SECTION 2
TOPICS OF INTEREST

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Several topics identified in the public comments on the *Draft TC & WM EIS* are of broad interest or concern and warrant a more detailed response than could effectively be presented in the side-by-side format in Section 3 of this CRD. These topics, listed below, and DOE's overall responses are addressed in this section.

- Transport and disposal of offsite waste
- Age/accuracy of data
- Remediation/cleanup at Hanford
- Vadose zone and groundwater modeling
- Cleanup actions for existing subsurface contamination
- The Oregon proposal
- Regulatory compliance
- Climate change
- Secondary-waste-form performance
- High-level radioactive waste (HLW) disposition (Yucca Mountain issue)
- Mitigation
- Exclusion of greater-than-Class C (GTCC) waste in cumulative impacts analysis

2.1 TRANSPORT AND DISPOSAL OF OFFSITE WASTE

Topic:

Many commentors expressed concern and/or opposition to transporting LLW and MLLW from other DOE sites to Hanford for disposal. Some commentors stated that Hanford should be cleaned up before any waste is imported from off site, while others suggested that the Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (WM PEIS) *(DOE 1997) Record of Decision (ROD) be rescinded based on the results of the* TC & WM EIS *analysis. Some commentors reminded DOE that the citizens of Washington State voted recently to deny the shipping of more nuclear waste to the state and expressed the opinion that the vote should be respected. These concerns regarding the import of offsite waste to Hanford generally were based on the draft EIS analysis that indicated the receipt of offsite waste would contribute radiological risk drivers (iodine-129 and technetium-99, among others) to groundwater impacts on the site, where exceedances of regulatory benchmarks are already predicted.*

Also, several commentors expressed concern that there could be a terrorist attack on a waste shipment while it was being transported to Hanford. Other commentors stated the risks were too great because of factors such as the weather, road conditions, or drivers in other vehicles causing an accident that could lead to a release of radioactive waste to the environment. Some commentors stated that over 800 latent cancer fatalities (LCFs) would result from DOE transportation activities. Many commentors oppose the use of roads near their communities to transport these wastes, with many of these commentors focusing on the transportation corridors of Interstates 5 and 205.

Discussion:

The transport of offsite waste to Hanford for disposal has been addressed in NEPA documentation previous to this *TC & WM EIS*. DOE issued a ROD in 2000 (65 FR 10061; February 25, 2000) for the *WM PEIS* (DOE 1997) choosing Hanford and the Nevada National Security Site (NNSS) (formerly the Nevada Test Site) as the regional locations for the disposal of LLW and MLLW from across the DOE complex. In the *WM PEIS*, DOE indicated that additional site-specific analyses would be prepared to

implement these programmatic decisions. This *TC & WM EIS* is that site-specific analysis of the potential environmental impacts associated with a number of proposed actions, including disposal of LLW and MLLW potentially shipped to Hanford from offsite DOE locations. This *Final TC & WM EIS* will be used to support DOE's future NEPA decisionmaking with respect to offsite waste when the Waste Treatment Plant (WTP) becomes operational.

Although not part of the proposed scope of this *TC & WM EIS*, the *WM PEIS* also analyzed shipment of other waste types between DOE sites, as well as disposal. In addition to potentially receiving other sites' LLW and MLLW, in accordance with the *WM PEIS* ROD, Hanford ships nuclear waste to the Waste Isolation Pilot Plant (WIPP) in New Mexico for disposal.

The *Final Hanford Site Solid (Radioactive and Hazardous) Waste Program Environmental Impact Statement, Richland, Washington (HSW EIS)* (DOE 2004a) analyzed offsite waste for disposal at Hanford, and DOE issued a ROD in 2004. However, a lawsuit was filed against DOE, which was later settled through a Settlement Agreement. As part of the Settlement Agreement, DOE committed to reanalyze offsite waste, with some exceptions, for disposal at Hanford. As stated in Appendix D of this *TC & WM EIS*, in accordance with DOE's January 6, 2006, Settlement Agreement with the State of Washington (as amended on June 5, 2008) regarding *State of Washington v. Bodman* (Civil No. 2:03-cv-05018-AAM), signed by DOE, Ecology, the Washington State Attorney General's Office, and the U.S. Department of Justice (DOJ), this *TC & WM EIS* evaluated the transportation of LLW and MLLW from other DOE sites to Hanford for disposal.

A number of commentors questioned the validity of the volume of offsite waste or questioned DOE's apparent reliance on the *HSW EIS* analysis. The volume of this offsite waste was established in the "Record of Decision for the *Solid Waste Program, Hanford Site, Richland, WA*: Storage and Treatment of Low-Level Waste and Mixed Low-Level Waste; Disposal of Low-Level Waste and Mixed Low-Level Waste, and Storage, Processing, and Certification of Transuranic Waste for Shipment to the Waste Isolation Pilot Plant" (69 FR 39449). The volumes are limited to 62,000 cubic meters (81,100 cubic yards) of LLW and 20,000 cubic meters (26,200 cubic yards) of MLLW. This volume was determined to be a reasonable starting point and followed the 2006 Settlement Agreement and its associated Memorandum of Understanding (MOU) between DOE and Ecology, and was reflected in the 2006 Notice of Intent (NOI) (71 FR 5655). The Preferred Alternative for waste management in the *Draft* and this *Final TC & WM EIS* also included limitations on, and exemptions for, offsite waste importation at Hanford, at least until the WTP is operational.

