3

The impacts of transport activities for this disposal group would be 38.0 million kilometers (23.6 million miles) traveled, 5 (4.67) accidents, and 0 (0.32) fatalities over the entire duration, from 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 8,290 rail shipments or 16,600 truck shipments. In addition, 1,000 truck shipments would be made to transport onsite-generated waste to storage locations and burial grounds (see Table 4–146). The total distance traveled carrying radioactive materials would be 27.4 million kilometers (17 million miles) on public rail or 53.8 million kilometers (33.4 million miles) on public roads.

4.3.12.3.1 Impacts of Incident-Free Transportation

The dose to transportation workers and the population from offsite transportation activities would be similar to those described under Alternative 2. The dose to transportation workers from onsite transport activity has been estimated to be 2.6 person-rem, resulting in 0 (1.6×10^{-3}) additional LCFs. This dose is slightly lower because of the shorter distance between the generator and disposal location.

4.3.12.3.1.1 Disposal Group 1

The estimates of incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1 of this chapter.

4.3.12.3.1.2 Disposal Group 2

The estimates of incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1 of this chapter.

4.3.12.3.1.3 Disposal Group 3

The estimates of incident-free operational risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1 of this chapter.

4.3.12.3.2 Impacts of Accidents During Transportation

The maximum reasonably foreseeable offsite transportation accident and the corresponding consequences under this alternative are similar to those described under Alternative 2.

Estimates of the total transportation accident risks (both off site and on site) under this alternative are similar to those described under Alternative 2.

4.3.12.3.2.1 Disposal Group 1

The estimates of accident risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1 of this chapter.

4.3.12.3.2.2 Disposal Group 2

The estimates of accident risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1 of this chapter.

4.3.12.3.2.3 Disposal Group 3

The estimates of accident risks during transport of waste materials for this disposal group have already been accounted for, as analyzed in Sections 4.1.12, 4.2.12, and 4.3.12.3.1 of this chapter.

4.3.12.3.3 Impacts of Construction and Operational Material Transports

The impacts of transporting construction and operational materials under this alternative are similar to those described under Alternative 2 (see Table 4–147). Also similar to Alternative 2, under this alternative, three different combinations of waste capacities 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—disposal groups—are evaluated. The impacts of transport activities for the disposal groups would range from 7.65 to 38.1 million kilometers (4.75 to 23.7 million miles) traveled, from 1 (0.94) to 5 (4.68) accidents, and would result in 0 (0.06 to 0.32) fatalities over the entire duration, from construction through deactivation and closure.

4.3.12.3.3.1 Disposal Group 1

The impacts of transport activities for this disposal group would be 7.65 million kilometers (4.75 million miles) traveled, 1 (0.94) accident, and 0 (0.06) fatalities over the entire duration, from construction through deactivation and closure.

4.3.12.3.3.2 Disposal Group 2

The impacts of transport activities for this disposal group would be 29.9 million kilometers (18.6 million miles) traveled, 4 (3.68) accidents, and 0 (0.15) fatalities over the entire duration, from construction through deactivation and closure.

4.3.12.3.3.3 Disposal Group 3

The impacts of transport activities for this disposal group would be 38.1 million kilometers (23.7 million miles) traveled, 5 (4.68) accidents, and 0 (0.32) fatalities over the entire duration, from 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 access to Hanford is restricted to the public, 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 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, and air quality.

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 radiologically 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 for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to radiological impacts of facility accidents.

Section 4.3.11.1.2 discusses hazardous chemical impacts of facility accidents under Waste Management Alternative 1. The potential risks of hazardous chemical impacts from 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; 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 4.3.12.1.3 discusses the potential human health risks of transporting construction materials from onsite, local, or regional locations to Hanford. 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 access to Hanford is restricted to the public, 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 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, and air quality.

Section 4.3.10.2.1 discusses short-term impacts on the public resulting from normal operations under Waste Management 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 radiologically contaminated produce and animal products.

For purposes of evaluating the potential for disproportionately high and adverse impacts caused by radiological emissions from normal operations, the total dose to an average individual of the minority, American Indian, Hispanic or Latino, and low-income populations is compared to the total dose to an average individual of the remainder of the population. These results are presented in Appendix J. Table 4–148 summarizes the average individual total doses over the life of the project under this Waste Management alternative. There are 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 4–148. Waste Management Alternative 2 Average Individual Total Dose from Radioactive Air Emissions over the Life of the Project

Subset Population	Individual Average Dose (millirem)	
	Subset Population	Remainder of Population
Minority	1.2×10^{-6}	1.5×10^{-6}
American Indian	8.0×10^{-7}	1.4×10^{-6}
Hispanic or Latino	1.2×10^{-6}	1.5×10^{-6}
Low-income	1.1×10^{-6}	1.4×10^{-6}

Source: Appendix J, Section J.5.6.1.3.

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 approximately one order of magnitude less than 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 for facility accidents under Waste Management Alternative 2. Examination of the risks shows that there would be essentially no LCFs per year for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to 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 hazardous chemical impacts of facility accidents under Waste Management Alternative 2. The potential risks of hazardous chemical impacts from reasonably foreseeable accidents would be encompassed by those discussed in Section 4.2.11.2.2 under FFTF Decommissioning

Alternative 2. The hazardous chemical impacts of accidents would be the same regardless of the disposal group.

Air quality impacts are discussed in Section 4.3.4.2. 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 4.3.12.2 discusses the potential human health risks of transporting offsite waste for disposal at Hanford and transporting construction materials from onsite, 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 radiological impacts of transportation would be the same regardless of the disposal group. The impact 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 potential short-term impacts on minority, American Indian, Hispanic or Latino, and low-income populations under Waste Management Alternative 3. Because access to Hanford is restricted to the public, 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, and air quality.

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 in Section 4.3.13.2 under Waste Management Alternative 2, regardless of the disposal group (see Table 4–148).

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 for 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 the minority, American Indian, Hispanic or Latino, or low-income populations due to 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 hazardous chemical impacts of facility accidents under Waste Management Alternative 3. The potential risks of hazardous chemical impacts from reasonably foreseeable accidents would be encompassed by those discussed in Section 4.2.11.2.2 under FFTF Decommissioning 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; 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 4.3.12.3 discusses potential human health risks of transporting offsite waste for disposal at Hanford and transporting construction materials from onsite, 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 groupings vary primarily in direct relation to the required size, number, and lifespan of disposal facilities (i.e., IDF-East, IDF-West, and the RPPDF) that would be constructed, operated, and ultimately closed under each disposal scenario. This subsection evaluates the impacts of waste generation associated with the construction, operations, deactivation, and closure of expanded waste treatment and storage facilities and new waste disposal, in addition to existing waste management activities analyzed under Waste Management Alternative 1, No Action. Common to Waste Management Alternatives 2 and 3 is that Hanford waste treatment and storage activities would be expanded at the CWC, T Plant, and WRAP to provide greater capacity and throughput. Also common to all three Waste Management alternatives is the continued operation of trenches 31 and 34 for disposal of LLW/MLLW until filled. The remaining space in the two trenches is 17,215 cubic meters (approximately 22,517 cubic yards) and the fiscal year 2007 projected emplacement rate is approximately 476 cubic meters (approximately 623 cubic yards) in the two trenches. Using 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 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 of 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 projected to be generated under each of the Waste Management alternatives as summarized in Table 4–149 for each of the Waste Management alternatives and disposal groupings. The inventories include secondary LLW, MLLW, and hazardous waste. Operations of the WRAP and T Plant will 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., 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. Using a combination of on and offsite capabilities, MLLW would be treated to meet an 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 for 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 (408,186 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 4–149 presents the estimated waste volumes generated under Waste Management Alternative 1.

