

1 The access road that is used to bring TRU waste shipments to WIPP is a wide, two-lane road
2 with paved shoulders.
3
4

5 **S.2.6.2 Hanford Site**

6

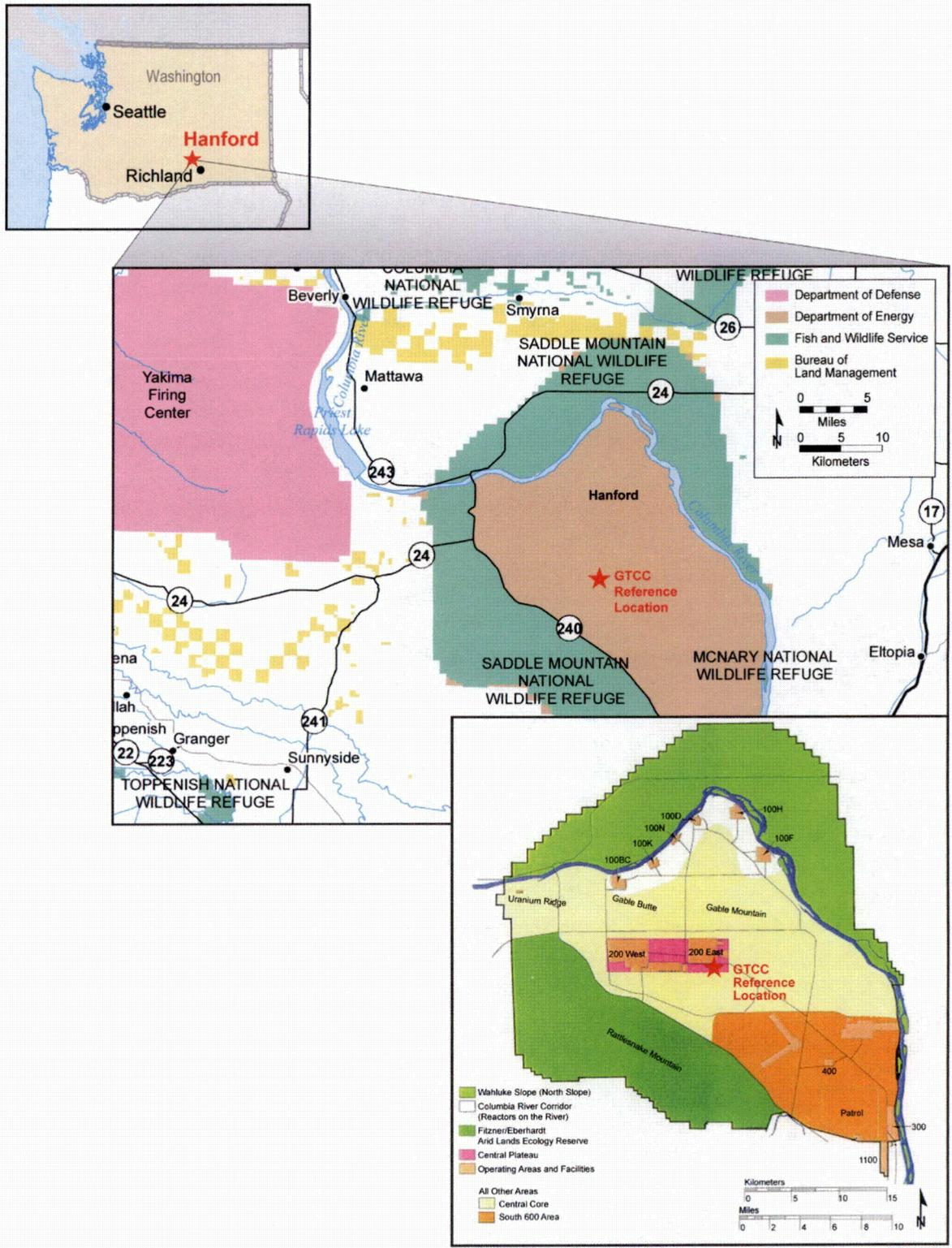
7 The GTCC reference location at the Hanford Site is south of the 200 East Area in the
8 central portion of the Hanford Site (Figure S-17). The 200 East and West Areas are located on a
9 plateau about 11 and 8 km (7 and 5 mi), respectively, south of the Columbia River. Historically,
10 these areas have been dedicated to fuel reprocessing and to waste management and disposal
11 activities.
12

13 Current waste management activities at the Hanford Site include the treatment and
14 disposal of LLRW on-site, the processing and certification of TRU waste pending its disposal at
15 WIPP, and the storage of high-level radioactive waste on-site pending treatment and ultimate
16 disposal. DOE will continue to defer the importation of off-site waste at Hanford, at least until
17 the Waste Treatment Plant (WTP) is operational, subject to appropriate NEPA review and
18 consistent with its previous preferred alternative for waste management (74 FR 67189). The
19 limitations and exemptions defined in DOE's January 6, 2006, Settlement Agreement with the
20 State of Washington (as amended on June 5, 2008) regarding *State of Washington v. Bodman*
21 (Civil No. 2:03-cv-05018-AAM), signed by DOE, the State of Washington Department of
22 Ecology, the Washington State Attorney General's Office, and the U.S. Department of Justice,
23 will remain in place. The main areas where waste management activities occur are the 200 West
24 Area and the 200 East Area. These 200 Areas cover about 16 km² (6 mi²). Activities at the
25 200 Areas include the operation of lined trenches for the disposal of LLRW and mixed LLRW
26 and the operation of the Environmental Restoration Disposal Facility for the disposal of LLRW
27 generated by environmental restoration activities that are being conducted at the Hanford Site to
28 comply with the Comprehensive Environmental Response, Compensation, and Liability Act
29 (CERCLA). DOE will dispose of LLW and MLLW at the Integrated Disposal Facility from the
30 tank treatment operations, WTP and effluent treatment operations, on-site non-CERCLA
31 sources, Fast Flux Test Facility decommissioning and onsite waste management (74 FR 67189).
32 U.S. Ecology, Inc., operates a commercial LLRW disposal facility on a 40-ha (100-ac) site
33 leased by the State of Washington near the 200 East Area. The facility is licensed by the State of
34 Washington.
35
36

37 **S.2.6.3 Idaho National Laboratory (INL) Site**

38

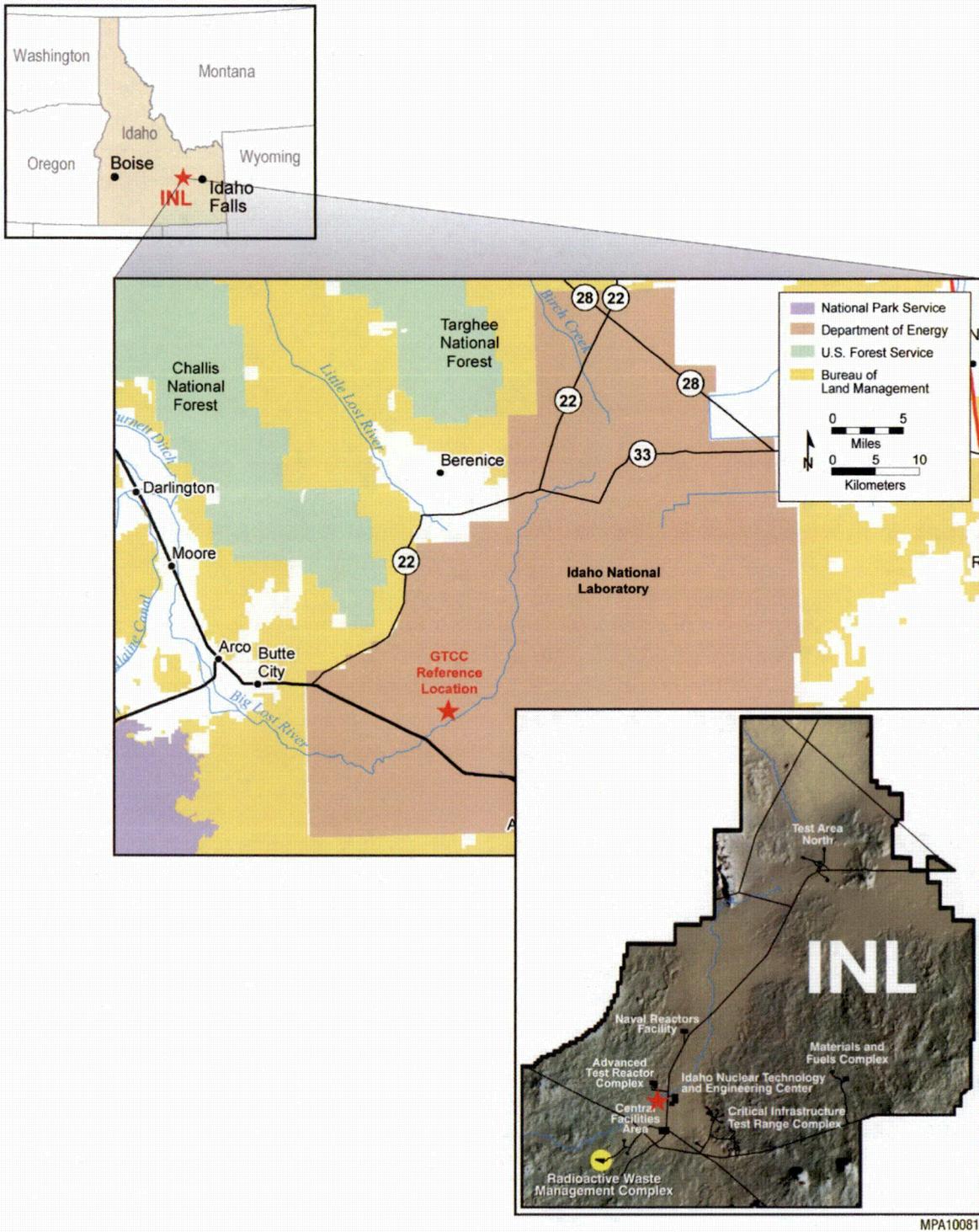
39 The GTCC reference location at the INL Site, which is southwest of the Advanced Test
40 Reactor Complex in the south central portion of the INL Site (Figure S-18), serves as a basis for
41 evaluation. If the INL Site is selected, the final location for a GTCC land disposal facility will be
42 based on further analysis. The Advanced Test Reactor is dedicated to research supporting DOE
43 missions, including nuclear technology research. The Remote-Handled Low-Level Waste
44 Environmental Assessment (RH LLW EA; INL 2011) identified its preferred site to be one that is
45 located to the southwest of the ATR Complex in the same area as the GTCC reference location.
46 The GTCC site, if sited at the INL Site, would not be expected to affect the preferred site selected
47 by the RH LLW EA.
48