Regardless of the limitation on offsite waste importation at Hanford (at least until the WTP is operational), DOE recognizes in this *TC & WM EIS* the potential negative impacts on Hanford groundwater that the offsite waste poses. The *TC & WM EIS* analysis shows that receipt of offsite waste streams that contain specific amounts of certain isotopes, specifically iodine-129 and technetium-99, which are radiological risk drivers, could cause an adverse impact on the environment. Therefore, one means of mitigating this impact would be for DOE to limit disposal of offsite waste streams at Hanford. For example, DOE evaluated the effect of applying waste acceptance criteria to offsite waste by removing a highly radioactive waste stream (e.g., high inventories of iodine-129 and technetium-99) from the inventory of offsite waste analyzed for disposal at Hanford in this final EIS. Another mitigation measure could be to treat the waste so the final waste form is more protective once it is disposed of. This and other mitigation measures are discussed in Chapter 7, Table 7–1 and Sections 7.1.6, 7.5.2.2, and 7.5.3, of this final EIS.

Other individuals indicated this EIS should not evaluate offsite waste because of the Cleanup Priority Act. In November 2004, Washington State voters passed Initiative 297, known as the Cleanup Priority Act. This act would have restricted the importation of offsite waste to Hanford, among other things. DOJ challenged the initiative, arguing it violated the U.S. Constitution. The Federal District Court agreed

and ruled the initiative "invalid in its entirety." The State of Washington appealed the ruling, but the Ninth Circuit Court of Appeals affirmed the lower court, declaring the initiative was preempted by the Atomic Energy Act of 1954.

A number of comments regarding offsite waste also included concerns related to the possibility of a terrorist attack and the potential impacts resulting from such an event. DOE considered the threat of terrorist attack and has taken steps to reduce any vulnerability to this threat. DOE considers, evaluates, and plans for potential terrorist attacks during transportation and storage of radioactive materials. The details of DOE's plans for terrorist countermeasures and the security of its facilities and transports are classified. DOE evaluates acts of sabotage or terrorism related to the transport of radioactive materials and waste in this *TC & WM EIS*, Appendix H, Section H.6.6. In considering the potential consequences of an act of sabotage or terrorism in this EIS, DOE has determined that the analyses of sabotage events described in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (Yucca Mountain EIS)* (DOE 2002) and its supplemental environmental impact statement (SEIS) (DOE 2008a) are bounding (i.e., the consequences of such an action involving transportation of waste to Hanford would be less than the corresponding consequences in the *Yucca Mountain EIS* and its SEIS) for this *TC & WM EIS* for the potential impacts of transporting LLW and MLLW to Hanford.

DOE understands that there is always a risk of an accident when transporting radioactive waste. DOE is constantly working to ensure that the risk of a traffic accident is minimized and has issued guidance for the safe transport of radioactive materials and wastes. As specified in DOE Manual 460.2-1A, *Radioactive Material Transportation Practices Manual for Use with DOE O 460.2A*, carriers of LLW and MLLW are expected to exercise due caution and care in dispatching shipments. According to the manual, the carrier will determine the acceptability of weather and road conditions, whether a shipment should be held before departure, and when actions should be taken while en route. The manual emphasizes that shipments should not be dispatched if severe weather or bad road conditions make travel hazardous. Current weather conditions, the weather forecast, and road conditions would be considered before dispatching a shipment. Conditions at the point of origin and along the entire route would be considered. DOE uses DOE Order 151.1C, *Comprehensive Emergency Management System*, as a basis to establish a comprehensive emergency management program that provides detailed, hazard-specific planning and preparedness measures to minimize the health impacts of accidents involving loss of control over radioactive material or toxic chemicals, as discussed in this *TC & WM EIS*, Chapter 3, Section 3.2.10.5, Emergency Preparedness. DOE contractors are responsible for maintaining emergency plans and response procedures for all facilities, operations, and activities under their jurisdiction and for implementing those plans and procedures during emergencies. The Transportation Emergency Preparedness Program was established by DOE to ensure its operating contractors and state, tribal, and local emergency responders are prepared to respond promptly, efficiently, and effectively to accidents involving DOE shipments of radioactive material. These measures would help DOE minimize and mitigate impacts on the environment.

A number of commentors indicated they believed shipping offsite waste to Hanford for disposal would result in 800 LCFs. This value for transportation risk does not exist in this *TC & WM EIS*. DOE believes that the value of approximately 800 LCFs, cited in the public comments, is from the results provided in the *Draft Global Nuclear Energy Partnership Programmatic Environmental Impact Statement (GNEP PEIS)* (DOE 2008b) regarding transportation of spent nuclear fuel (SNF) and HLW, which did not include Hanford's HLW. This value represents the maximum impacts associated with 50 years of transportation activities supporting the operations of all existing U.S. commercial light-water reactors if they all were replaced with high-temperature, gas-cooled reactors. The *GNEP PEIS* was canceled by DOE on June 29, 2009 (74 FR 31017), because DOE is no longer pursuing domestic commercial reprocessing. As shown in the Summary, Section S.5.3, Table S–7; Chapter 2, Table 2–11 and

Section 2.8.3.10; and Chapter 4, Section 4.3.12, it is unlikely that the estimated total public radiation exposures from transporting LLW and MLLW to Hanford for disposal would result in any additional LCFs.

This *TC & WM EIS* analyzes the transport of radioactive waste from specific origination sites to specific destinations. Appendix H, Figure H–4, Waste Management Alternatives – Analyzed Truck and Rail Routes, shows the routes that were analyzed in this EIS. It is possible that, due to changes in route characteristics, weather conditions, and highway construction, routes between Hanford and other sites could vary; however, this change is not expected to alter the comparative risk results presented for the alternatives. DOE recognizes the concerns of Portland area residents regarding the transport of radioactive waste to Hanford; however, analysis shows that the risks would be small. Further, DOE does not expect any shipments to use Interstate 5 or 205 because waste shipments would originate east and southeast of Hanford. None of the offsite radioactive waste streams analyzed in this *TC & WM EIS* that would originate on the West Coast would use Interstate 5 or 205.