Table 4–149. 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	NA	38	NA	NA	38	2007–2035	1
Hazardous waste[a]	NA	38	NA	NA	38	2007–2035	1
Alternatives 2 and 3: Treatment and Storage							
Low-level radioactive waste	NA	1,457	NA	NA	1,457	2019–2050	40
Hazardous waste[a]	NA	98	NA	NA	98	2019–2050	3
Alternative 2: Disposal Group 1							
Low-level radioactive waste	NA	58	NA	NA	58	2007–2050	1
Hazardous waste[a]	NA	58	NA	NA	58	2007–2050	1
Alternative 2: Disposal Group 2							
Low-level radioactive waste	NA	58	NA	NA	58	2007–2050	1
Hazardous waste[a]	NA	58	NA	NA	58	2103–2202	3
Alternative 2: Disposal Group 3							
Low-level radioactive waste	NA	58	NA	NA	58	2007–2050	1
Hazardous waste[a]	NA	58	NA	NA	58	2168–2267	3
Alternative 3: Disposal Group 1							
Low-level radioactive waste	NA	58	NA	NA	58	2007–2050	1
Hazardous waste[a]	NA	58	NA	NA	58	2007–2050	1
Alternative 3: Disposal Group 2							
Low-level radioactive waste	NA	58	NA	NA	58	2007–2050	1
Hazardous waste[a]	NA	58	NA	NA	58	2103–2152	3
Alternative 3: Disposal Group 3							
Low-level radioactive waste	NA	58	NA	NA	58	2007–2050	1
Hazardous waste[a]	NA	58	NA	NA	58	2168–2267	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.

Note: All values are in cubic meters. To convert cubic meters to cubic yards, multiply by 1.308.

Key: NA=not available.

Source: SAIC 2007c, 2008.

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 4–149.

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 (107,256 cubic yards) of LLW and MLLW. Construction, operations, deactivation, and closure of two disposal facilities would provide for disposal of tank waste, onsite-generated non-CERCLA waste, FFTF waste, waste management waste streams, and offsite-received LLW/MLLW. Disposal facilities would include a single IDF in the 200-East Area and an RPPDF. The RPPDF would be used for disposing of equipment and soils that are not highly contaminated but result from clean closure of the tank farms. 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 in the alternative.

4.3.14.2.1 Waste Inventories

Table 4–149 presents the estimated waste volumes 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. 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 4–149.

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 (107,256 cubic yards) of LLW and MLLW. Construction, operations, deactivation, and closure of two IDFs and one RPPDF would provide for disposal of tank waste, onsite-generated non-CERCLA waste, FFTF waste, waste management waste streams, and offsite-received LLW/MLLW. 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-generated non-CERCLA, offsite-received LLW/MLLW, FFTF waste, and waste management waste streams; and an RPPDF. The RPPDF would be used for disposing 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 in the alternative.

4.3.14.3.1 Waste Inventories

Table 4–149 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, MLLW, and LLW would be generated from operations of WRAP and the T Plant, and LLW 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 TRC of illness, injury, and death. This section addresses potential impacts on the worker associated with implementation of each of the Waste Management alternatives and disposal groupings. 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 the referenced incidence rates and the projected labor hours, occupational safety impacts associated with each of the alternatives were determined (see Table 4–150). The number of cases associated with alternatives having less construction activities could be slightly overstated. Conversely, alternatives having a larger component of construction activity could be slightly understated.

As shown in Figure 4–39, the greatest industrial safety impacts are associated with alternatives having the greatest number of labor hours.

4.3.15.1 Alternative 1: No Action

There are one million total labor hours 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 and no fatalities.

4.3.15.2 Alternative 2: Disposal in IDF, 200-East Area Only

This Waste Management alternative examines the construction, operations, deactivation, and closure of IDF-East and the RPPDF in addition to ongoing LLBG 218-W-5 activities. This alternative also involves the construction, operations, and deactivation of several new and expanded facilities to support ongoing Hanford waste treatment and storage activities. In summary, using the total labor hours (37.9 million) and the incidence 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. Under Alternative 2 there are three separate disposal groups associated with disposal activities.

Table 4–150. Waste Management Alternatives – Industrial Safety Impacts

Alternative	Labor Category	Million Labor Hours	Total Recordable Case Rate per 100 Workers per Year	Projected Total Recordable Cases	Fatality Rate per 100,000 Workers per Year	Projected Fatalities
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
1 Total		1.00		10.0		0.001
2 and 3: Treatment and Storage	Construction	3.52	2.0	35.2	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
2 and 3 Treatment and Storage Total		37.9		379		0.05
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	6.13	2.0	61.3	0.26	0.008
2 Disposal Group 1 Total		19.9		199		0.026
2: Disposal Group 2	Construction	8.89	2.0	88.9	0.26	0.012
	Operations	95.2	2.0	952	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
2 Disposal Group 2 Total		128		1,280		0.16
2: Disposal Group 3	Construction	8.89	2.0	88.9	0.26	0.012
	Operations	172	2.0	1,720	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
2 Disposal Group 3 Total		205		2,050		0.26
3: Disposal Group 1	Construction	3.67	2.0	36.7	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
3 Disposal Group 1 Total		21.4		214		0.03
3: Disposal Group 2	Construction	10.5	2.0	105	0.26	0.014
	Operations	94.8	2.0	948	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
3 Disposal Group 2 Total		129		1,290		0.17
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
3 Disposal Group 3 Total		205		2,050		0.26

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.

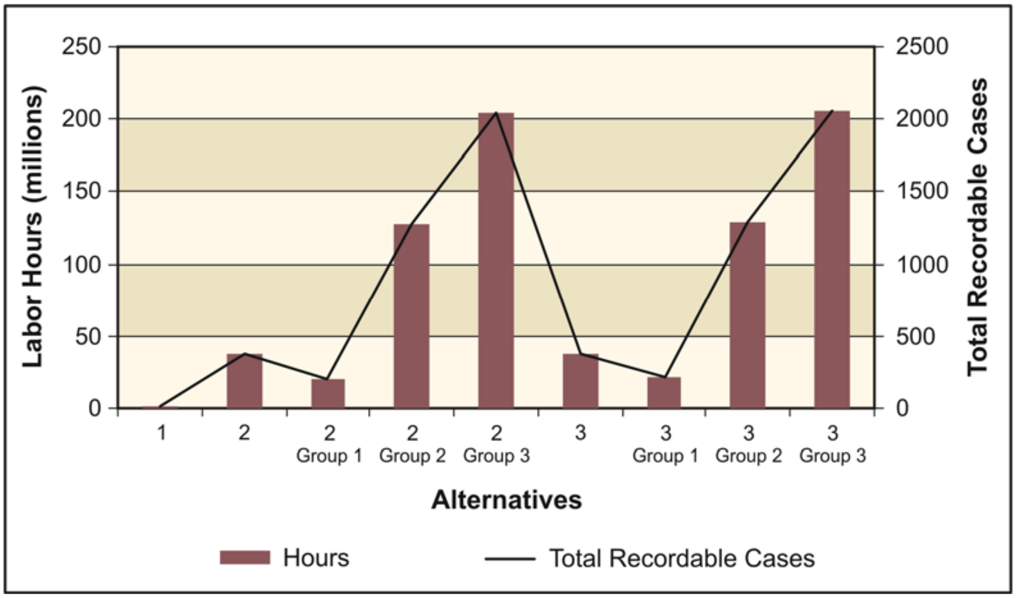


Figure 4–39. Total Recordable Cases and Labor Hours by Alternative

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, total labor hours equal about 205 million hours, and it is anticipated that there would be 2,050 TRCs. No deaths are projected.