MPA100819

1
2
3
4

FIGURE S-17 GTCC Reference Location at the Hanford Site



1
2
3
4
5

FIGURE S-18 GTCC Reference Location at the INL Site

1 Current waste management activities at the INL Site include the treatment and storage of
2 mixed LLRW on-site, the treatment of LLRW on-site and its disposal on-site or off-site in DOE
3 or commercial facilities, the storage of TRU waste on-site and its preparation for and shipment to
4 WIPP, and the storage of high-level radioactive waste and spent nuclear fuel on-site pending the
5 disposal of these last two materials. These wastes originate from DOE activities and from the
6 on-site Naval Reactors Program. LLRW (RH waste) from INL Site operations is disposed of at
7 the Subsurface Disposal Area at the Radioactive Waste Management Complex. CH LLRW is
8 sent off-site. TRU waste is also stored and treated at the Radioactive Waste Management
9 Complex and Idaho Nuclear Technology and Engineering Center to prepare it for disposal at
10 WIPP.

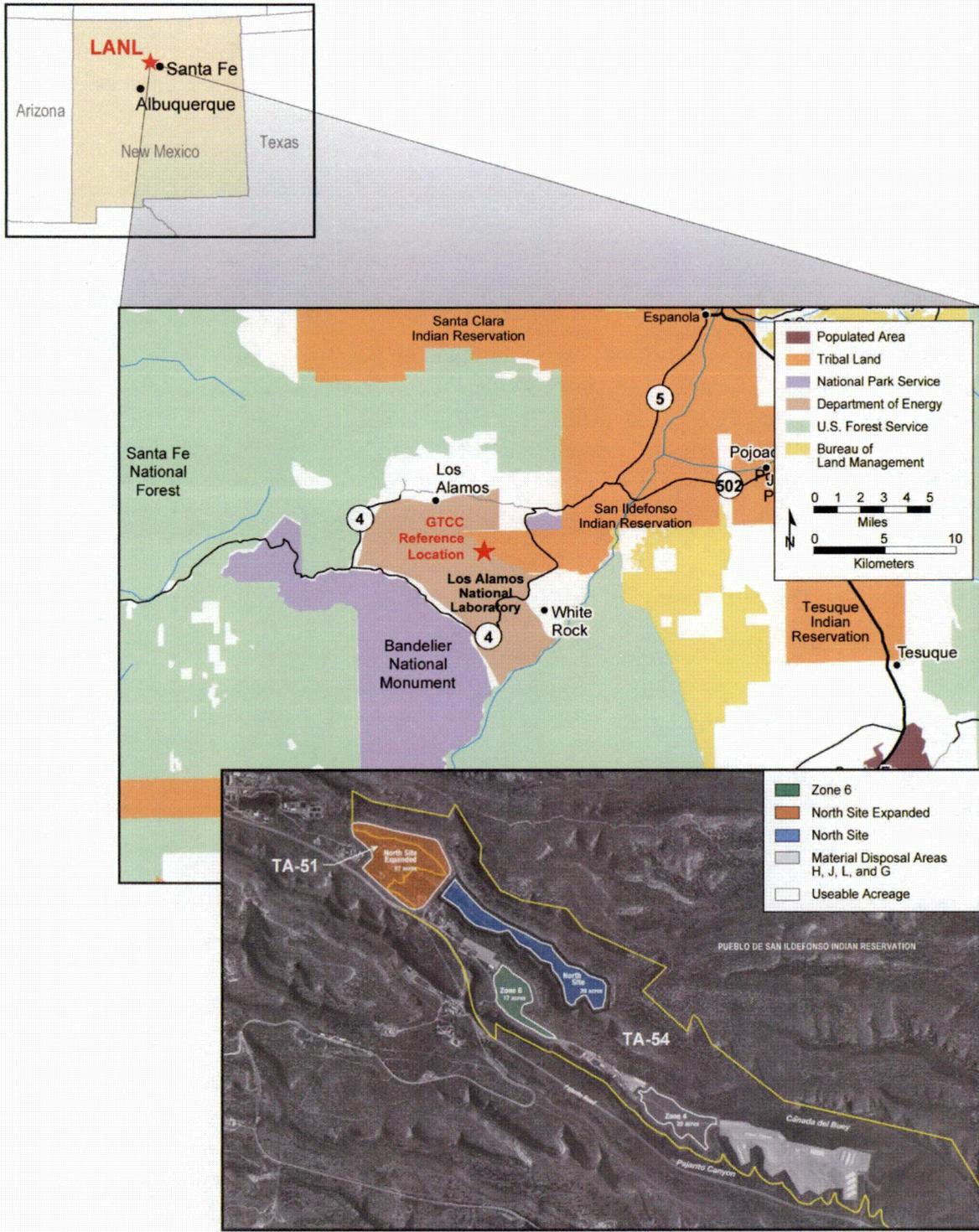
11 12 13 **S.2.6.4 Los Alamos National Laboratory (LANL)** 14

15 The GTCC reference location at LANL is situated in three undeveloped and relatively
16 undisturbed areas within Technical Area (TA)-51 and TA-54 on Mesita del Buey: Zone 6, North
17 Site, and North Site Expanded (Figure S-19). Zone 6 is slightly less than 7 ha (17 ac) in area. It is
18 not fenced, but access by road is controlled by a gate. The total area of the North Site is about
19 16 ha (39 ac). The North Site Expanded section adds another 23 ha (57 ac). The primary function
20 of TA-54 is the management of radioactive and hazardous chemical wastes. Its northern border
21 coincides with the boundary between LANL and the Pueblo de San Ildefonso; its southeastern
22 boundary borders the community of White Rock. A subsurface volatile organic compound
23 (VOC) vapor plume is present in the vadose zone at the Material Disposal Area L within TA-54.
24 The primary source of these subsurface VOC vapors are the two shaft fields at Material Disposal
25 Area L.

26
27 Current waste management activities at LANL include the storage of mixed LLRW, the
28 disposal of LLRW on-site, the storage of TRU waste on-site, and the storage of sealed sources
29 recovered by the Office of Global Material Security/Off-Site Source Recovery Project
30 (GMS/OSRP) for national security or public health and safety reasons pending disposal. Area G
31 at TA-54 currently accepts on-site LLRW for disposal; also, in special cases, off-site waste has
32 been accepted from other DOE sites for disposal. Engineered shafts are actively used to dispose
33 of RH LLRW.

34
35 Since 1989, DOE has funded the Environmental Program at LANL to complete the
36 cleanup of the environmental legacy contamination brought about from seven decades of nuclear
37 weapons development and management, as well as government-sponsored nuclear science and
38 energy research.³ Groundwater sampling data from monitoring wells at LANL indicate the
39 presence of chromium groundwater contamination beneath Mortandad Canyon near the property
40 boundary between LANL and the Pueblo de San Ildefonso. This chromium contamination is a
41 result of historical use of potassium dichromate – a corrosion inhibitor – in non-nuclear cooling-
42 tower water that was discharged to an outfall as part of LANL operational maintenance

³ Legacy contamination is generally defined as the contamination of the environment resulting from pre-1999 Los Alamos National Laboratory activities and waste-management practices within DOE's environmental management scope.



1
2
3
4

FIGURE S-19 GTCC Reference Location at LANL

1 activities. DOE evaluated a proposed interim measure that would control migration of the
2 chromium groundwater contamination plume off LANL lands and the feasibility of long-term
3 corrective actions intended to remediate the chromium plume in an environmental assessment
4 (DOE/EA-2005).⁴

7 **S.2.6.5 Nevada National Security Site (NNSS)**

8
9 The GTCC reference location for NNSS is identified within Area 5 and serves as a basis
10 for evaluation (Figure S-20). Area 5 is one of two areas (the second is Area 3) at NNSS that
11 support the site's radioactive waste management program. Area 5 is located in the southeastern
12 section of NNSS in Frenchman Flat. If NNSS is selected, the final location for a GTCC disposal
13 facility will be based on further analysis. NNSS presently serves as a disposal site for LLRW and
14 mixed LLRW generated by DOE facilities. It is also an interim storage site for a limited amount
15 of newly generated TRU mixed wastes pending transfer to WIPP for disposal. From 1984
16 through 1989, boreholes (at depths of 21 to 37 m [70 to 120 ft]) were used at the Area 5
17 Radioactive Waste Management Site to dispose of higher-activity LLRW and TRU waste.