2.2 AGE/ACCURACY OF DATA

Topic:

Some commentors noted that some of the inventory data included in this EIS came from 2002–2003 and, therefore, are outdated (e.g., tank farm and offsite waste volume projections). Other commentors questioned how the use of newer data/methodology would affect analytical results and requested that a qualitative discussion be added to this Final TC & WM EIS *on how newer data/methodology results may differ from those presented in this final EIS. Some commentors recommended that more-recent data be used in this final EIS to enhance accuracy.*

Discussion:

To address a number of comments, DOE reevaluated the data used in the draft EIS; determined whether newer data were available and appropriate to use; and incorporated the latest relevant data and information, wherever available, applicable, and referenceable, in this final EIS. Some of the data changes are discussed in more detail in Section 3.0 in the supplement analysis (SA) of the *Draft TC & WM EIS* (DOE 2012). The SA is provided in this *Final TC & WM EIS* as Appendix X for convenience only. These include radioactive and nonradioactive inventories used in the cumulative impacts analysis (Section 3.1) and changes to the alternatives analyses (Section 3.2). Examples include inventories for unplanned releases and offsite waste. In both cases, DOE updated the projected waste inventories. To address uncertainties and lack of data in some areas, conservative assumptions were made that overestimate the impacts.

To address a specific comment on the draft EIS that questioned DOE's use of the 2002 Best-Basis Inventory (BBI) for tank waste inventory data, the 2002 BBI estimates were reviewed in 2005 by Ecology and several DOE offices, i.e., Office of River Protection (ORP); Richland Operations Office (RL); Office of Health, Safety, and Security; Office of Environmental Management (EM); and Office of the General Counsel. The conclusion then, which is supported by a review in 2011 of the 8-year span of BBI data and of the uncertainty, was that the 2002 BBI is appropriate for the analyses in this *TC & WM EIS*. This conclusion is supported in Section 4.0, Assumptions, in the *Technical Guidance Document for Tank Closure Environmental Impact Statement Vadose Zone and Groundwater Revised Analyses (Technical Guidance Document)* (DOE 2005), dated March 25, 2005, which was approved by DOE and Ecology. In summary, DOE and Ecology concluded that the 2002 BBI inventory values for both technetium-99 and iodine-129, two risk-driving radionuclides, are at the higher end of the range of numbers, based on the inherent uncertainty in the way the BBI is formulated. This use of some conservatism by using the higher numbers for two risk drivers is still considered appropriate for the EIS analysis. Appendix D, Section D.1.1.4, of this *TC & WM EIS* discusses the continued use of, and uncertainties associated with,

the 2002 BBI, and Section D.1.1.5 provides a comparison of the 2002 BBI with the latest available update to the BBI, dated October 2010, and discusses the differences between the two BBI estimates. Also, the Ecology foreword to this EIS includes a discussion on technetium-99 and iodine-129 inventories and partitioning of these constituents among immobilized high-level radioactive waste (IHLW), immobilized low-activity waste (ILAW), and secondary waste.

To address the specific comment that inventory estimates in the *Draft TC & WM EIS* for tank waste in the soil are not complete, DOE undertook a detailed review of the past leaks released to the soil evaluated in the draft EIS and determined that the inventory of 14 unplanned releases needed to be revised. This change in inventory is relatively minor, but the inventory estimates and the groundwater analysis were revised in this *Final TC & WM EIS*. However, as noted by commentors and discussed in Appendix D, Section D.1.4, of this EIS, this does not change the uncertainty regarding the volume of tank waste leaked.

With regard to the comment that the EIS estimates of tank residuals may have resulted in a disproportionate amount of radioactivity in the residues at the bottom of the tanks, DOE currently does not have a technical basis for making more-specific assumptions about the expected compositions of the waste "heels" that would remain in the tanks after retrieval and believes that the estimates in this *TC & WM EIS* are appropriate. Retrieval has been completed for only a small number of SSTs, and there is uncertainty as to how those tanks will compare with the range across all 149 SSTs. However, the tank closure process, which includes examination of the tanks and residual waste, requires preparation of performance assessments and a closure plan. These required documents will, prior to physical closure actions, provide the information and analysis necessary for DOE and the regulators to make specific decisions on what levels of residual tank waste are acceptable in terms of short- and long-term risks.

DOE received comments about offsite waste volumes and the uncertainty related to the characteristics of potential waste streams that could be transported to Hanford for disposal. The volumes and characteristics cannot be specifically identified because the waste has yet to be generated. However, as stated in both the *Draft* and this *Final TC & WM EIS*, Appendix D, Section D.3.6, DOE prepared the report *Analysis of Offsite-Generated Waste Projections, "Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site"* in 2006 using the best-available waste volume projections (consistent with Council on Environmental Quality [CEQ] requirements [40 CFR 1502.22] for addressing incomplete or unavailable information) while focusing on ongoing DOE operations and post-2010 cleanup activities that may generate wastes requiring or utilizing DOE regional disposal facilities. Expert judgment was then applied to these waste projections and waste characteristics data to develop a waste forecast for use in this *TC & WM EIS* based on similar waste streams that had been generated previously. DOE acknowledges that uncertainty remains in the waste projections, where most waste volume estimates were derived from, but conservative assumptions were employed to support EIS analyses.