4.3.15.3 Alternative 3: Disposal in IDF, 200-East and 200-West Areas

Waste Management Alternative 3 includes the construction of IDFs in the 200-East and 200-West Areas of Hanford, in addition to the RPPDF and continued LLBG 218-W-5 activities. As under Alternative 2, several Hanford waste treatment and storage facilities would also be expanded. The construction, operations, and deactivation of 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 379 TRCs over the life of the project. Applying the fatality (0.26) rate per 100,000 workers returns a value of 0.05. A fatality is not projected to occur over the period of the project. The following paragraphs evaluate the impact of 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 requires about 21 million hours to complete. It would generate 214 TRCs; no fatalities are expected.

4.3.15.3.2 Disposal Group 2

This disposal group requires a total of about 129 million labor hours. Approximately 1,290 TRCs are anticipated, and no fatalities are expected for this alternative.

4.3.15.3.3 Disposal Group 3

To complete the work under this disposal group would require about 205 million hours. This alternative is expected to generate 2,050 TRCs; fatalities are not anticipated.

4.4 COMBINATION OF ALTERNATIVES

The potential short-term environmental and human health impacts associated with implementation of alternatives and options for (1) Hanford SST system closure (i.e., tank closure), (2) decommissioning of the 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, of this chapter. The individual Tank Closure, FFTF Decommissioning, and Waste Management alternatives and options, as applicable, are described in detail in Chapter 2 and Appendix E. This section presents the potential short-term, combined impacts on key resource indicators of implementing selected alternatives and options associated with the three sets of proposed actions.

Key resource indicators have been selected from the total range of impacts measures presented for each resource area or discipline analyzed elsewhere in this chapter to focus on those measures that provide the most meaningful and useful assessment of potential impact. Combined impacts analyses have not been performed for the following resource areas or disciplines: noise and the facility accidents component of public and occupational health and safety. As presented in this section, the combined impacts 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 alternatives and options from each of the sets of proposed actions analyzed in this EIS. For the purposes of this combined impacts analysis, the impacts from disposition of RH-SCs at INL are counted in the combination total for Hanford even though the work would not occur at Hanford.

Several hundred impacts 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 purposes of analysis, 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:

- **Combination 1:** all No Action Alternatives
- **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
- **Combination 3:** Tank Closure Alternative 6B, Base Case (All Vitrification with Separations; Clean Closure); 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

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 and therefore represents, on the whole, 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, a combination that includes Alternative 6A, Option Case, would result in maximum short-term impacts. Selection of these three alternative combinations for detailed analysis in this EIS is 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 whether proposed facilities and actions would be compatible with guidelines established by the *Hanford Comprehensive Land-Use Plan EIS* and recent supplement analysis (DOE 1999, 2008) and RODs (64 FR 61615, 73 FR 55824). Although in some cases previously undisturbed land would be developed, the analyses established that all proposed facilities and actions would be compatible with site land-use guidelines; thus, this issue is not addressed further in this section. However, since the land needed for facility construction is additive, the total land requirement for each of the three combinations is addressed below.

To determine the combined land requirement at Hanford, the area needed for each component within each combination was added together (see Table 4–151). Since 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. The land requirement at INL is minimal under all combinations (none under Combination 1 and 0.1 hectares [0.3 acres] of disturbed land under Combinations 1 and 2); therefore, it is not addressed further.

As noted in Table 4–151, Combination 1 requires the least amount of land (i.e., 2 hectares [5 acres]), all of which would be undisturbed land within Borrow Area C. Combination 2 has a total land requirement of 307 hectares (759 acres), 67 percent of which is undeveloped. The total land area needed under Combination 3 would be 793 hectares (1,960 acres), 94 percent of which is undeveloped. Under Combinations 2 and 3, approximately two-thirds of the undeveloped land would be within Borrow Area C.

Although not addressed in the table, the greatest land area would be required under an alternative combination that included Tank Closure Alternative 6A, Base 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 combination, a total of 1,150 hectares (2,830 acres) would be needed, 95 percent of which is currently undeveloped.

Table 4–151. Combined Hanford Land Use Requirements

Combination and Component	Alternative	Land Area Required (hectares) Hanford Total Land	Land Area Required (hectares) Hanford Undeveloped Land
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
Combination 2			
Tank Closure	2B	195	97.9
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	3.6	2.8
Waste Management	2, DG 1	108	106
Total		307	207
Combination 3			
Tank Closure	6B, Base Case	381	340
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	3.3	3.2
Waste Management	2, DG 2	409	406
Total		793	749

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.
Source: Compiled from Sections 4.1.1.2.1–4.1.1.12.1, 4.2.1.1.1–4.2.1.3.1, 4.3.1.1.1–4.3.1.3.1.

4.4.1.2 Visual Resources

The impact on visual resources under these *TC & WM EIS* combinations is related to a number of factors. Among these is the area of undeveloped land that would be disturbed by new facilities, as analyzed in Section 4.4.1.1 above. Thus, the values for undeveloped land found in Table 4–151 provide a guide to the range of visual impacts that could be expected from 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 (i.e., 2 hectares [5 acres]) would be required under Combination 1. In this case, all development would be within Borrow Area C, an area that, with the exception of an access road, is undisturbed grassland at present. This combination would disturb about 0.2 percent of Borrow Area C. Combination 2 would require 207 hectares (511 acres) of undeveloped land, and Combination 3 would require 793 hectares (1,960 acres) of undeveloped land. In both cases, about two-thirds of this land would be within Borrow Area C.

Facilities and actions likely to have the greatest overall impact on visual resources are those that would require large 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. No facilities that would be constructed under Combination 1 would require more than 20 hectares (50 acres) of land. Under 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 minimally visible 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 Combination 2, Combination 3 would require construction of the ILAW Interim Storage Facilities and the HLW Debris Storage Facilities. Combination 3 would require

401 hectares (991 acres) within Borrow Area C, nearly triple the land requirement of Combination 2 (139 hectares [344 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 4–151—Tank Closure Alternative 6A, Base 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)—requiring a total of 1,090 hectares (2,700 acres) of undeveloped land. This would include 656 hectares (1,620 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 Combination 1 and Class IV under 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 4–152 presents the projected peak annual and total demands for electricity, liquid fuels, and water under each alternative combination. Under each combination, the peaks for each component could potentially occur during different time periods and not overlap. To determine the potential maximum impact of each alternative combination, the peaks of each component were totaled together even when peak impacts are projected to occur in different timeframes. The resulting total projections are overly conservative and represent the upper limit for utility resource requirements.