20 **S.2.6.6 Savannah River Site (SRS)**

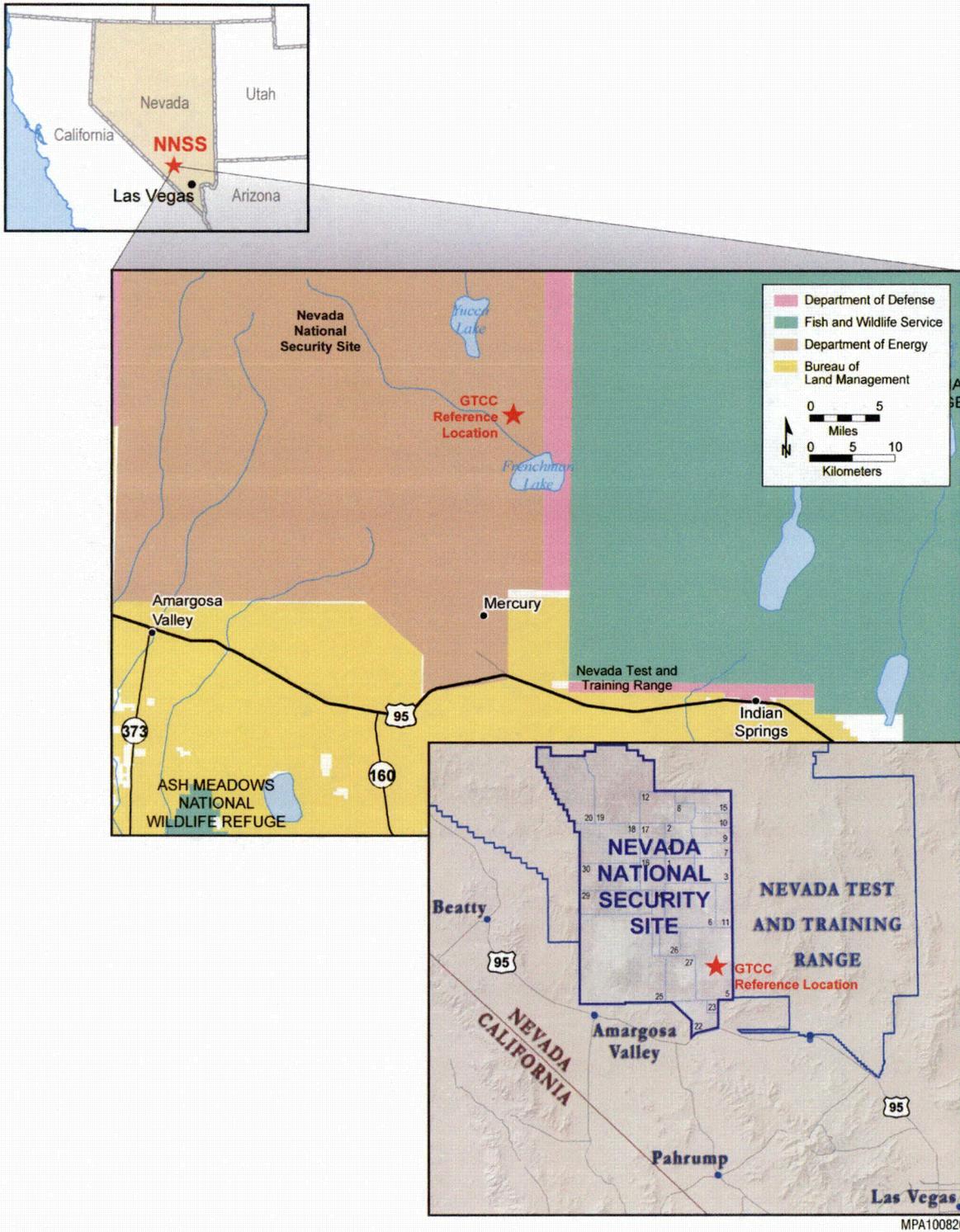
21
22 The GTCC reference location is situated on an upland ridge within the Tinker Creek
23 drainage, about 3.2 km (2 mi) to the northeast of Z-Area in the north-central portion of SRS
24 (Figure S-21). The area is not currently being used for waste management.

25
26 SRS currently manages high-level waste, TRU waste, LLRW, and mixed LLRW. High-
27 level waste is vitrified at the Defense Waste Processing Facility and stored on-site pending
28 disposal. TRU waste is stored, prepared for shipment, and shipped to WIPP for disposal. LLRW
29 is treated and disposed of on-site, or it is prepared for shipment to be disposed of at other DOE
30 sites (e.g., NNSS) or commercial facilities. On-site facilities for LLRW disposal include
31 engineered trenches and vaults.

34 **S.2.6.7 WIPP Vicinity**

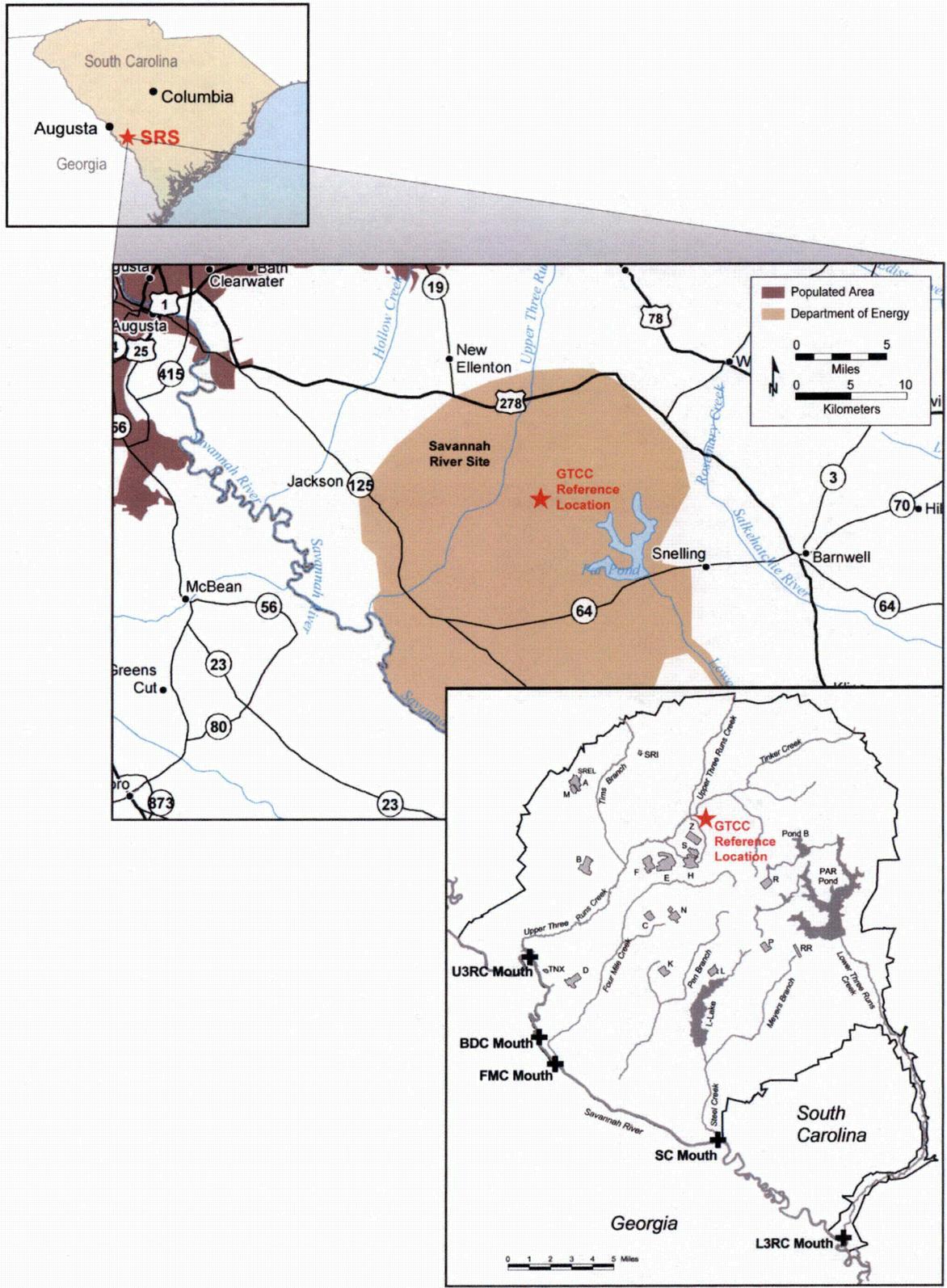
35
36 WIPP Vicinity refers to Township 22 South, Range 31 East, Sections 27 and 35, with
37 each section containing a total of 260 ha (640 ac) or 2.6 km² (1 mi²). Only a portion of
38 Section 27 or Section 35, if selected, would be needed to accommodate a new GTCC LLRW and
39 GTCC-like waste disposal facility. Section 27 is within the WIPP Land Withdrawal Boundary
40 (LWB), while Section 35 is just outside the WIPP LWB to the southeast (Figure S-22).
41 Section 27 is administered by DOE, and Section 35 is administered by the Bureau of Land
42 Management in the U.S. Department of the Interior. WIPP is located in Eddy County in
43 southeastern New Mexico, about 42 km (26 mi) east of the city of Carlsbad. The land is a
44

⁴ *Final Environmental Assessment for Chromium Plume Control Interim Measure and Plume-Center Characterization, Los Alamos National Laboratory, Los Alamos, New Mexico* (December 2015).
<http://energy.gov/nepa/ea-2005-chromium-plume-control-interim-measure-and-plume-center-characterization-los-alamos>.