Other data-related clarifications added in this final EIS include an explanation of the "2006 baseline start date." A start date of 2006 was assumed in this EIS to establish the durations of, and relationships between, the alternatives, thus allowing a comparison of short-term impacts between them. However, this start date and subsequent dates do not necessarily reflect current milestones/commitments and have no relationship to the EIS long-term analysis. Further discussion on this subject can be found in the Reader's Guide; Summary, Section S.1.3.2; Chapter 1, Section 1.4.2; and Chapter 2, Section 2.2.2.2.1, of this EIS.

2.3 REMEDIATION/CLEANUP AT HANFORD

Topic:

Many commentors supported a full cleanup of groundwater contamination at Hanford. Some commentors felt strongly that existing waste at Hanford should be cleaned up before more waste (i.e., offsite waste) is brought to the site for disposal.

Discussion:

In general, the scope of this *TC & WM EIS* does not include (nor will the potential NEPA ROD) groundwater remediation activity as part of the proposed actions evaluated. Hanford groundwater remediation activities, as required under the Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and/or the Hanford Federal Facility Agreement and Consent Order (known as the Tri-Party Agreement, or TPA), are in various stages of assessment, risk-based end-state development, corrective action, and/or active remediation. Site groundwater contamination in the non-tank-farm areas of the 200 Areas is being addressed under CERCLA remedial action. However, actions to address tank farm past leaks and associated contamination in the vadose zone are being evaluated under the RCRA Facility Investigation/Corrective Measures Study process. As such, the vadose zone contamination associated with tank farm past leaks is included as part of the tank farm RCRA operable unit rather than a CERCLA operable unit and is assessed in this *TC & WM EIS*.

Although some contamination has reached the groundwater, efforts are ongoing at Hanford to prevent existing plumes from reaching the river. Groundwater pump-and-treat systems are currently in place or under construction (for cleanup of contaminants such as carbon tetrachloride). Temporary caps are being placed on the tank farms as part of RCRA corrective action. The EIS impacts analysis shows that, if additional steps like those indicated above are not taken, plumes would continue to migrate over time to the river.

DOE received comments on the potential impacts of future remediation activities that are in various stages of planning (which, given the inherent uncertainty, were not included in the cumulative impacts analysis). In response, DOE performed a sensitivity analysis in this final EIS to evaluate the potential impacts if certain remediation activities were conducted in the future at some of the more prominent waste sites on the Central Plateau and along the river corridor. The goal of the sensitivity analysis is to help DOE, EPA, and Ecology prioritize cleanup efforts in the future. This analysis is provided in Appendix U, Section U.1.3, and is discussed further in Chapter 7, Section 7.5.

See Section 2.1 of this CRD for a discussion on the transport and disposal of offsite waste.

2.4 VADOSE ZONE AND GROUNDWATER MODELING

Topic:

A number of commentors expressed concern about the levels of detail and complexity in the vadose zone and groundwater modeling. The concern was typically expressed as an assertion that the modeling was not acceptable because a particular process, parameter, or feature was not modeled at a more detailed, mechanistic level.

Discussion:

DOE acknowledges that the vadose zone and groundwater model constructs are abstractions (and approximations) of real-world features. The primary purpose of this *TC & WM EIS* is to support the decisionmaking process as required by NEPA. DOE used vadose zone and groundwater models that are appropriate for the scope of this *TC & WM EIS* and allow DOE to evaluate and disclose the potential impacts of the courses of action under the alternatives against each other and against relevant standards.

DOE acknowledges that the potential long-term impacts evaluated during the 10,000-year period of analysis provided by the vadose zone and groundwater modeling constructs used in this EIS are not exact estimates of what will occur in the future due to assumptions and uncertainties. However, that does not mean that the analysis is not useful, as discussed in Chapter 5, Sections 5.1.1, 5.2.1, 5.3.1, and 5.4.1, of this EIS. NEPA requires DOE to fully disclose the estimates of long-term impacts and their uncertainties to inform the decisionmaking process. EPA indicated in its foreword that, because DOE disclosed model limitations and uncertainties, there is not enough information to accurately predict future migration of groundwater contaminants. DOE disagrees that limits and uncertainty diminish the model usefulness as part of the decisionmaking process, now or in the future. DOE believes that, in addition to the groundwater model results themselves, comparison of the results with actual field data and discussion of the uncertainty in the results are important aspects of the evaluation of the alternatives. Accordingly, Appendix U of this *Final TC & WM EIS* has been expanded to include a more complete comparison of model results with field data, and additional sensitivity analyses have been added to further clarify whether changes in assumptions would affect comparison of the alternatives. Both of these discussions were added to this *Final TC & WM EIS* in response to EPA comments on the draft EIS. DOE also believes, as indicated in this *TC & WM EIS*, that the uncertainties in the groundwater modeling are largely a function of data availability and scenario uncertainty, rather than of the models or software used for the long-term groundwater impact analyses.

Throughout the development of the vadose zone and groundwater models, choices were made regarding the level of abstraction and complexity in the components of the models. In all cases, the choices were made subject to the primary goal of comparing the long-term potential impacts of the alternatives without bias and in the context of other sources at Hanford. These choices were systematically discussed and reviewed by the *TC & WM EIS* Technical Review Group, the Hanford Local Users' Group, and Ecology. EPA was invited, but chose to not participate. A summary of this interactive process is included in the November 2007 document, *MODFLOW Flow-Field Development: Technical Review Group Process and Results Report*, available on the ORP website at http://www.hanford.gov/orp. Ecology's views on the acceptability of the vadose zone and groundwater modeling in the context of this NEPA analysis can be found in its foreword to this *TC & WM EIS*. Finally, in response to public comment, DOE has provided additional explanatory material to Appendices L, "Groundwater Flow Field Development"; M, "Release to Vadose Zone"; N, "Vadose Zone Flow and Transport"; and O, "Groundwater Transport Analysis," in this final EIS to more clearly describe the modeling choices, uncertainty, and relationship to the decisionmaking process.