As shown in Table 4–152, the tank closure component is the most significant contributor to combined peak and combined total utility demands under all combinations, except that surveillance and monitoring activities during the 100-year administrative control period associated with the FFTF Decommissioning No Action Alternative have greater total demands for electricity and water than those associated with the Tank Closure No Action Alternative. For electricity, gasoline, and water, both the highest combined peak and combined total demands occur under 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 are highest under Combination 3 despite the fact that Tank Closure Alternative 2B under Combination 2 has higher peak annual demands for diesel fuel, gasoline, and water than Alternative 6B, Base Case. The combined peak diesel fuel demand is highest under Combination 2, although the combined total diesel fuel demand is highest under Combination 3.

Overall, combined peak annual electrical energy demands could range from 0.04 million megawatt-hours under Combination 1 to as high as 1.26 million megawatt-hours under Combination 3, with the total combined energy requirements ranging from 0.73 to 21.7 million megawatt-hours over the entire duration of alternatives. The peak electrical energy demand of 1.26 million megawatt-hours (approximating an electric load of 144 megawatts) under Combination 3 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.

Table 4–152. Combined Utility Infrastructure Requirements

Combination and Component	Alternative	Electricity Peak Year(s)[a] and Total (M megawatt-hours)	Diesel Fuel Peak Year(s)[a] and Total (M liters)	Gasoline Peak Year(s)[a] and Total (M liters)	Water Peak Year(s)[a] and Total (M liters)
Combination 1					
Tank Closure	No Action	0.035 (2008)	11.8 (2008)	1.0 (2008)	1,090 (2008)
		0.12	35.9	4.61	3,300
FFTF Decommissioning	No Action	0.006 (2008–2107)	0	0.0011 (2008–2107)	79.8 (2008–2107)
		0.60	0	0.11	7,980
Waste Management	No Action	0.00019 (2007–2035)	3.46 (2009)	0.012 (2036–2135)	25.5 (2009)
		0.0056	13.9	1.23	35.7
Combined Peak[b]		0.04	15.3	1.01	1,200
Combined Total[b]		0.73	49.8	5.95	11,300
Combination 2					
Tank Closure	2B	1.16 (2040)	271 (2040)	8.18 (2040)	3,560 (2040)
		17.9	4,040	156	86,300
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	0.0039 (2017)	2.33 (2015–2021)	0.32 (2015–2021)	16.5 (2015–2021)
		0.0045	5.35	0.87	31.1
Waste Management	2, DG 1	0.018 (2007–2050)	41.6 (2011–2052)	4.69 (2011–2052)	90.9 (2011–2052)
		0.56	257	21.7	3,050
Combined Peak[b]		1.18	315	13.2	3,670
Combined Total[b]		18.5	4,300	179	89,400
Combination 3					
Tank Closure	6B, Base Case	1.24 (2040)	255 (2040)	6.56 (2040)	3,500 (2040)
		21.1	4,360	216	92,600
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	0.0039 (2013–2017)	1.70 (2015–2021)	0.28 (2013–2016)	15.6 (2015–2021)
		0.0077	5.09	0.88	30.4
Waste Management	2, DG 2	0.018 (2007–2050)	154 (2011–2102)	15.2 (2011–2102)	283 (2011–2102)
		0.56	1,460	83.1	21,200
Combined Peak[b]		1.26	258	22.0	3,800
Combined Total[b]		21.7	5,830	300	114,000

[a] Year(s) in parentheses 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; M=million.

Source: Compiled from Tables 4–2, 4–99, and 4–128.

For liquid fuels (diesel fuel and gasoline), combined peak annual requirements could range from about 16.3 million liters (4.3 million gallons) under Combination 1 to as high as 328 million liters (86.6 million gallons) under Combination 2, with the total combined liquid fuel requirements ranging from 55.7 million liters (14.7 million gallons) to 6,130 million liters (1,619 million gallons) over the entire duration of alternatives. It has been assumed for the purposes of analysis 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.

Water requirements could entail a combined peak annual demand ranging from about 1,200 million liters (317 million gallons) under Combination 1 to 3,800 million liters (1,000 million gallons) under Combination 3, with total combined water requirements ranging from 11,300 million liters (2,985 million gallons) to 114,000 million liters (30,115 million gallons) over the duration of the alternatives. The projected peak annual water demand of 3,800 million liters (1,000 million gallons) under 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 combinations of alternatives would exceed the capacity of a Hanford utility system. While Combination 3 reflects the upper end of the three combinations, it does not bound infrastructure resource demands. A 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 a combination, the combined peak annual electrical energy demand could be 1.99 million megawatt-hours with a total combined energy requirement of 189 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 (1,817 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 (1,817 million gallons) under all alternatives under this 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 nonradiological 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 4–153 provides the peak incremental concentrations for selected pollutants and averaging periods under the three combinations of alternatives.

Under each combination, the peaks for each pollutant and component could potentially occur during different time periods. For the purposes of analysis, 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 Combination 1, the projected air pollutant concentrations would be dominated by the Tank Closure alternative. Under Combination 2, the Tank Closure alternative dominates for carbon monoxide, and the Tank Closure and Waste Management alternatives have similar contributions for the other pollutants. Under Combination 3, the Waste Management alternative dominates for all pollutants.

Table 4–153. Combined Criteria Air Pollutant Concentrations

Combination and Component	Alternative	Maximum Average Concentration (micrograms per cubic meter)			
		Carbon Monoxide (8 hours)	Nitrogen Dioxide (annual)	Particulate Matter, PM_{10} (24 hours)	Sulfur Dioxide (1 hour)
Combination 1					
Tank Closure	No Action	3,410	8.56	**546**	24.0
FFTF Decommissioning	No Action	4.35	0.000644	0.00272	0.0419
Waste Management	No Action	70.6	1.24	**507**	0.705
Total		3,480	9.8	1,050	24.7
Combination 2					
Tank Closure	2B	5,840	20.4	**4,510**	99.4
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	780	2.84	53.8	37.6
Waste Management	2, DG 1	**10,100**	22.7	**4,080**	84.9
Total		16,700	45.9	8,650	222
Combination 3					
Tank Closure	6B, Base Case	5,290	14.2	**5,110**	65.4
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	772	2.04	94.5	50.4
Waste Management	2, DG 2	**43,400**	95.5	**18,000**	370
Total		49,500	112	23,200	486
Most Stringent Standard or Guideline		10,000	100	150	660

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; PM_{10}=particulate matter with an aerodynamic diameter less than or equal to 10 micrometers.

Source: Compiled from Tables 4–3, 4–100, and 4–129.