1
2
3
4
5

FIGURE S-20 GTCC Reference Location at NNSS



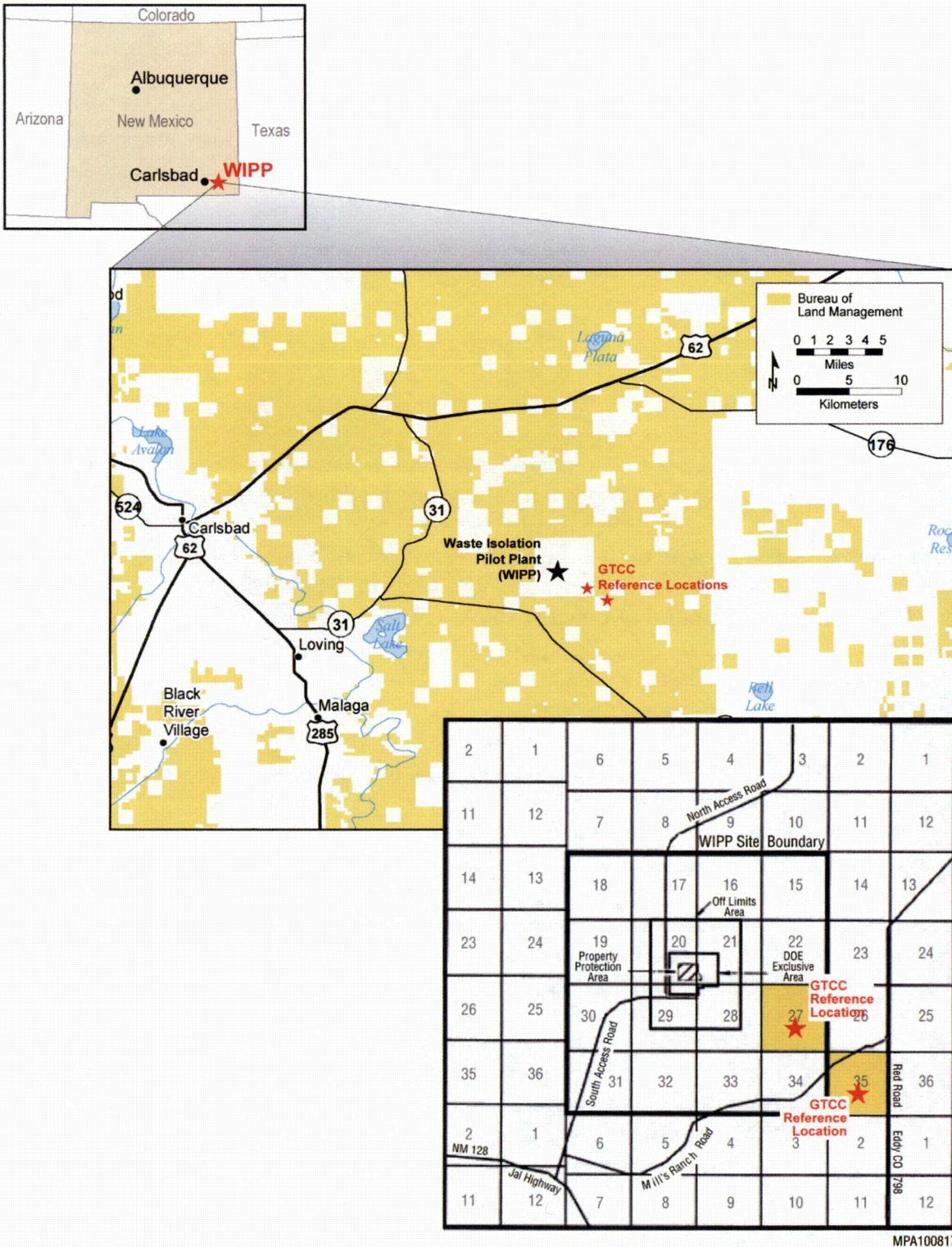
MPA100822

1

2

3

FIGURE S-21 GTCC Reference Location at SRS



1
2
3
4

FIGURE S-22 GTCC Reference Locations (Sections 27 and 35) at the WIPP Vicinity

1 relatively flat, sparsely inhabited area (about 118,556 people in an 80-km [50-mi] radius,
2 according to the 2010 census), known as Los Medaños (Spanish for “the dunes”).
3

4 There are no potash or oil and gas leases on Section 27 since it is part of the land that has
5 been withdrawn. Section 35 contains oil and gas leases. Currently, no waste management
6 activities are being conducted at Section 27 or Section 35.
7
8

9 **S.2.6.8 Generic Regional Commercial Disposal Sites**

10
11 In the absence of specific commercial sites, DOE evaluated generic commercial facilities
12 in the EIS to allow DOE to make a determination regarding disposal of GTCC LLRW and
13 GTCC-like waste in such a facility. DOE solicited technical capability statements from
14 commercial vendors that might be interested in constructing and operating a GTCC LLRW and
15 GTCC-like waste disposal facility in a request for information in the *FedBizOpps* on July 1,
16 2005. Although at the time, several commercial vendors expressed an interest, no vendors
17 provided specific information on disposal locations and methods for analysis in the EIS. On
18 June 20, 2014 Waste Control Specialists, LLC, (WCS), filed (and resubmitted on July 21, 2014)
19 a Petition for Rulemaking with the Texas Commission on Environmental Quality (TCEQ)
20 requesting the State of Texas to revise certain provisions of the Texas Administrative Code to
21 remove prohibitions on disposal of GTCC LLRW, GTCC-like waste and TRU waste at its TCEQ
22 licensed facilities. On January 30, 2015, TCEQ sent a letter to the NRC requesting guidance on
23 the State of Texas’s authority to license disposal of GTCC LLRW, GTCC-like waste and TRU
24 waste. This matter is under review by NRC.
25

26 Should DOE identify a specific commercial facility or facilities for the disposal of GTCC
27 LLRW and GTCC-like waste, DOE would conduct site-specific NEPA reviews, as appropriate.
28 The generic commercial sites are evaluated in the GTCC EIS on the basis of a regional approach
29 that divides the United States into four regions consistent with the designations of Regions I
30 through IV of the NRC. The states that make up each of these four regions are shown in
31 Figure S-3. Region I comprises the 11 states in the northeast; Region II comprises the 10 states in
32 the southeast; Region III comprises the 7 states in the Midwest; and Region IV comprises the
33 remaining 22 states in the western part of the country.
34

35 Current commercially operated LLRW disposal facilities for non-GTCC LLRW are
36 located in Region II (a facility in Barnwell, South Carolina, which receives Class A, B, and C
37 waste) and Region IV (facilities in Richland, Washington, and in Clive, Utah, which receive
38 Class A, B, and C wastes and Class A waste, respectively). Another disposal facility (located in
39 Region IV in Andrews County, Texas) has been licensed and is now operating and available to
40 dispose of Class A, B, and C wastes. The federal sites evaluated in the EIS are also located
41 within these same two regions.
42
43

44 **S.2.7 Alternatives Considered but Not Evaluated in Detail**

45
46 DOE identified the alternatives for detailed analysis in the EIS on the basis of the
47 rationale provided in the Notice of Intent (NOI) for the GTCC EIS (72 FR 40135). Several

1 comments received during the scoping process indicated that DOE should include alternatives in
2 addition to those identified in the NOI. However, none of the suggested alternatives were
3 determined to be a reasonable alternative.

4
5 In the NOI for the GTCC EIS, DOE identified co-disposal of the GTCC LLRW and
6 GTCC-like waste at the then-proposed Yucca Mountain repository as one alternative to be
7 considered; however, DOE did not include this as an alternative in the GTCC EIS because since
8 publication of the NOI, the Secretary of Energy determined that developing a permanent
9 repository for high-level waste and spent nuclear fuel at Yucca Mountain, Nevada, is not a
10 workable option, and the repository will not be developed. Therefore, DOE concluded that
11 co-disposal at a Yucca Mountain repository is not a reasonable alternative and has eliminated it
12 from evaluation in this EIS.

13
14 DOE did not evaluate developing a geologic repository exclusively for disposal of GTCC
15 LLRW and GTCC-like wastes because DOE determined that such an alternative is not
16 reasonable due to the time and cost associated with siting a deep geologic repository and the
17 relatively small volume of GTCC LLRW and GTCC-like wastes identified in the GTCC EIS.
18 The results presented in this EIS for the WIPP geologic repository alternative are indicative of
19 the high degree of waste isolation that would be provided by disposal in a geologic repository.

20
21 In addition, the NOI for the GTCC EIS also identified ORR as a site to be evaluated for
22 potential disposal of GTCC LLRW and GTCC-like waste by using a land disposal method
23 because of its ongoing waste disposal mission. Based on internal reviews conducted by the Low-
24 Level Waste Disposal Facility Federal Review Group, DOE determined that the site is not
25 appropriate for disposal of LLRW containing high concentrations of long-lived radionuclides
26 (such as those found in GTCC LLRW and GTCC-like waste), especially those with high
27 mobility in the subsurface environment. For this reason, DOE concluded that ORR is not a
28 reasonable disposal site alternative and eliminated it from detailed evaluation in this EIS.

29 30 31 **S.2.8 Which Resource Areas Are Analyzed in the EIS?**

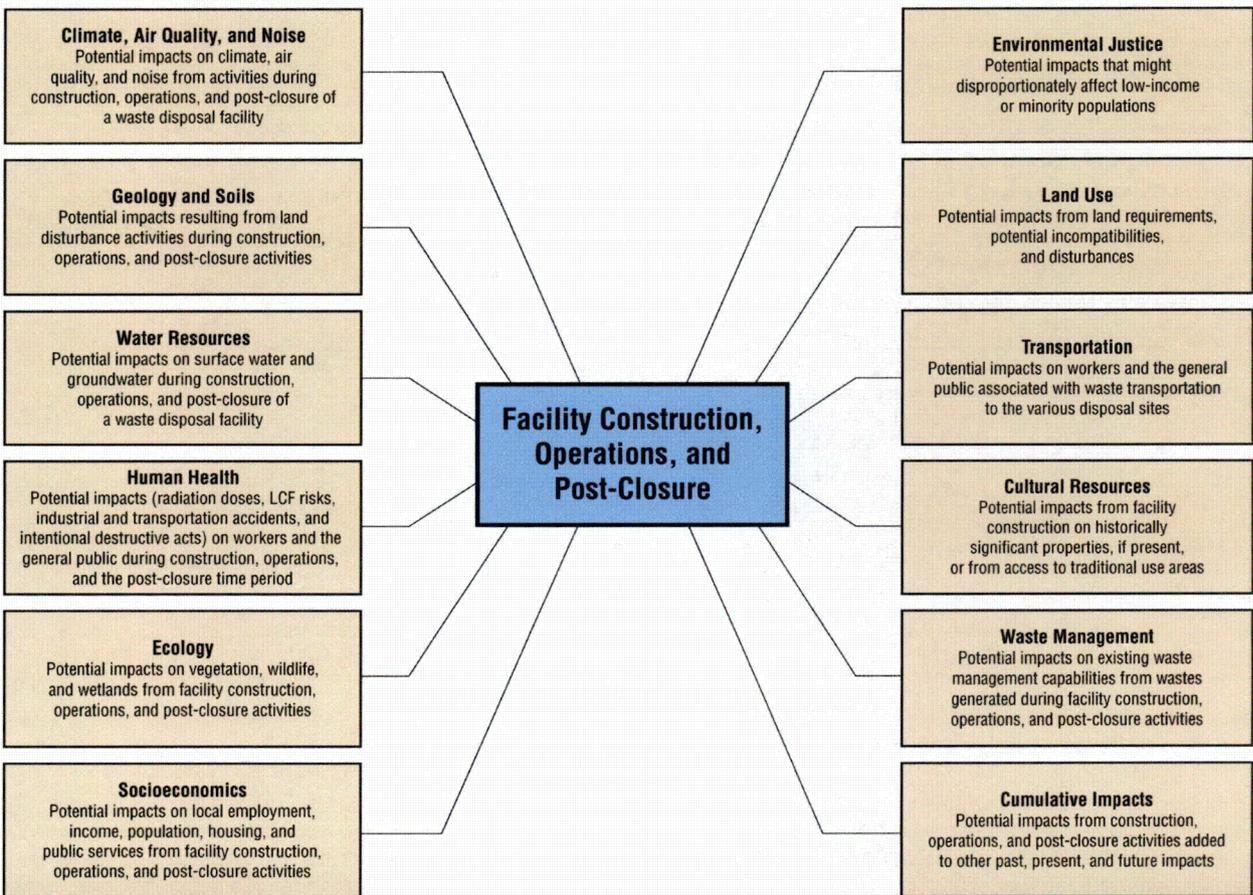
32
33 DOE evaluated each alternative for its potential consequences on the following
34 11 environmental resource areas, as shown in Figure S-23:

35
36 Climate, air quality, and noise,
37 Geology and soils,
38 Water resources,
39 Human health,
40 Ecology,
41 Socioeconomics,
42 Environmental justice,
43 Land use,
44 Transportation,
45 Cultural resources, and
46 Waste management.
47

1 In addition to the above resource areas, DOE evaluated inadvertent human intrusion and
 2 cumulative impacts to address the impacts that could result from implementation of the proposed
 3 GTCC action at each site in combination with past, present, and future planned activities
 4 (including federal and nonfederal activities) at or in the vicinity of that site.
 5
 6

7 **S.3 SUMMARY AND COMPARISON OF POTENTIAL ENVIRONMENTAL IMPACTS**
 8

9 DOE has evaluated the resource areas shown in Figure S-23 for each of the alternatives in
 10 the GTCC EIS for disposal of the entire inventory of GTCC LLRW and GTCC-like waste. The
 11 resource areas are evaluated for the construction, operations, and post-closure phases of the
 12 proposed action. The decommissioning of the disposal facility is also part of the proposed action,
 13 but because the facility would not be closed and properly decommissioned until some time in the
 14 far future (decades), the impact analysis for the decommissioning phase would be conducted at
 15 that time. These evaluation results are presented in Table S-3. This table presents a comparison
 16 of the potential impacts of the five alternatives on the resource areas shown in Figure S-23.
 17
 18



MPA100825

19

20 **FIGURE S-23 Environmental Resource Areas on Which the Impacts of the Alternatives Are**
 21 **Evaluated**

TABLE S-3 Comparison of Potential Impacts

Resource Area	Alternative				
	Alternative 1 No Action	Alternative 2 WIPP Geologic Repository	Alternative 3 Borehole	Alternative 4 Trench	Alternative 5 Vault
Climate, Air Quality, and Noise	No incremental impacts due to construction activities for a disposal facility are expected because none would be undertaken. It is assumed that the current facility operations in the storage sites would continue and result in minimal impacts.	Impacts would be low because most construction and operational activities would occur below ground. Emissions associated with Alternative 2 are lower than those for Alternatives 3 to 5.	<p>Construction and operational activities would be within the boundaries of all the sites evaluated, and these activities would contribute little to concentrations of airborne pollutants or noise at or beyond the site boundaries. For most sites, during the construction phase, peak annual emissions associated with the borehole method would be between those associated with the trench and vault methods, with the vault method resulting in the highest relative emissions and the trench method having the lowest of the three methods. Construction related emissions from all three disposal methods would generally add 1% or less to emissions in the nearby areas surrounding the various sites (the exception would be at NNSS where SO₂ and NO_x emissions could add about 3%). Peak annual emissions from the operation of a borehole, trench, and vault facility at the various sites would be lower than those for the peak annual construction phase.</p> <p>Emissions of greenhouse gases are expected to be low and not result in significant climate change concerns. Noise levels at a distance of 690 m (2,300 ft) from the source would be below the EPA guideline of 55 dBA or decibels for all the sites evaluated. This distance is smaller than the distance between the GTCC reference locations and the respective nearest off-site residences. Estimated distances of the GTCC reference locations from the respective nearest known off-site residences are as follows: >6 km (4 mi) at the Hanford Site; >11 km (7 mi) at the INL Site; about 3.5 km (2.2 mi) at LANL (nearest residence in White Rock); >6 km (4 mi) at NNSS; >14 km (9 mi) at SRS; and >5 km (3 mi) at the WIPP Vicinity.</p>		
Geology and Soils	No incremental impacts due to construction activities for a disposal facility are expected because none would be undertaken. It is assumed that the current facility operations in the storage sites would continue and result in minimal impacts.	No incremental impacts are expected because construction, operational, and post-closure activities would not involve additional land disturbance.	Impacts would be proportional to the total land area affected. The borehole method would disturb the most land, followed by the trench and vault methods. No adverse impacts are expected, and no significant changes to surface topography would occur. The potential for erosion would be lower at the five western sites evaluated (Hanford Site, INL Site, LANL, NNSS, and WIPP Vicinity) than at the eastern site (SRS) because of the low precipitation rates at the western sites.		

TABLE S-3 (Cont.)

Resource Area	Alternative				
	Alternative 1 No Action	Alternative 2 WIPP Geologic Repository	Alternative 3 Borehole	Alternative 4 Trench	Alternative 5 Vault
Water Resources	No incremental impacts due to construction activities for a disposal facility are expected because none would be undertaken. It is assumed that the facility operations in the storage sites would continue and result in minimal impacts.	Incremental impacts would be minor when added to those associated with operations at WIPP.	Impacts on water resources would generally be small at all sites evaluated. The increase in water use is less than 1% of the current annual use as capacity at the sites evaluated. Impacts on surface water and groundwater resources from surficial spills would be expected to be low. Water consumption associated with the borehole method during construction would be about 530,000 L/yr (140,000 gal/yr), which is the smallest amount associated with the three land disposal methods. The corresponding values for the trench and vault methods are 1,000,000 L/yr (270,000 gal/yr) and 3,300,000 L/yr (860,000 gal/yr), respectively. The initial construction period was assumed to be about 3.4 years for all three land disposal methods. The amount of potable and raw water consumed during the operational phase of the borehole method would also be the smallest of the three disposal methods; it would be about 2,500,000 L/yr (650,000 gal/yr). A total of 5,300,000 L/yr (1,400,000 gal/yr) would be required for operating either the trench or the vault method.		
Human Health Annual Collective Worker Dose ^a	Human health impacts from waste storage activities would be low. The annual occupational dose from these activities is estimated to be 4 person-rem, which corresponds to an annual LCF risk of 0.002.	The annual collective worker dose at WIPP is estimated to be 0.29 person-rem, which corresponds to an annual LCF risk of 0.0002. No fatalities and 3 lost workdays per year could occur due to occupational injuries.	The annual collective worker dose estimates for the disposal facility would be the same for all the sites evaluated because the same number of workers are assumed; the dose estimates, however, vary by disposal method. The annual collective worker doses are estimated to be 2.6 person-rem for the borehole method, 4.6 person-rem for the trench method, and 5.2 person-rem for the vault method. These doses correspond to annual LCF risks of 0.002, 0.003, and 0.003, respectively. No fatalities are expected to occur during waste disposal operations, and the number of lost workdays per year due to occupational injuries would range from 1 to 2 for the three alternatives, with the borehole method having the lowest number and the vault method having the highest number.		

TABLE S-3 (Cont.)

Resource Area	Alternative				
	Alternative 1 No Action	Alternative 2 WIPP Geologic Repository	Alternative 3 Borehole	Alternative 4 Trench	Alternative 5 Vault
Human Health (Cont.) Maximum Long-Term Impacts	The estimated maximum long-term human health impacts could range up to 470 rem/yr, which corresponds to an annual LCF risk of 0.3.	Both the annual dose and LCF risk would be zero because there would be no releases to the accessible environment and therefore no radiation doses and LCF risks during the first 10,000 years following closure of the WIPP repository. This is noted in Section 5.1.12.1 of the <i>Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement</i> issued in 1997 (DOE/EIS-0026-S-2).	The estimated maximum long-term human health impacts for the borehole method range from 0 mrem/yr (NNSS, WIPP Vicinity, and generic commercial Region IV) to 820 mrem/yr (INL Site). These doses correspond to an annual LCF risk of 0 to 0.0005. For the trench method, the estimates range from 0 mrem/yr (NNSS, WIPP Vicinity, and generic commercial Region IV) to 2,100 mrem/yr (INL Site), with a corresponding annual LCF risk of 0 to 0.001. For the vault method, the estimates range from 0 mrem/yr (NNSS, WIPP Vicinity, and generic commercial Region IV) to 2,300 mrem/yr (INL Site), with a corresponding annual LCF risk of 0 to 0.001. The estimates for the vault method are generally highest, followed by the trench and then the borehole methods. Table S-4 presents a tabulation of the estimates for long-term human health impacts.		
Human Health (Cont.) Waste Handling Accident to an Individual	The impacts from a waste handling accident to an individual from storage activities were not analyzed; storage practices are assumed to follow applicable requirements.	The impacts from a waste handling accident to an individual from current storage activities were not re-analyzed in this EIS as analysis was performed in Chapter 5 of "The WIPP Disposal Phase Final Supplement EIS (EIS-0026-S-2, September 1997); the accident analysis in the EIS has been reviewed by EM and is still representative and bounding. It is expected that the dose and LCF risk to an individual from this accident would be similar to those estimated for disposal at the WIPP Vicinity (i.e., highest individual dose of 7.5 rem with corresponding LCF risk of 0.005).	For the borehole, trench, and vault methods, the highest individual dose and LCF risk from a waste handling accident is for an individual assumed to be located 100 m (330 ft) from a fire involving an SWB. This individual is expected to be a noninvolved worker. While the estimates for all the sites evaluated are fairly comparable, they vary from site to site, depending on local meteorology and the assumed location of the nearest individual. The estimates are the same for all three methods. The estimates are as follows (the dose in rem is given first, followed by the LCF risk in parentheses): 16 (0.009) for the Hanford Site, 11 (0.007) for the INL Site, 12 (0.007) for LANL, 2.4 (0.001) for NNSS, and 7.5 (0.005) for the WIPP Vicinity. Because the calculations depend on the specific meteorology and location of the nearest individual, estimates were not performed for the generic commercial disposal facilities; however, it is expected that the impacts would be comparable to those listed above for the federal sites.		