2.5 CLEANUP ACTIONS FOR EXISTING SUBSURFACE CONTAMINATION

Topic:

Several commentors expressed concern that existing contamination at Hanford will migrate to the Columbia River, negatively affecting offsite populations living downriver, as well as wildlife living in and around the river. Further, commentors expressed concern that no cleanup actions were being undertaken to reduce impacts associated with existing subsurface contamination.

Discussion:

As discussed in Chapter 5 of this *TC & WM EIS*, DOE acknowledges that "benchmark standards" could be exceeded in groundwater at the Core Zone Boundary and/or at the Columbia River nearshore at various dates. The term "benchmark standards" used in this *TC & WM EIS* represents dose or concentration levels that correspond to established human health effects. For groundwater, the benchmark is the maximum contaminant level (MCL), provided that an MCL is available. Ecology may impose additional mitigation measures through future permitting processes or corrective actions under the scope of the TPA. In response to comments received on the *Draft TC & WM EIS* concerning potential long-term impacts on groundwater resources, several sensitivity analyses in the draft EIS were combined and integrated into this final EIS to clarify or enhance mitigation discussions. The additional analyses evaluate the potential impacts if certain remediation activities were conducted in the future at some of the more prominent waste sites on the Central Plateau and along the river corridor. Furthermore, sensitivity analyses that evaluate improvements in Integrated Disposal Facility (IDF) performance (e.g., infiltration rates) and in secondary- and supplemental-waste-form performance (e.g., release rates) were performed and are included in this EIS. The discussion found in Chapter 7, Section 7.5, Long-Term Mitigation Strategies, was added to summarize these results. The results of these analyses will aid DOE in formulating an appropriate mitigation action plan subsequent to this EIS and its associated ROD and in prioritizing future Hanford remedial actions that would be protective of human health and the environment and would reduce long-term impacts on groundwater. Further discussion regarding mitigation topics is provided in Section 2.11 of this CRD. As referenced in Chapter 7, Section 7.5.2.8, DOE has drafted a roadmap that implements a strategy for the development of better-performing secondary-waste forms.

Regarding further migration of existing contamination into the Columbia River, the estimated human health impacts on offsite populations living downriver are small. In fact, under all alternatives analyzed, the estimated annual dose to offsite populations is less than 1 percent of the natural background radiation dose. For this dose analysis, members of the offsite population are assumed to have the activity pattern of residential farmers, using the surface water to meet the entirety of annual drinking water requirements and to irrigate a garden that provides approximately 25 percent of annual crop and animal product requirements. The offsite population is also assumed to consume fish harvested from the river. For more information addressing long-term impacts and estimates of human health impacts on a population using Columbia River water downstream of Hanford, see Appendix Q of this EIS.

2.6 THE OREGON PROPOSAL

Topic:

On January 4 and March 18, 2010, the Oregon State Department of Energy submitted comments (comment documents 15 and 215, respectively) on the Draft TC & WM EIS *that included a proposal (which they referred to as the "Oregon proposal") to combine various tank closure elements to form a new Tank Closure alternative and suggested that this proposed new alternative be analyzed in this* TC & WM EIS.

Discussion:

DOE has reviewed Oregon's proposal for a new Tank Closure alternative and has determined that the proposal is technically infeasible as defined. Accordingly, the Oregon proposal cannot be considered a reasonable alternative and was not analyzed in detail in this *TC & WM EIS*, as described in Chapter 2, Section 2.6.4. In its entirety, the Oregon proposal fails to account for the required tradeoffs inherent in the design, capacity, and implementation schedule associated with its storage, retrieval, treatment, disposal, and closure elements. DOE reached this conclusion based upon a number of factors. The WTP, which is currently designed and more than 62 percent constructed, has inadequate waste treatment

throughput capacity to support completing the processing of the tank waste through low-activity waste (LAW) treatment by the year 2040, as suggested in the Oregon proposal. Technical and resource shortcomings for meeting the required waste throughput in 18 years of operation include inadequate tank waste storage, retrieval, and pretreatment capacity. The Oregon proposal also assumes the implementation of iron phosphate (i.e., phosphate glass) and fractional crystallization treatment technologies. However, both of these technologies have been assessed by DOE repeatedly over the last decade with the conclusion remaining that they are not mature enough for implementation and therefore do not merit further analysis in this EIS. Additional discussions on these two treatment technologies are included in Appendix E, Section E.1.3.3.3. Further, the Oregon proposal assumes that DOE is making a decision on the closure of the cribs and trenches (ditches) through this EIS; however, their closure is not within the scope of the EIS proposed actions, as described in Chapter 1, Section 1.4.2, of this EIS.

Several elements of the Oregon proposal were included in the alternatives analyses, sensitivity analyses, and/or potential mitigation measures. These include additional tank waste storage capacity, dry storage of the cesium and strontium capsules, onsite interim storage of all IHLW canisters, and selective clean closure of a number of SST farms, as well as clean closure of all the SST farms. Clean closure of the cribs and trenches (ditches) is analyzed in the cumulative impacts analysis sections of this EIS.

2.7 REGULATORY COMPLIANCE

Topic:

Several commentors expressed concern that none of the proposed alternatives comply with Federal and state laws or are protective of human health and the environment. Specifically, statements were made that the CEQ regulations for implementing NEPA require that an EIS "rigorously explore and objectively evaluate all reasonable alternatives." Among other things, this means that reasonable alternatives should meet the purpose and need for agency action. One of the purposes and needs for DOE action is "to treat the waste and close the single-shell tank…system in a manner that complies with Federal and applicable Washington State laws and USDOE directives to protect human health and the environment."