When added this way, the total incremental concentrations do not exceed the ambient standards, except for PM, which exceeds ambient standards under all three combinations; carbon monoxide, which exceeds ambient standards under Combinations 2 and 3; and nitrogen dioxide, which exceeds ambient standards under Combination 3. As discussed previously, the PM emissions for all activities are conservatively estimated and no controls are assumed in the estimates, but the methodology is consistently applied so that alternatives can 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 of the three alternative combinations. Table 4–154 provides the volumes of selected geologic and soil materials and total material requirements under the three combinations of alternatives. Representative geologic resources were selected from certain categories (e.g., construction, borrow/backfill, and closure) to facilitate meaningful comparison of demands for alternative components within each combination. As previously described in Section 4.1.5 and elsewhere, it is expected that these materials would be excavated from Borrow Area C and so conservatively reflect the combined impact of obtaining required materials from onsite reserves.

Table 4–154. Combined Geologic and Soil Resource Requirements

Combination and Component	Alternative	Representative Resource Demands (cubic meters)			Total Requirements[a] (cubic meters)
		Construction Gravel	Borrow-Soil	Closure-Barrier Materials	
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
Combination 2					
Tank Closure	2B	255,000	782,000	2,300,000[b]	4,330,000
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	1,900	80,400	19,300	127,000
Waste Management	2, DG 1	11,500	0	1,760,000[c]	1,990,000
Total		268,000	863,000	4,080,000	6,450,000
Combination 3					
Tank Closure	6B, Base Case	880,000	8,550,000	689,000[d]	10,900,000
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	1,900	121,000	0	148,000
Waste Management	2, DG 2	11,500	0	6,800,000[c]	7,630,000
Total		893,000	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; IDF-East=200-East Area Integrated Disposal Facility; RPPDF=River Protection Project Disposal Facility.

Source: Compiled from Tables 4–7, 4–106, and 4–133.

Total geologic resource requirements could range from approximately 99,000 cubic meters (129,000 cubic yards) of material under Combination 1 to as much as 18,700,000 cubic meters (24,600,000 cubic yards) under Combination 3 (see Table 4–154). While the tank closure component generally has the highest geologic resource demands and associated potential for indirect impacts on geology and soils, the waste management component has 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 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 is 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 Combinations 1 and 2 without the need to develop Borrow Area C to a significant degree.

However, a more conservative case 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 a 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 combined impacts on water resources of the three alternative combinations. In general, potential impacts are expected to vary proportionally to 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 combinations are not expected to have any direct impact on major surface-water features, including the Columbia River, as 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 by wind. While unlikely to reach surface-water features as discussed above, which would be controlled via application of best management practices and other measures, 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. As described in Section 4.4.1.1, Combination 2 has a total land requirement of about 307 hectares (758 acres). The total land area needed under Combination 3 would be about 793 hectares (1,960 acres). Under Combinations 2 and 3, about two-thirds of the undeveloped land would be within Borrow Area C. Further, the only component activity with the potential to directly impact surface-water hydrology is excavation work in Borrow Area C, which could impact the areas surrounding Cold Creek but which would be conducted so as to minimize any direct impacts. Excavation activities and thus, potential impacts on this surface-water feature, would be greatest under Combination 3 as indicated above, with the relative intensity of the excavation impacts to meet geologic resources demands 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 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 the 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 4–155. Since no new facilities would be built at INL under Combination 1 and only minimal disturbance (0.1 hectares [0.3 acres]) would take place within the MFC under Combinations 2 and 3, terrestrial habitat would not be impacted at the site.

Table 4–155. Combined Hanford Ecological Resource Disturbance

Combination and Component	Alternative	Land Area (hectares)	
		Terrestrial Habitat	Sagebrush Habitat
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
Combination 2			
Tank Closure	2B	97.9	1.2
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	2.8	0
Waste Management	2, DG 1	106	64.3
Total		207	65.6
Combination 3			
Tank Closure	6B, Base Case	340	98.3
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	3.2	0
Waste Management	2, DG 2	406	248
Total		749	346

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.
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 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 combination. Combination 2 would involve disturbance of 207 hectares (511 acres), 32 percent of which is sagebrush habitat. In the case of Combination 3, a total of 749 hectares (1,850 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 4–155, the greatest impact on terrestrial habitat would occur under an alternative combination that included Tank Closure Alternative 6A, Base 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 a combination would disturb a total of up to 1,090 hectares (2,700 acres) of terrestrial habitat, 40 percent of which would be sagebrush.

4.4.6.2 Wetlands and Aquatic Resources

Since 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 impact on these resources from any of the alternative combinations.

4.4.6.3 Threatened and Endangered Species

Impacts of individual components of this EIS on threatened and endangered species, including other Federally or state-listed special status species, have been evaluated earlier in this chapter under "Ecological Resources" (see Sections 4.1.7, 4.2.7, and 4.3.7). That analysis focused on listed species that would be potentially affected by proposed projects and actions and was based on their observed presence, as well as the amount of undeveloped land, especially sagebrush habitat, that potentially would be disturbed.

For the combined impacts analysis, the number of special status species observed or potentially present within areas affected by the three *TC & WM EIS* alternative combinations was determined. While none of the combinations would impact Federally or state-listed threatened or endangered species, a number of state-listed species with other special status designations could be affected. Under 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 Combination 2. Under Combination 3, as many as seven special status species could be impacted. These include the loggerhead shrike (Federal species of concern and state candidate), sage sparrow (state candidate), black-tailed jackrabbit, long-billed curlew, Piper's daisy, stalked-pod milkvetch, and crouching milkvetch (state watch). Since the potential to cause disturbance to these species would be greater as habitat disturbance increases, especially sagebrush habitat, the overall potential to impact special status species increases from Combination 1 to Combination 3.

Although not one of the identified alternative combinations, a combination that would include 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), has the greatest potential to impact special status species. This combination could affect the same seven species affected under Combination 3. However, the overall potential to impact these species would be greater under this 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 are directly related to the acreage and location of land disturbed (see Table 4–149) and the visual impacts expected from these combinations.

Combination 1 would require the least acreage of undeveloped land and would involve the least disturbance of this land. 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 components. Combination 1 would disturb about 2 hectares (5 acres) of Borrow Area C. Cultural deposits have no 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 combination.

Combination 2 would require 207 hectares (511 acres), and Combination 3 would require 793 hectares (1,960 acres) of previously undisturbed land. Although a larger area of land would be disturbed compared with Combination 1, cultural deposits have no to low potential of being present in the areas that would be impacted under these 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 Combination 1 would have no impact on historic resources including buildings associated with the Manhattan Project and Cold War era, located within the 200-East and 200-West Areas.

Combinations 2 and 3, which would disturb more land than Combination 1, also would not affect historic resources in the area. Historic resources located in the northwest portion of the 200-West Area would not be affected by construction or excavation.

4.4.7.3 American Indian Interests

Impacts of individual components of this EIS on American Indian areas of interest have been evaluated earlier in this chapter under "Cultural and Paleontological Resources" (see Sections 4.1.8, 4.2.8, and 4.3.8).

Construction of new facilities and disturbance of previously undeveloped land are actions that would have the greatest impact. 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 Combination 1, the industrial appearance of the 200-East and 200-West Areas would remain largely unchanged. 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. Combination 3 would require construction of the ILAW Interim Storage Facilities and HLW Debris Storage Facilities in addition to other facilities in relation to Combination 2. The land requirement within Borrow Area C would increase to 401 hectares (991 acres), nearly triple the land requirement for Combination 2 (139 hectares [344 acres]), causing the greatest visual impact on Rattlesnake Mountain.