TABLE S-3 (Cont.)

Resource Area	Alternative				
	Alternative 1 No Action	Alternative 2 WIPP Geologic Repository	Alternative 3 Borehole	Alternative 4 Trench	Alternative 5 Vault
Human Health (Cont.) Waste Handling Accident to Nearby Population	The impacts from a waste handling accident to the nearby population from current storage activities were not analyzed. Current storage practices are assumed to follow applicable requirements.	The impacts from a waste handling accident involving a fire involving an SWB were not calculated for disposal of GTCC LLRW and GTCC-like waste at the WIPP repository; however, it is expected that the dose and LCF risk to a population from this accident would be similar to those estimated for disposal at the WIPP Vicinity (i.e., highest population dose of 7.0 person-rem with corresponding LCF risk of 0.004).	For the borehole, trench, and vault methods, the highest population dose and LCF risk from a waste handling accident is for a nearby population assumed to be located 100 m (330 ft) from a fire involving an SWB. The estimates are the same for all three methods but vary from site to site, depending on the local meteorology and assumed locations and number of the nearest population, with the highest estimate generated for LANL. The estimates are as follows (the dose in person-rem is given first, followed by the LCF risk in parentheses): 95 (0.06) for the Hanford Site, 13 (0.008) for the INL Site, 160 (0.1) for LANL, 0.47 (0.0003) for NNSS, and 7.0 (0.004) for the WIPP Vicinity. Because the calculations depend on the specific meteorology and locations and number of nearby populations, estimates were not performed for the generic commercial disposal facilities; however, it is expected that the impacts would be comparable to those listed above for the federal sites.		
Ecological Resources	No incremental impacts due to construction activities for a disposal facility are expected because none would be undertaken. It is assumed that the current facility operations in the storage sites would continue and result in minimal impacts.	Incremental impacts on habitat and wildlife would be localized and not result in adverse population-level effects.	Impacts on ecological resources would generally be small at all sites evaluated because of the relatively small amount of land affected. Impacts would be incurred by the individuals using the impacted areas, but population-level impacts are not expected. There are no federally listed or state-listed threatened or endangered species reported to be in the GTCC project areas at the INL Site or WIPP Vicinity. Construction activities could affect federal or state candidate species or species under review for federal listing at the INL Site or WIPP Vicinity. Impacts on these species would likely be small, since the area of habitat disturbance would be small relative to the overall size of such habitat in the area. Several federally listed or state-listed bird and mammal species occur within the GTCC project areas at the Hanford Site, SRS, LANL, and NNSS. Impacts on these species would likely be small, since the area of habitat disturbance would be small relative to the overall size of such habitat in the area. Adverse impacts would be minimized by conducting biological surveys in the project area and using good engineering practices to minimize impacts on the environment.		

TABLE S-3 (Cont.)

Resource Area	Alternative				
	Alternative 1 No Action	Alternative 2 WIPP Geologic Repository	Alternative 3 Borehole	Alternative 4 Trench	Alternative 5 Vault
Socioeconomics	No incremental impacts due to construction activities for a disposal facility are expected because none would be undertaken. It is assumed that the current facility operations in the storage sites would continue and result in minimal impacts.	Impacts would be small because all construction and waste disposal activities could be conducted by the current workforce at WIPP.	The socioeconomic impacts would be small for all three alternatives at all of the sites considered. Estimated peak construction year in-migration would range from a low of 10 (borehole method at NNSS) to a high of 127 (vault method at WIPP Vicinity), requiring less than 1% of the vacant housing in the peak year. Operations would create about 38 to 51 direct jobs and about the same number of indirect jobs, resulting in an increase of less than 0.1% in the annual employment growth rate. The income during operations would be about \$4 to \$5 million per year.		
Environmental Justice	No incremental impacts due to construction activities for a disposal facility are expected because none would be undertaken. It is assumed that the current facility operations in the storage sites would continue and result in minimal impacts.	There would be no incremental impacts beyond those that have already occurred on the minority and low-income populations near the site.	The construction, operations, and post-closure of the land disposal facilities are not expected to result in the potential for disproportionately high and adverse impacts on minority and low-income populations in the vicinity of the sites considered in this EIS. DOE will continue to consult with American Indian tribes and coordinate with them to ensure that their concerns are considered. Subsequent NEPA review to support any GTCC implementation would consider any unique exposure pathways (such as subsistence fish, vegetation or wildlife consumption, and well water use) to determine any additional potential health and environmental impacts.		
Land Use	No incremental impacts due to construction activities for a disposal facility are expected because none would be undertaken. It is assumed that the current facility operations in the storage sites would continue and result in minimal impacts.	No changes in land use at the WIPP site or surrounding area would occur. No additional land surface within the existing footprint of the WIPP site would be affected by the construction of the additional underground rooms at WIPP to emplace the GTCC LLRW and GTCC-like waste, except for the small increased amount of land within the existing facility boundary needed to store excavated material (salt) from the repository.	The amounts of land required for the three alternatives are 20 ha (50 ac) for the trench method, 24 ha (60 ac) for the vault method, and 44 ha (110 ac) for the borehole method. Sufficient space is available at all of the sites to allow for disposal of GTCC LLRW and GTCC-like waste in a manner compatible with ongoing nearby activities. It may be necessary to modify the current land use classification at the reference locations at SRS and the WIPP Vicinity in order to allow disposal facility construction and operational activities to occur.		

TABLE S-3 (Cont.)

Resource Area	Alternative				
	Alternative 1 No Action	Alternative 2 WIPP Geologic Repository	Alternative 3 Borehole	Alternative 4 Trench	Alternative 5 Vault
Transportation	No transportation impacts would occur because no wastes would be shipped.	A total of 33,700 truck shipments or 11,800 rail shipments would be required to transfer the GTCC LLRW and GTCC-like waste to WIPP. This could result in 1 non-radiological fatality from rail accidents and 2 non-radiological fatalities for trucks. For truck transportation, the collective population dose is estimated to be 68 person-rem (with an LCF risk of 0.04, which includes an accident risk of 3×10^{-5} LCF), and the worker dose is estimated to be 180 person-rem (with an LCF risk of 0.1). The values for truck transportation are larger by factors of 1.6 and 3, respectively, than the corresponding values for rail transportation. The impacts are lower for use of rail than trucks because the number of shipments required is smaller. The number of estimated shipments to the WIPP repository is larger than the number associated with the other three action alternatives, primarily due to the assumption that activated metals and RH wastes with higher external dose rates would be packaged in shielded canisters for disposal at WIPP prior to being loaded onto the transport vehicles. All wastes being shipped to WIPP are assumed to be CH wastes, and the external dose rates are taken to be 0.5 and 1.0 mrem/h at 1 m for use of truck and rail, respectively. Although the number of estimated shipments to the WIPP repository is larger than the number associated with the other alternatives, the overall estimated public and worker doses are less because the wastes are shipped as CH wastes. Should the WIPP repository be selected as the option for disposal of these wastes, further evaluation and analysis to optimize the waste	A total of 12,600 truck shipments or about 5,000 rail shipments would be required to transfer the GTCC LLRW and GTCC-like waste to the various alternate disposal sites. This could result in 1 non-radiological fatality from accidents for both truck and rail. The collective population dose for truck transportation ranges from 69 person-rem (SRS) to 170 person-rem (Hanford Site) and could result in an LCF risk of up to 0.1, which includes an accident risk of up to 5×10^{-5} LCF. The worker doses for truck transportation range from 170 person-rem (SRS) up to 500 person-rem and could result in an LCF risk of up to 0.3. The values for truck transportation are larger by factors of 1 to 3 than the corresponding values for rail transportation, depending on which disposal site is addressed. The impacts are lower for use of rail than truck because a smaller number of shipments is required. The external dose rates for CH packages are assumed to be 0.5 and 1.0 mrem/h at 1 m for truck and rail, respectively, which are the same as those used for Alternative 2. The external dose rates for RH packages are taken to be 2.5 and 5.0 mrem/h at 1 m for truck and rail, respectively. About 94% of all shipments would be composed of RH waste. Because of the large percentage of RH shipments, the radiological transportation impacts for Alternatives 3, 4, and 5 are generally greater than those for Alternative 2. Should one of the land disposal methods be selected as the option for disposal of these wastes, further evaluation and analysis to optimize the waste shipment configuration would be conducted to minimize to the extent possible the number of shipments and potential transportation impacts.		

TABLE S-3 (Cont.)

Resource Area	Alternative				
	Alternative 1 No Action	Alternative 2 WIPP Geologic Repository	Alternative 3 Borehole	Alternative 4 Trench	Alternative 5 Vault
Transportation (Cont.)		shipment configuration would be conducted to minimize to the extent possible the number of shipments and potential transportation impacts.			
Cultural Resources	No incremental impacts would occur because continued waste storage would not result in disturbance of additional areas that were not already affected.	No incremental impacts are expected because construction, operational, and post-closure activities would not involve additional land disturbance.	The likelihood of impacting cultural resources is proportional to the amount of land disturbed, with the borehole method requiring the greatest amount of land disturbance. Procedures given in Section 106 of the National Historic Preservation Act would be followed as appropriate to mitigate any impacts on these resources. Local American Indian tribes would be consulted to ensure no traditional cultural properties were impacted. There are no known cultural resources within the GTCC reference locations at the Hanford Site and INL Site. Eighteen cultural resources are reported to be in and near the GTCC reference location at LANL, with some sites considered eligible for listing under the National Historic Preservation Act. A handful of very small lithic scatters are located within the GTCC reference location at NNSS. There are seven archaeological sites within the GTCC reference location at SRS. Some isolated prehistoric artifacts and possibly some larger prehistoric cultural resources would be found in the GTCC reference locations at the WIPP Vicinity.		
Waste Management	No incremental impacts are expected because no construction or operational activities for disposal of GTCC LLRW and GTCC-like waste would be performed.	The small quantities of hazardous and nonhazardous waste produced during waste disposal activities would be managed in the same manner as similar wastes generated by operations at WIPP.	The small quantities of nonradioactive (hazardous and nonhazardous waste) and radioactive (solid and liquid LLRW) waste produced during construction and waste disposal activities would be managed in the same manner as wastes produced by ongoing operations at the various DOE sites evaluated. Specific waste management plans would be prepared as necessary to address these wastes for the WIPP Vicinity.		