Discussion:

The alternatives presented in this *TC & WM EIS* were developed under NEPA (42 U.S.C. 4321 et seq.) to address the essential components of DOE's three sets of proposed actions (tank closure, FFTF decommissioning, and waste management) and to provide an understanding of the differences between the potential environmental impacts of the range of reasonable alternatives. Consistent with CEQ guidance (46 FR 18026), this EIS analyzes the range of reasonable alternatives that covers the full spectrum of potential combinations. The alternatives considered by DOE in this EIS are "reasonable" in the sense that they are practical or feasible from a technical and economic standpoint and meet the agency's purposes and needs. Potential conflicts with laws and regulations do not necessarily cause an alternative to be unreasonable, but such conflicts must be considered, and additional mitigation commitments may be required if it is selected for implementation.

This *TC & WM EIS* addresses the potential laws and requirements that would apply, depending on the alternative. Issues concerning the ability to meet legal standards or requirements are also discussed, along with the potential mitigation measures that may be needed and are feasible for implementation by DOE. Additional mitigation measures could be required to obtain future permits issued by the State of Washington, or they may be addressed under the scope of the TPA as part of future remedial actions that are subject to CERCLA. In the ROD for this EIS, DOE will identify and discuss the factors considered in reaching its decisions, such as economic, technical, and national policy considerations, along with mitigation and monitoring measures that DOE will implement.

The scope of this *TC & WM EIS* includes decisions on storage, retrieval, treatment, and disposal of tank waste and on closure of the SST system. This closure includes the tank system and the vadose zone impacted by the tank farms (i.e., past leaks). However, as discussed in the Summary, Section S.1.3.2, and Chapter 1, Section 1.4.2, DOE will not make decisions on groundwater remediation, including the remediation of groundwater contamination resulting from non-tank-farm areas within the 200 Areas, because that is being addressed under CERCLA (42 U.S.C. 9601 et seq.)

As EISs are to be completed early in the planning process for proposed actions, mitigation approaches to potential issues evaluated in an EIS can vary, based on whether the potential impacts have occurred. As a result, the approach to regulatory compliance depends on the portion of the proposed action being evaluated. For example, some activities analyzed in this EIS have not yet occurred. Secondary waste associated with the WTP has not been generated yet. Although this EIS highlights potential compliance issues with secondary waste, the purpose of mitigation measures is to identify those activities necessary to prevent the potential secondary-waste issues evaluated in this *Final TC & WM EIS* from occurring or to minimize their impacts.

A similar situation exists related to receipt of offsite waste. This *Final TC & WM EIS* identifies potential issues with receipt of offsite waste containing iodine-129 and some amounts of technetium-99. One mitigation measure to address this type of issue would be to apply waste acceptance criteria, which would eliminate or restrict receipt of certain waste streams for disposal at Hanford. Another option could be to generate a better waste form.

Addressing regulatory compliance issues associated with closure of the SSTs is a little different. There are potential compliance issues presently identified with the tanks, as well as with the associated CERCLA cribs and trenches (ditches) adjacent to them. In this case, this EIS is evaluating options for addressing and mitigating an existing situation that has already occurred due to 60 years of activities associated with the Hanford mission. The *TC & WM EIS* analysis indicates that, over the long term, removal of the waste from the SSTs and closure of the tanks would have long-term benefits over not closing the SSTs.

Following completion of the mitigation action plan and before implementing closure actions, DOE will develop a tank farm system closure plan that will be implemented for each of the waste management areas. The first waste management area to be addressed is Waste Management Area C. The TPA has milestones for the completion of a soil investigation for Waste Management Area C (Milestone M-45-61), submittal of a closure plan (Milestone M-45-82), and completion of Waste Management Area C closure (Milestone M-45-83). DOE will complete the soil investigation to determine the nature and extent of the contamination. To inform the decision process for closure, DOE will complete a Waste Management Area C performance assessment and risk assessment. Following completion of the tank waste retrievals and data collection activities for residuals in the pipelines, ancillary equipment, and soil, the performance assessment will be revised to reflect all data. This revised performance assessment and closure plan will be presented for public review and comment, and the Waste Management Area C closure plan will be modified and incorporated into the Hanford sitewide permit. The same process will apply for all tank farm waste management areas.

2.8 CLIMATE CHANGE

Topic:

Several commentors stated that the effects of climate change on various resources at Hanford and the possible effects on environmental impacts of the Tank Closure, FFTF Decommissioning, and Waste Management alternatives were not adequately considered in this EIS.

Discussion:

Regarding commentors' concerns, DOE has reviewed and revised, as necessary, its analyses on the effects of climate change on various resources at Hanford and the possible effects on environmental impacts of the *TC & WM EIS* alternatives. As described in Chapter 6, Section 6.3.4, DOE has reviewed climate studies that forecast general trends in Hanford regional climate change. However, there are no reliable methodologies for projections of specific future climate changes in the Hanford region, and thus such changes have not been quantified in this EIS. To account for this uncertainty, Appendix O, Section O.6.2, describes the effects of enhanced infiltration such as that which may occur during a wetter climate. In the *Draft TC & WM EIS*, Appendix V focused on the potential impacts of a rising water table from a proposed Black Rock Reservoir. Following the retraction of the Black Rock Reservoir proposal, the focus of Appendix V in this final EIS was changed to analysis of potential impacts of infiltration increases resulting from climate change under three different scenarios. Appendix V includes sensitivity analyses of potential impacts at Hanford that could result from climate changes that may increase model boundary recharge parameters and the rise of the groundwater table. Additional qualitative discussion of the potential effects of climate change on human health, erosion, water resources, air quality, ecological resources, and environmental justice has been added to Chapter 6 of this final EIS. Additional discussion of the types of regional climate change that could be expected has also been added to Chapter 6, Section 6.5.2, Global Climate Change. The potential impacts of the alternatives on climate change are addressed in Chapter 6, Section 6.5.2, and Appendix G, Section G.5, of this *TC & WM EIS*.