4.4.8 Paleontological Resources

Impacts of individual components of this EIS on paleontological resources have been evaluated earlier in this chapter under "Cultural and Paleontological Resources" (see Sections 4.1.8, 4.2.8, and 4.3.8). Since no paleontological resources have been discovered within any of the areas that would potentially be disturbed by the alternatives proposed under any of the combinations, there would be no impact on these resources from any of the alternative combinations.

4.4.9 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 4–156 provides the projected peak workforce, commuter traffic, and truck activity under the three combinations.

Table 4–156. Combined Socioeconomic Impact Measures

Combination and Component	Alternative	Peak Annual Workforce[a] (Peak Year)	Peak Daily Commuter Traffic	Peak Daily Truck Loads (Peak Year)	
				Off Site	On Site
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
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 (2051–2052)	428 (2051–2052)
Total		8,190	6,550	79	697
Combination 3					
Tank Closure	6B, Base Case	7,870 (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	1,750

[a] The workforce is rounded into full-time equivalent quantities.
Note: Totals may not equal the sum of the contributions due to rounding.
Key: DG=Disposal Group; FFTF=Fast Flux Test Facility.
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.

Under each combination, the peaks for each component could potentially occur during different timespans. To determine the potential impact of each alternative combination, the peak amounts of each component were totaled together. The resulting conservative total estimates represent the upper limit of workforce requirements. As shown in Table 4–156, the projected total workforce in all three combinations would be dominated by the requirements of the tank closure component. The 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 (123,317 in 2008) in the ROI. The higher workforce ranges from approximately 8.4 percent (149,947 in 2021) to 4 percent (313,824 in 2101) of the projected labor force in the ROI. For comparison, in 2006, the employment of approximately 10,000 people at Hanford was about 10 percent of those 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 the commuter traffic under Combination 3. In addition to the commuter traffic, trucks moving equipment and resources off site would peak around 26,500 trips per year (102 trips per day) under Combination 2. Combination 3 would require the larger number of trucks (approximately 457,000 trips per year) moving material on site. Based on this predicted truck activity and commuter traffic, the LOS on offsite roads in the Hanford area is expected to be impacted.

4.4.10 Public and Occupational Health and Safety—Normal Operations

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 combinations of alternatives on the public and workers. Table 4–157 presents the projected peak annual and total impacts on the general population and an MEI under each component (alternative) and combination. Combined impacts on the general population are estimated by adding the impacts on the population living within 80 kilometers (50 miles) of the site (Hanford or INL) under each alternative. Under each combination, the peaks for each component could potentially occur during different time periods and not overlap. To determine the potential maximum impact of each alternative combination, the peaks of each component were totaled even when peak impacts are projected to occur in different timeframes. Similarly, impacts on an MEI are added although the MEI may be in different locations along the perimeter of Hanford or INL. This approach provides a conservative estimate of potential impacts.

Table 4–158 presents the combined impacts of normal operations on the worker population. The total impact on the worker population is 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 occur would overlap, but because of the varying durations of activities, there would be times when only one or two of the activities would be under way. 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.

Under each of the three combinations, the selected Tank Closure alternative dominates the impacts on the public and workers. The Tank Closure alternative accounts for an especially high proportion of impacts on the public to more than 99 percent of the dose to the general population and the MEI. The dose from the operational life of the project under Combination 1, about 600 person-rem, would result from a comparatively low annual offsite impact occurring at a fairly constant rate for approximately 100 years. Although the dose from the life of the project in the general population would be of the same order of magnitude under Combinations 2 and 3 (460 person-rem and 600 person-rem, respectively), the peak annual dose under the Tank Closure Alternative 6B is substantially higher. This means that most of the public dose occurs over a shorter period of time—during waste treatment, tank and soil excavation activities, or both.

Table 4–158 shows that the cumulative worker dose increases as the level of activity increases among the combinations. Combination 1, comprising the No Action Alternatives, would have worker doses from continued operations and maintenance activities under each alternative. Combination 2 would have higher cumulative worker doses: the Tank Closure alternative worker dose would increase as a result of retrieving and processing tank waste; the FFTF Decommissioning alternative dose would increase due to processing sodium and RH-SCs and entombing the buildings; and the Waste Management alternative dose would increase due to a longer period of disposal operations and an increase in waste processing activities. Combination 3 would have the largest cumulative worker doses: the Tank Closure alternative worker dose would increase as a result of tank and soil removal and processing; the FFTF Decommissioning alternative dose would increase as a result of the removal of the RCB vessels, piping, and components for disposal at IDF-East; and the Waste Management alternative dose would increase due to the receipt of offsite waste and a longer period of disposal operations.

Table 4–157. Combined Public Health Impacts—Normal Operations

Combination and Component	Alternative	Time Period	General Population[a] Dose (person-rem)	General Population[a] Risk (LCFs)	Maximally Exposed Individual[b] Dose (millirem)	Maximally Exposed Individual[b] Risk (LCFs)
Combination 1						
Tank Closure	No Action	Peak annual	6.3	0 (4×10^{-3})	0.13	8×10^{-8}
		Project total	600	0 (4×10^{-1})	12	7×10^{-6}
FFTF Decommissioning	No Action	Peak annual	0	0	0	0
		Project total	0	0	0	0
Waste Management	No Action	Peak annual	0	0	0	0
		Project total	0	0	0	0
Combined Impacts		Peak annual	6.3	0 (4×10^{-3})	0.13	8×10^{-8}
		Project total	600	0 (4×10^{-1})	12	7×10^{-6}
Combination 2						
Tank Closure	2B	Peak annual	76	0 (5×10^{-2})	1.7	1×10^{-6}
		Project total	460	0 (3×10^{-1})	9.2	5×10^{-6}
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	Peak annual	0.0033	0 (2×10^{-6})	0.00012	7×10^{-11}
		Project total	0.0072	0 (4×10^{-6})	0.00026	2×10^{-10}
Waste Management	2, DG 1	Peak annual	0.000018	0 (1×10^{-8})	0.00000021	1×10^{-13}
		Project total	0.00067	0 (4×10^{-7})	0.0000082	5×10^{-12}
Combined Impacts		Peak annual	76	0 (5×10^{-2})	1.7	1×10^{-6}
		Project total	460	0 (3×10^{-1})	9.2	5×10^{-6}
Combination 3						
Tank Closure	6B, Base Case	Peak annual	76	0 (5×10^{-2})	1.7	1×10^{-6}
		Project total	600	0 (4×10^{-1})	12	7×10^{-6}
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	Peak annual	0.0033	0 (2×10^{-6})	0.00012	7×10^{-11}
		Project total	0.0072	0 (4×10^{-6})	0.00026	2×10^{-10}
Waste Management	2, DG 2	Peak annual	0.000018	0 (1×10^{-8})	0.00000021	1×10^{-13}
		Project total	0.00067	0 (4×10^{-7})	0.0000082	5×10^{-12}
Combined Impacts		Peak annual	76	0 (5×10^{-2})	1.7	1×10^{-6}
		Project total	600	0 (4×10^{-1})	12	7×10^{-6}

[a] The reported value is the projected number of LCFs in the population and is therefore presented as a whole number. When the reported whole value is zero, 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.1.1.3).