^a The annual occupational doses for the three land disposal alternatives were based on an average annual dose rate of 0.2 rem per full-time equivalent (FTE) worker and the annual number of FTE workers estimated for waste disposal. An “FTE worker” for waste disposal purposes would not actually be one worker but would likely consist of several individually badged workers, since the workers would perform other tasks in addition to waste disposal. The worker dose estimates for Alternative 2 were based on actual doses that have occurred during defense-generated TRU waste disposal operations.

1
2

1 Potential environmental consequences under the No Action Alternative would result from
2 continuing the practices currently used to manage these wastes for both the short term and long
3 term. However, it is assumed that current facility operations in the storage sites would continue
4 for the short term and result in minimal impacts on most resource areas (e.g., air quality,
5 geology, water resources, ecological resources, socioeconomics, land use, transportation, and
6 cultural resources). The main concerns are associated with the long-term human health impacts
7 that could result from storage of this waste. Calculations performed for the GTCC EIS indicate
8 that long-term human health impacts for the No Action Alternative (analyzed for the period
9 beyond 100 years and up to 10,000 years to be consistent with the time frame analyzed for
10 Alternatives 2 to 5) could be as high as 470 rem/yr with a lifetime latent cancer fatality (LCF)
11 risk of 0.3 associated with that one year of exposure (as compared to the highest estimate of
12 12 rem/yr and LCF risk of 0.007 [in generic commercial Region I] or 2.3 rem/yr and LCF risk of
13 0.001 [at federal sites] for the action alternatives [i.e., Alternatives 2 to 5]), depending on the
14 region of the country in which a storage site might be located.

15
16 The results of the EIS analysis indicate that the potential impacts on the various
17 environmental resource areas (shown in Figure S-23) from the action alternatives
18 (i.e., Alternatives 2 to 5) would be small and would not vary significantly among the sites
19 evaluated. Like the No Action Alternative, but potentially to a much lesser extent, the exception
20 would be the long-term human health impacts in the post-closure phase for Alternatives 3 to 5
21 (borehole, trench, and vault disposal) as calculated on the basis of impacts to a hypothetical
22 resident farmer near a disposal facility. For Alternative 2, there would be no releases to the
23 accessible environment and therefore no radiation doses or LCF risks during the first
24 10,000 years following closure of the WIPP repository. Table S-4 presents a more detailed
25 comparison of the long-term human health impacts. The radiological impacts to members of the
26 general public as described in this EIS are incremental to, and, in most cases, small, compared to
27 those from natural and man-made sources of radiation, which result in an annual exposure of
28 about 310 mrem/yr each, for a total of about 610 mrem/yr per individual (NCRP 2009).

29
30 On the basis of the site-specific precipitation rates that were assumed, it is estimated that
31 the federal sites located in the arid regions of the country (Hanford Site, LANL, NNSS, and
32 WIPP Vicinity) would generally have lower long-term human health impacts from the
33 groundwater pathway than would the sites located in more humid regions (such as SRS). The
34 exception is the INL Site, which is shown in Table S-4 to have the highest dose and LCF risk
35 estimates (estimated to be up to 2.3 rem/yr and 0.001, respectively). The INL Site results are
36 primarily due to the distribution coefficient (K_d) of zero assumed in the calculations for the
37 radionuclides identified in the waste inventory; this assumption was made as a conservative
38 approach to account for the basalt layer that is present in some parts of the INL Site (including
39 the GTCC reference location). Essentially, this assumption considers radionuclides to be released
40 to the full extent once the basalt layer has been penetrated. Estimates of long-term human health
41 impacts from the groundwater pathway for the No Action Alternative also indicate that the arid
42 regions would result in lower doses and LCF risks.

43
44 Site- and radionuclide-specific K_d s were assumed in the long-term human health
45 calculations and can vary significantly between sites. K_d s provide an indication of the degree to
46 which the radionuclide would adhere to soil and not move with the percolating water. The higher

TABLE S-4 Comparison of Estimated Potential Maximum Human Health Long-Term Impacts for Alternatives 1 to 5^a

Alternative	Maximum Human Health Long-Term Impacts ^b	
	Annual Dose (rem/yr)	Annual LCF Risk
1: No Action	470	0.3
2: WIPP (geologic repository)	0 ^{c,d}	0 ^{c,d}
3: Borehole method		
Hanford Site	0.0048	0.00003
INL Site	0.82	0.0005
LANL	0.16	0.00009
NNSS	0	0
WIPP Vicinity	0	0
Generic Commercial Region IV	0	0
4: Trench method		
Hanford Site	0.048	0.00003
INL Site	2.1	0.001
LANL	0.38	0.0002
NNSS	0	0
SRS	1.7	0.001
WIPP Vicinity	0	0
Generic Commercial Region II	1.2	0.0007
Generic Commercial Region IV	0	0
5: Vault method		
Hanford Site	0.049	0.00003
INL Site	2.3	0.001
LANL	0.43	0.0003
NNSS	0	0
SRS	1.3	0.0008
WIPP Vicinity	0	0
Generic Commercial Region I	12	0.007
Generic Commercial Region II	1.2	0.0007
Generic Commercial Region III	0.53	0.0003
Generic Commercial Region IV	0	0

^a Radiation doses are given to two significant figures, and LCF risks are given to one significant figure. A value of zero for long-term human health impacts means that the radioactive contamination does not reach the well of the hypothetical receptor (for Alternatives 1, 3, 4, and 5) or the Culebra Dolomite at WIPP for Alternative 2.

Footnotes continued on next page.

TABLE S-4 (Cont.)

- ^b For Alternatives 1, 3, 4, and 5, these impacts are the peak long-term annual radiation doses and LCF risks estimated to occur within the first 10,000 years after closure of the waste disposal facility to a hypothetical resident farmer 100 m (330 ft) downgradient from the edge of the disposal facility. For Alternative 2, there would be no releases to the accessible environment and therefore no radiation doses and LCF risks during the first 10,000 years following closure of the WIPP repository, as noted in Section 5.1.12.1 of the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* issued in 1997 (DOE/EIS-0026-S-2).
- ^c The disposal of defense-generated TRU waste at WIPP is conducted in accordance with the standards and criteria in 40 CFR Parts 191 and 194. As noted in footnote b, there would be no releases to the accessible environment for disposal of defense-generated TRU wastes at WIPP in the first 10,000 years following closure, and the corresponding annual dose and LCF risk are both reported as zero.
- ^d The post-closure impacts from disposing of the GTCC LLRW and GTCC-like waste at WIPP were evaluated in the same manner as was done for disposal of defense TRU waste in this repository. This analysis indicates that the GTCC LLRW and GTCC-like waste inventory could be disposed of at WIPP in compliance with existing regulations. However from a statute perspective, DOE acknowledges that only defense-generated TRU waste is currently authorized for disposal at the WIPP geologic repository under the WIPP LWA as amended (P.L. 102-579 as amended by P.L. 104-201), and that legislation would be required to allow disposal of waste other than TRU waste generated by atomic energy defense activities at WIPP and/or for siting a new facility within the land withdrawal area.

1

2

3 the K_d for a specific radionuclide, the more that radionuclide would adhere to soil particles. Sites
4 that have high K_d s would generally result in lower groundwater radionuclide concentrations than
5 those with lower K_d s.

6

7 SRS was estimated to have the second-highest potential dose and LCF risks after the INL
8 Site. The peak annual dose to the hypothetical resident farmer receptor at SRS is estimated to be
9 about 1.7 rem/yr, with C-14, Tc-99, and I-129 being the major radionuclide contributors to the
10 dose. The K_d s assumed for these three radionuclides are very low and generally the same as
11 those used for all the federal sites evaluated in the EIS. As a result, these same three
12 radionuclides are also the major contributors to the dose and LCF risk to the hypothetical
13 resident farmer for the groundwater pathway to the federal sites in the western part of the
14 country. However, the low precipitation rates for these sites resulted in generally lower peak
15 annual doses and LCF risks than those for SRS, which is located in a more humid region.

16

17 Finally, of the three waste types, the activated metals and sealed sources would result in
18 lower peak annual doses and LCF risks than would the Other Waste. This would occur because
19 the Other Waste type is physically the most leachable of the three waste types. In the GTCC EIS,

1 it is assumed that the Other Waste would be stabilized with grout to minimize degradation over
2 time. This would also reduce leaching of radionuclides. The activated metal and sealed source
3 wastes are much more durable than the stabilized Other Waste, and leaching from these two
4 waste types would be much lower over the long term.

5
6 These results are intended to be viewed in a comparative manner, given the uncertainties
7 associated with this analysis. A number of simplifying assumptions are made for the purposes of
8 the comparative analysis in this EIS, especially in terms of the long-term performance of
9 engineered materials assumed for the borehole, trench, and vault disposal facilities. It is expected
10 that detailed, site-specific assessments that would include more specific calculations on the
11 physical and chemical performance of different engineered materials would be made before
12 implementation of any alternative.

13
14 The results presented here should not be used for regulatory compliance purposes in the
15 future, and they should not be compared with site-specific performance assessments that have
16 been conducted for existing waste disposal facilities. Such assessments are based on site-specific
17 exposure scenarios and conditions. However, the assessment in this EIS does provide useful
18 information to guide the decision-making process for identifying the most appropriate alternative
19 to manage these GTCC LLRW and GTCC-like waste.