2.9 SECONDARY-WASTE-FORM PERFORMANCE

Topic:

Numerous commentors were concerned that the disposal of secondary waste derived from treatment of tank waste would cause unacceptable adverse impacts on the groundwater. These commentors supported the mitigation of these potential adverse impacts.

Discussion:

DOE acknowledges the concerns regarding secondary-waste-form performance and its potential importance to impacts on groundwater quality. The *TC & WM EIS* analysis confirms the *Tank Waste Remediation System, Hanford Site, Richland, Washington, Final Environmental Impact Statement (TWRS EIS)* (DOE and Ecology 1996) ROD (62 FR 8693) to retrieve waste from the SSTs and treat the waste. Accordingly, there are risks and uncertainties associated with the treatment and disposal of secondary waste produced by the WTP, as well as by the supplemental treatment technologies and, in particular, with the impacts this waste may have at an IDF. As discussed in Chapter 7, Section 7.1.6, this is a particular area of focus for DOE, especially with regard to partitioning and capture of iodine-129, a conservative tracer, in secondary-waste forms. "Conservative tracer" means that iodine-129 moves at the same rate as the groundwater and that its relatively high mobility results in minimal attenuation at the Core Zone Boundary and the Columbia River nearshore. Additional sensitivity analyses have been performed and are included in this final EIS. The additional analyses evaluate the potential impacts of increasing the partitioning of contaminants in primary-waste forms, as well as improving secondary- and supplemental-waste-form performance. The discussion found in Section 7.1 was expanded to summarize these results. The results of these analyses will aid DOE in formulating appropriate performance requirements for secondary- and supplemental-waste forms.

As referenced in Chapter 7, Section 7.5.2.8, DOE has drafted a roadmap that implements a strategy for the development of better-performing secondary-waste forms. DOE, along with EPA, Ecology, the Oregon State Department of Energy, the U.S. Nuclear Regulatory Commission (NRC), technical experts from the DOE national laboratories, academia, and private consultants, participated in a Hanford Site

Secondary Waste Roadmap Workshop on July 21–23, 2008, to develop the roadmap. This workshop, discussed in Section 7.5.2.8 and Appendix E, Section E.1.2.4.5.6, included discussions to identify the risks and uncertainties associated with treatment and disposal of secondary waste generated during HLW and LAW treatment and disposal and to develop a roadmap for addressing these associated risks and uncertainties. These activities are still ongoing. To provide additional insight, DOE performed a sensitivity analysis in this final EIS to evaluate the potential impacts if certain remediation activities were conducted in the future at some of the more prominent waste sites (including those containing technetium-99) on the Central Plateau and along the river corridor. The goal of the sensitivity analysis is to help DOE, EPA, and Ecology prioritize cleanup efforts in the future. This analysis is provided in Appendix M of this EIS and is discussed further in Section 7.5.

The secondary-waste roadmap workshop focused on the waste streams that are expected to contain the largest fractions of iodine-129 and technetium-99, which the draft EIS IDF risk assessment analyses showed may have the largest contribution to the estimated IDF disposal groundwater impacts. For example, the roadmapping effort evaluated sending the scrubber/offgas treatment liquids with technetium-99 to the Effluent Treatment Facility (ETF) for treatment and solidification, followed by disposal in an IDF, and sending the silver mordenite and carbon beds with the captured iodine-129 to be packaged and sent to an IDF.

The workshop culminated in development of the following programmatic/regulatory and technical needs elements (PNNL 2009):

- Select and deploy Hanford tank waste supplemental treatment technology.
- Provide treatment capability for secondary-waste streams resulting from tank waste treatment.
- Develop consensus on secondary-waste-form acceptance.
- Define secondary-waste composition ranges and uncertainties.
- Identify and develop waste forms for secondary-waste immobilization and disposal.
- Develop test methods to characterize secondary-waste-form performance.

Section 7.5 of Chapter 7 was added and Appendix M of this final EIS was expanded to provide more-detailed discussion, sensitivity analysis, and potential mitigation strategies for the treatment and disposal of the secondary waste than that originally presented in the draft EIS.

2.10 HIGH-LEVEL RADIOACTIVE WASTE DISPOSITION (YUCCA MOUNTAIN ISSUE)

Topic:

Many commentors expressed concern that currently there is no viable disposal pathway for Hanford's HLW. Some were opposed to storing HLW at Hanford because of its proximity to the Columbia River, while others supported storage until a permanent disposal site is found. One commentor stated that, because the Nuclear Waste Policy Act requires permanent isolation of HLW and SNF, leaving these wastes stored at Hanford indefinitely is not a legal option or an acceptable option to the State of Washington. Many commentors supported the completion of a geologic repository for HLW disposal, and some questioned the decision to terminate the Yucca Mountain program.

Discussion:

The Secretary of Energy has determined that a Yucca Mountain repository is not a workable option for permanent disposal of SNF and HLW. However, DOE remains committed to meeting its obligations to manage and ultimately dispose of these materials. The Administration has convened the Blue Ribbon Commission on America's Nuclear Future to conduct a comprehensive review of policies for managing

the back end of the nuclear fuel cycle, including all alternatives for the storage, processing, and disposal of SNF and HLW. The Blue Ribbon Commission's final recommendations will form the basis of a new solution to managing and disposing of SNF and HLW (BRC 2012).