[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; 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 4–136.

Table 4–158. Combined Worker Health Impacts—Normal Operations

Combination and Component	Alternative	Project Total Impact–Worker Population		Duration of Radiological Work (years)	Average Annual Impact–Full-Time Equivalent Worker[b]	
		Dose (person-rem)	Risk (LCFs)[a]		Dose (millirem/ year)	Risk (LCFs)[a]
Combination 1						
Tank Closure	No Action	280	0 (2×10^{-1})	102	140	9×10^{-5}
FFTF Decommissioning	No Action	1	0 (6×10^{-4})	100	50	3×10^{-5}
Waste Management	No Action	37	0 (2×10^{-2})	29	200	1×10^{-4}
Combined Impacts		320	0 (2×10^{-1})		<200	$<1\times10^{-4}$
Combination 2						
Tank Closure	2B	11,000	7	61	160	1×10^{-4}
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	5.2	0 (3×10^{-3})	3	33	2×10^{-5}
Waste Management	2, DG 1	3,400	2	45	200	1×10^{-4}
Combined Impacts		14,000	9		<200	$<1\times10^{-4}$
Combination 3						
Tank Closure	6B, Base Case	82,000	49	96	870	5×10^{-4}
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	11	0 (7×10^{-3})	3	51	3×10^{-5}
Waste Management	2, DG 2	6,600	4	94	200	1×10^{-4}
Combined Impacts		89,000	50		<870	$<5\times10^{-4}$

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.1.1.3). 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 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; 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, 4–135, 4–137, 4–138, and 4–139.

Worker risks shown in Table 4–158 should be viewed in the context of the duration of the alternatives and the DOE administrative controls employed that limit worker dose, as discussed in Section 4.1.10. Some of the alternatives would occur over multiple generations of workers (e.g., 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 that 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, Combination 3 would require about 112,000 FTE radiation worker years; however, the actual number of worker years could be greater than 112,000 to comply with the administrative control level.

Note that the FTE worker average annual dose, shown in Table 4–158, 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.

4.4.11 Public and Occupational Health and Safety—Transportation

The risks from the 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 4–159 provides the impacts on transportation workers and on the general population from transportation activities under the three selected alternative combinations.

Table 4–159. Combined Transportation Risks

Combination and Component	Alternative	Worker		General Population		Nonradiological Traffic Fatalities[a]
		Collective Dose (person-rem)	Risk (Latent Cancer Fatalities)	Collective Dose (person-rem)	Risk (Latent Cancer Fatalities)	
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]	2.62	0.00	0.08	0.00	0.00
Total		2.62	0 (0.0)	0.08	0 (0.0)	0 (0.0)
Combination 2						
Tank Closure	2B	262	1.6×10^{-1}	73	4.4×10^{-2}	0.57
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option[c]	0.95	0.00	0.34	0.00	0.021
Waste Management	2, DG 1[d]	2,620	1.57	352	2.1×10^{-1}	1.20
Total		2,880	2 (1.7)	425	0 (2.5×10^{-1})	2 (1.8)
Combination 3						
Tank Closure	6B, Base Case	560	3.4×10^{-1}	89	5.3×10^{-2}	1.3
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option[b]	0.99	0.00	0.34	0.00	0.024
Waste Management	2, DG 2[e]	2,620	1.57	352	2.1×10^{-1}	1.4
Total		3,180	2 (1.9)	441	0 (2.6×10^{-1})	3 (2.7)

[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 for Alternative 2B. Also, 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 for Alternative 6B, Base Case. Also, 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.

Source: Compiled from Tables 4–69, 4–70, 4–124, 4–125, 4–146, and 4–147.

As indicated in Table 4–159, no combination of transports would be expected to result in an LCF among the exposed population. There could be two additional fatalities among the exposed workers under 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, which would administratively limit the annual dose to 2 rem (DOE Standard 1098-99). 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 3 over the entire duration of activities. Considering that the duration of activities ranges from 30 to over 100 years and the average traffic fatalities in the U.S. is about 40,000 per year, the expected risk of traffic fatalities is small.

4.4.12 Environmental Justice

The potential for high and adverse impacts on minority and low-income populations that would result from implementing 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 selected combinations of alternatives. Resource areas that could impact the general population, and therefore could potentially impact minority and low-income populations, include public and occupational health and safety due to normal operations, accidents, and transportation; and air quality.

Section 4.4.9 discusses the short-term radiological impacts on the public resulting from normal operations. As shown in Table 4–158, the majority of the dose received by the public and the MEI under all combinations is 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 for all Tank Closure alternatives. Similarly, the dose to the Yakama Reservation MEI is approximately one order of magnitude lower than the dose to the offsite MEI for both the peak year of exposure and across the lifetime of the project for all Tank Closure alternatives. Therefore, none of the selected combinations of alternatives would pose disproportionately high and adverse impacts on minority or low-income populations.

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. Since 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 combination alternatives 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; because 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 combination alternatives. None of the selected combinations would be expected to result in an LCF to the exposed population, which includes minority, American Indian, Hispanic or Latino, and low-income populations. Therefore, none of the alternative combinations would pose disproportionately high and adverse impacts on minority or low-income populations residing along transportation routes.

4.4.13 Waste Management

Waste management generation and facility utilization impacts of implementing the various tank closure, FFTF decommissioning, and waste management component activities 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 is either sufficient or the new infrastructure will be constructed as part of the alternative. This section describes the combined impacts of managing these wastes. Projected waste generation rates for the proposed activities 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 capacities of treatment, storage, and disposal facilities likely to be involved in managing the additional waste. Potential impacts of waste generated as a result of site environmental restoration activities unrelated to tank closure, FFTF decommissioning, or waste management are not within the scope of this analysis.

Table 4–160 presents the projected waste generation for the three alternative combinations considered. The three combinations include onsite, non-CERCLA waste. Combinations 2 and 3 also include the projected receipt of offsite waste shipments. Under 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 this source, the volume of LLW and MLLW for the period from 2006 through 2035 is estimated to be approximately 5,300 cubic meters (187,200 cubic yards). For TRU waste, the estimated volume is 22,526 cubic meters (29,500 cubic yards) and for hazardous waste, the estimated volume is 870 cubic meters (1,140 cubic yards). However, since hazardous waste is often shipped directly off site for disposal, estimates are often not provided. Therefore, it is expected that this is only a subset of the total hazardous waste that will 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 4–160. Combined Waste Generation Volumes