Because it is now unclear when IHLW shipments off site will begin, DOE reexamined storage needs for IHLW canisters under each Tank Closure alternative. The EIS analysis shows that vitrified HLW can be safely stored at Hanford for up to 145 years until disposition decisions are made and implemented.

2.11 MITIGATION

Topic:

Numerous comments were made regarding the mitigation of potential impacts of the proposed actions identified in this EIS. Some commentors stated that mitigation was either missing from, or not adequately addressed in, the draft EIS. One commentor stated that, under both NEPA and CEQ regulations implementing NEPA, mitigation actions are required. The commentor expressed the opinion that the mitigation discussion in Chapter 7, Section 7.1, of the draft EIS, for the most part, proposes ways to lessen the impacts of the proposed actions and does not constitute actual mitigation of the impacts. Moreover, DOE does not commit to these actions. Another commentor suggested that each alternative presented in the Draft TC & WM EIS *be amended to identify mitigation to protect the environment (specifically, soil and groundwater) and uncounted future generations.*

Discussion:

DOE disagrees that mitigation measures have been inadequately analyzed in this *TC & WM EIS*. The NEPA evaluation process is conducted early in agency planning, when details of the proposed project may not yet be well enough defined for specific mitigation measures to be developed. Chapter 7, Section 7.1, of the draft EIS discusses mitigation measures that could be used to avoid or reduce potential impacts on all resource areas. Some of the mitigation measures discussed would apply across all alternatives due to the similar nature of many of the activities analyzed in this EIS (e.g., facility construction). Therefore, for the purpose of limiting redundancy, the discussion of these measures is not duplicated for each alternative in this EIS. However, the resource subsections of Section 7.1 do acknowledge specific alternatives where only certain mitigation measures would apply or where additional mitigation consideration may be warranted. The discussion presented in this EIS identified potential mitigation measures that could be applied; specific mitigation measures would be selected based on the course of action chosen by DOE as identified in the ROD. Following completion of this *Final TC & WM EIS* and its associated ROD, DOE would be required, in accordance with DOE implementing procedures for NEPA (10 CFR 1021.331), to prepare a mitigation action plan that explains mitigation commitments expressed in the ROD. This mitigation action plan will be prepared before DOE would implement any *TC & WM EIS* alternative actions that are the subject of a mitigation commitment expressed in the ROD. Copies of any mitigation action plan developed by DOE will be made available for inspection in appropriate DOE public reading room(s), will be posted on the DOE NEPA website, and will also be available upon request.

In response to comments received on the *Draft TC & WM EIS* concerning the potential long-term impacts on groundwater resources, additional sensitivity analyses were performed and are included in this final EIS. The additional analyses evaluate the potential impacts if certain remediation activities were conducted in the future at some of the more prominent waste sites on the Central Plateau and along the river corridor. Furthermore, sensitivity analyses that evaluate improvements in IDF performance (e.g., infiltration rates) and in secondary- and supplemental-waste-form performance (e.g., release rates) were performed and are included in this final EIS. The discussion found in Chapter 7, Section 7.5, was added to summarize these results. The results of these analyses will aid DOE in formulating an

appropriate mitigation action plan subsequent to this EIS and its associated ROD and in prioritizing future Hanford remedial actions that would be protective of human health and the environment and would reduce long-term impacts on groundwater.

2.12 EXCLUSION OF GREATER-THAN-CLASS C WASTE IN CUMULATIVE IMPACTS ANALYSIS

Topic:

Several commentors questioned the exclusion of GTCC waste impacts analysis in the Draft TC & WM EIS. *One commentor stated that DOE is in violation of NEPA requirements for simultaneous disclosure of all actions by separating the* TC & WM EIS *from an EIS being drafted by DOE concerning GTCC waste.*

Discussion:

DOE has prepared the *Draft Environmental Impact Statement for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste (GTCC EIS),* DOE/EIS-0375-D (DOE 2011a), which addresses the transportation and disposal of LLW generated by activities licensed by NRC or an agreement state that contains radionuclides in concentrations exceeding Class C limits (10 CFR 61). The *Draft GTCC EIS* also addresses DOE LLW and non-defense-generated transuranic (TRU) waste, which have characteristics similar to GTCC LLW and for which there may be no path for disposal. The *Draft GTCC EIS* was published in February 2011 after the *Draft TC & WM EIS* had already been issued in October 2009; however, information from the *Draft GTCC EIS* was incorporated into the *Final TC & WM EIS* cumulative impacts analysis. Even though the *Draft GTCC EIS* was not available prior to issuance of the *Draft TC & WM EIS*, DOE did identify the *GTCC EIS* in the draft EIS in Chapter 1, Section 1.8, Related NEPA Reviews, based on a Notice of Intent to prepare the *GTCC EIS* in the *Federal Register* (72 FR 40135).

Hanford is being considered as a candidate location for a new GTCC waste disposal facility in the *GTCC EIS*, although DOE did not identify a preferred alternative for the location in the *Draft GTCC EIS*. Such a facility is not expected to be operational until after 2019. Further, DOE announced on December 18, 2009, a modification of the *TC & WM EIS* Preferred Alternatives in the *Federal Register* (74 FR 67189). In the announcement, DOE modified its Preferred Alternative for waste management in this *Final TC & WM EIS* by stating that DOE would not ship GTCC LLW to Hanford, at least until the WTP was operational. This moratorium on shipment of offsite waste, including GTCC LLW, to Hanford would allow time to better understand waste form performance and potential impacts on groundwater before allowing the receipt of offsite waste at Hanford.