Component	Alternative	Waste Type: HLW[a]	Mixed TRU Waste	LLW	MLLW	Hazardous Waste[b]	Nonradioactive/ Nonhazardous Waste[b]	Liquid LLW (liters)
Combination 1								
Tank Closure	No Action	N/A	N/A	35	21	12	307	N/A
FFTF Decommissioning	No Action	N/A	N/A	1,699	57	396	NR	622,925
Waste Management	No Action	N/A	N/A	38	N/A	38	NR	N/A
Onsite, non-CERCLA waste[c]		N/A	22,526	3,735	1,516	870	NR	N/A
Offsite waste[d]		N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total		N/A	22,526	5,507	1,594	1,316	307	622,295
Combination 2								
Tank Closure	2B	15,968	206	38,374	725,811	79,262	2,273	9,691
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	N/A	N/A	153	690	NR	462	181,699
Waste Management	2, Disposal Group 1	N/A	N/A	1,515	98	58	NR	N/A
Onsite, non-CERCLA waste[c]		N/A	22,526	3,735	1,516	870	NR	N/A
Offsite waste		N/A	N/A	62,000	20,000	N/A	N/A	N/A
Total		15,968	22,732	105,777	748,115	80,190	2,735	191,390
Combination 3								
Tank Closure	6B, Base Case	790,459	412	103,852	2,518,334	80,880	2,480,402	9,691
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	N/A	N/A	828	708	73	10,180	323,788
Waste Management	2, Disposal Group 2	N/A	N/A	1,515	98	58	NR	N/A
Onsite, non-CERCLA waste[c]		N/A	22,526	3,735	1,516	870	NR	N/A
Offsite waste		N/A	N/A	62,000	20,000	N/A	N/A	N/A
Total		790,459	22,938	171,930	2,540,619	81,881	2,490,582	333,479

[a] Includes cesium and strontium canisters, HLW melters, and other HLW. Includes ILAW under Alternative 6B, Base Case.
[b] Hazardous and nonhazardous waste is directly shipped off site; therefore, it is generally not forecasted.
[c] 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.
[d] 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 yards, multiply by 1.308; to liters to gallons, by 0.26417.

Key: CERCLA=Comprehensive Environmental Response, Compensation, and Liability Act; FFTF=Fast Flux Test Facility; HLW=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; NR=not reported; TRU=transuranic.

Source: Compiled from Tables 4–84, 4–86, 4–94, 4–126, and 4–149.

The estimates for the disposal of offsite-received LLW and MLLW from other DOE sites are provided and are consistent with the January 6, 2006, Settlement Agreement among DOE, Ecology, and the Washington State Attorney General's Office (*State of Washington v. Bodman*, Civil No. 2.03-cv-05018-AAM). The volumes of such offsite waste are limited to 62,000 cubic meters (81,000 cubic yards) of LLW and 20,000 cubic meters (26,000 cubic yards) of MLLW; these volumes were established in existing stipulations that were agreed upon with the State of Washington and entered as orders of the court, and as recorded in the ROD for the solid waste program (69 FR 39449). Thus, this *TC & WM EIS* evaluated the upper limits 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 is influenced by the volume of waste produced and the ability of the waste to meet onsite disposal criteria. The Waste Management alternatives analyze the use of current disposal facilities (e.g., lined trenches) and construction of new facilities (IDF and RPPDF). All three Waste Management alternatives include continued disposal of LLW and MLLW in lined trenches, with the timeframe of disposal completion varying from 2035 to 2050. Waste Management Alternatives 2 and 3 both include construction of the RPPDF for disposal of equipment and soils that are not highly contaminated but result from clean closure activities, and one or two IDFs for tank waste, onsite-generated non-CERCLA waste, FFTF 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 facilities, one in the 200-East Area (for tank waste only), IDF-East, 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 amount 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 among the disposal group options. Disposal details for each of the Waste Management alternatives and disposal groupings are discussed in Chapter 2.

For HLW, combined generation rates range from 15,968 cubic meters (20,886 cubic yards) under Combination 2 to 790,459 cubic meters (1,034,000 cubic yards) under Combination 3 (see Table 4–160). 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 the present.

For mixed TRU waste, combined generation rates range from 22,526 cubic meters (29,500 cubic yards) under Combination 1 to 22,938 cubic meters (30,000 cubic yards) under Combination 3. It is anticipated that TRU waste would be disposed of at WIPP.

For LLW, combined generation rates range from 5,507 cubic meters (7,200 cubic yards) under Combination 1 to 171,930 cubic meters (225,000 cubic yards) under Combination 3. All LLW would be sent directly to disposal on site.

For MLLW, combined generation rates range from 1,594 cubic meters (2,080 cubic yards) under Combination 1 to 2,540,619 cubic meters (3,323,130 cubic yards) under Combination 3. Using a combination of on- and offsite capabilities, MLLW would be treated to meet an RCRA land disposal restriction treatment standards and then disposed of on site.

Hazardous waste volumes are often not forecasted, but for what has been forecasted, combined generation rates range from 1,316 cubic meters (1,720 cubic yards) under Combination 1 to 81,881 cubic meters

(107,000 cubic yards) under Combination 3. All hazardous waste generated at Hanford is shipped off site for disposal or recycling.

Nonhazardous waste volumes are also often not forecasted, but for what has been forecasted, combined generation rates range from 307 cubic meters (402 cubic yards) under Combination 1 to 2,480,402 cubic meters (3,240,000 cubic yards) under Combination 3. All nonhazardous waste generated at Hanford is shipped off site for disposal or recycling.

As discussed above, none of the three combinations of alternatives would exceed the capacity of the current or planned Hanford waste management infrastructure. While Combination 3 reflects the upper end of the three combinations, it does not bound waste management infrastructure demands. A combination that would include Tank Closure Alternative 6A (Base or Option Case) in substitution for Alternative 6B, Base Case, along with 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 impact on the waste management infrastructure for HLW, MLLW, hazardous waste, and liquid LLW.

A combination that would include Tank Closure Alternative 6B (Option Case) in substitution for Alternative 6B, Base Case, along with 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 impact on the waste management infrastructure for LLW.

A combination that would include Tank Closure Alternative 4 in substitution for Alternative 6B, Base Case, along with 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 impact on the waste management infrastructure for mixed TRU waste.

However, the generation of these wastes would unlikely have major impacts on the waste management infrastructure at Hanford because sufficient capacity exists or would be constructed under the corresponding Waste Management alternatives.

4.4.14 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 is projected over the duration of the alternatives under each combination (see Table 4–161). The resulting total number of TRCs and fatalities represents the potential impacts on worker safety.

As indicated in the table, the number of projected TRCs and fatalities is greatly influenced by the requirements of the Tank Closure alternatives. The number of TRCs ranges from 173 under Combination 1 to 6,870 under Combination 3. The greater number of TRCs is directly related to the amount of work required and the length of time that work is performed.

Table 4–161. Industrial Safety Impacts for Selected Combinations of Alternatives

Combination and Component	Alternative	Number of Total Recordable Cases	Number of Fatalities
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
Combination 2			
Tank Closure	2B	3,940	0.52
FFTF Decommissioning	2, Idaho Option, Hanford Reuse Option	17.1	0.002
Waste Management	2, DG 1	578	0.076
Total		4,540	0.60
Combination 3			
Tank Closure	6B, Base Case	5,190	0.67
FFTF Decommissioning	3, Idaho Option, Hanford Reuse Option	18.5	0.002
Waste Management	2, DG 2	1,660	0.21
Total		6,870	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.
Source: Compiled from Tables 4–98, 4–127, and 4–150.

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