20

21

22 **S.4 CUMULATIVE IMPACTS**

23

24 Potential impacts of the GTCC proposed action are considered in combination with the
25 impacts of past, present, and reasonably foreseeable future actions. Cumulative impacts are
26 evaluated for Alternatives 2 to 5. DOE did not evaluate the cumulative impacts of the No Action
27 Alternative at the many privately-owned and operated locations, since such an evaluation would
28 involve making speculative assumptions about environmental conditions and future activities at
29 those locations where GTCC LLRW could be stored.

30

31 For Alternative 2, the low potential impacts of that alternative indicate that the
32 cumulative impacts from the construction, operations, and post-closure phases of the proposed
33 action at the WIPP site would be small and would not exceed regulatory requirements
34 established for the WIPP facility. The post-closure performance analysis performed for
35 emplacement of all GTCC LLRW and GTCC-like waste at WIPP demonstrates that disposal of
36 these wastes would result in WIPP still being in compliance with existing regulatory
37 requirements for technical performance.

38

39 For Alternatives 3 to 5 at the federal sites, the estimated impacts from the GTCC
40 proposed action are not expected to contribute substantially to cumulative impacts for the various
41 resource areas evaluated, with the likely exception of potential human health impacts in the long
42 term. That is, during the post-closure phase of the proposed action, potential leaching of
43 radionuclides from the GTCC LLRW and GTCC-like waste inventory into groundwater could
44 contribute to doses and LCF risks to a hypothetical resident farmer located about 100 m (330 ft)
45 from the edge of the borehole, trench, or vault disposal facility at the federal reference locations
46 (i.e., at the Hanford Site, the INL Site, LANL, and SRS). For the Hanford Site, as stated in the

1 *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford*
2 *Site, Richland, Washington* (DOE 2012), when the impacts of technetium-99 from past leaks and
3 cribs and trenches (ditches) are combined, DOE believes it may not be prudent to add significant
4 additional technetium-99 to the existing environment. Therefore, one means of mitigating this
5 impact would be for DOE to limit disposal of off-site waste streams containing iodine-129 or
6 technetium-99 at Hanford. The post-closure doses and LCF risks are summarized in Table S-4.
7 The resident farmer scenario is assumed to be conservative (i.e., one that overestimates the
8 expected dose and LCF risk) because it assumes a total loss of institutional control and
9 institutional memory with regard to the disposal facility. The sites evaluated are on federal land
10 and would most likely continue to be managed by the federal government for a long time.
11 Follow-on NEPA evaluations to support further considerations of siting a new borehole, trench,
12 or vault disposal facility at the sites evaluated in this EIS would provide more detailed analyses
13 of site-specific issues relative to cumulative impacts.

14 15 16 **S.5 UNCERTAINTIES ASSOCIATED WITH THE EVALUATIONS IN THE GTCC EIS**

17
18 The impact analyses conducted for the GTCC EIS used methodologies and approaches
19 consistent with Council on Environmental Quality and DOE requirements and guidance for
20 preparing an EIS. Uncertainties associated with the various environmental resource areas
21 evaluated in this EIS are not unique to the GTCC EIS. As previously discussed, the results of the
22 impact analyses for the action alternatives (summarized in Sections S.3 and S.4) indicate that the
23 impacts on the various resource areas from the proposed action would be generally small and
24 that they would not vary much among the sites evaluated, with the possible exception of
25 potential post-closure impacts on human health. The results from the analysis of human health
26 impacts in the post-closure phase indicate that potential future doses and LCF risks to a
27 hypothetical resident farmer could vary significantly by site. Hence, the discussion on
28 uncertainties focuses on this aspect of the analysis because it provides information useful in
29 identifying a preferred alternative.

30
31 Several factors could alter the estimated human health impacts associated with disposal
32 of these wastes, including changes in (1) the waste volume and radionuclide inventory, (2) the
33 assumptions about the design and layout of the facilities, (3) the assumptions used to simulate
34 how long the integrity of the engineered barriers and waste stabilizing agents would stay intact,
35 and (4) the assumptions about site characteristics used as input for the calculations.

36
37 The radiological impacts on human health would depend mostly on the total radioactivity
38 and the mix of radionuclides that would make up the waste. That is, if the waste volumes
39 doubled but total activity remained the same, it is anticipated that there would be no major
40 change in the potential radiological impacts. Increasing the total radionuclide activity by a factor
41 of two with the same mix of radionuclides, however, would essentially double the potential
42 radiological impacts. Because the uncertainty with regard to the waste inventory is generally low
43 to moderate, the inventory does not represent a major source of uncertainty in the human health
44 impact analysis.

45
46 Changes in the design and layout of the disposal facility could also change the potential
47 human health impacts. For purposes of analysis in the EIS, the depths of the disposal area

1 available for waste placement are assumed to be 4.3 to 5.5 m (14 to 18 ft) above ground surface
2 (ags) for vaults, at 5 to 10 m (15 to 30 ft) bgs for trenches, and from 30 to 40 m (100 to 130 ft)
3 bgs for boreholes. Changes in the design and layout of the disposal facility could result in
4 changes in the total area and the subsequent depths of the waste disposal horizon in the EIS
5 analyses. The footprint of the disposal facility, along with the distance from the edge of the
6 facility to an off-site hypothetical well where potential radiation exposures are assumed to occur,
7 determines the total distance that the radionuclides need to travel in the groundwater aquifer to
8 cause a radiation dose. For example, a decrease in the footprint of the disposal facility would
9 shorten the distance from the midpoint of the waste zone to the off-site well. This shorter
10 distance would increase the radionuclide concentrations in the groundwater at an off-site well
11 because there would be less dilution, and it would result in somewhat higher doses from the use
12 of this groundwater. Calculations based on actual distances during implementation should
13 provide a more representative estimate.

14
15 Changes to the design of the disposal facility could result in changes to the area
16 potentially exposed to infiltrating water. A larger disposal area would allow more water
17 infiltration and result in more radionuclides leaching out to deeper soils. Alternatively, a smaller
18 area (with a subsequent greater depth of waste disposal) would result in a shorter soil column
19 beneath the disposal units through which radionuclides leaching from the disposal area would
20 need to travel to reach the groundwater table. The overall effect that could result from changes in
21 the geometrical configuration of the disposal cells needs to be assessed with regard to the time
22 frame used to evaluate the potential impacts and the specific site in question. However, these
23 changes would not add a significant amount of uncertainty to the results, unless major changes
24 were made to the current conceptual facility designs used in these analyses.

25
26 For the GTCC EIS, it is assumed that the engineered barriers (including the cover) would
27 remain effective for the first 500 years after closure of the disposal facility and that during this
28 time, essentially no infiltrating water would reach the wastes from the top of the disposal facility.
29 It is assumed that after 500 years, some amount of infiltrating water (20% of the site-specific
30 natural infiltration rate reported for each of the sites evaluated) would contact the wastes through
31 the top of the disposal facility, and that the water infiltration rate to the perimeter and beneath the
32 disposal facilities would be 100% of the site-specific natural infiltration rate. It should be noted
33 that if the infiltration rate to the top of the disposal facility is increased, the dose estimates would
34 also increase. It is also assumed that the Other Waste would be stabilized with grout or other
35 material and that this stabilizing agent would be effective for 500 years. No credit is taken for the
36 effectiveness of this stabilizing agent after 500 years. The radionuclides in the disposed-of
37 wastes would be available for leaching by infiltrating water after 500 years.

38
39 Many of the radionuclides in the GTCC LLRW and GTCC-like wastes have very long
40 half-lives, so the 500-year effectiveness period assumed for purposes of analysis in this EIS is
41 relatively short and would not result in an appreciable reduction in the total hazard associated
42 with these wastes as a result of radioactive decay, especially when the time it would take for
43 these radionuclides to reach the hypothetical off-site receptor is considered. The uncertainty is
44 related to how much longer the engineered barriers and stabilization process could remain
45 effective for the sites at which the potential impacts are estimated to be high.

46

1 In addition, global climate change impacts might add another aspect of uncertainty with
2 regard to the long-term performance of the borehole, trench, and vault waste disposal facilities at
3 the sites evaluated in the GTCC EIS. Since 1990, the average annual precipitation over the
4 United States has increased by about 5%, but there were regional differences, e.g., increases
5 mostly in the Northeast, Midwest, and southern Great Plains and a mix of increases and
6 decreases in much of the Southeast and Southwest (Melillo et al. 2014). The global climate
7 change model predictions indicate that in the Southwestern United States, drier or prolonged
8 drought conditions could arise notably in the spring, whereas Northern areas could become
9 wetter.

10
11 Although the global climate change impacts are modeled only to the year 2100, these
12 initial indications can be used to provide a perspective on what impacts global climate change
13 might have on the proposed borehole, trench, and vault waste disposal facilities at the various
14 reference locations or regions evaluated in this EIS. As discussed previously, the water
15 infiltration rate is one of the key input parameters that affect how much radioactivity could leach
16 from waste in the disposal facility. On the basis of the global climate change predictions under a
17 higher (i.e., worst-case) emission scenario (Melillo et al. 2014), average annual infiltration rates
18 at the sites located in the Southwest (e.g., LANL, NNSS, WIPP Vicinity, and the generic
19 commercial location in the southern part of NRC Region IV) are expected to decrease slightly or
20 remain the same, while rates at the sites located in the Northwest (e.g., Hanford and INL Sites)
21 and in the Southeast (e.g., SRS), would increase slightly.

22
23 On the basis of Melillo et al. (2014), it can be said that the maximum increase or decrease
24 in precipitation under a higher emission scenario would be up to 20% depending on the season.
25 Under a lower emission scenario, these percentages would be lower, and thus climate changes
26 would probably not have any significant impacts on GTCC LLRW and GTCC-like waste
27 disposal operations. This is because slight increases in precipitation are expected in humid sites
28 such as SRS. For sites located in drier areas, such as Hanford, INL, LANL, NNSS, and
29 WIPP/WIPP Vicinity, changes of up to about 20% by season would be expected under a higher
30 emission scenario but these changes are not significant due to its lower annual precipitation.
31 However, because the post-closure human health estimates presented in the GTCC EIS are for
32 10,000 years or more, and because current global climate change model projections extend only
33 to the year 2100, it is uncertain whether the indications discussed here would continue for the
34 10,000-year post-closure period analyzed in the GTCC EIS.

35
36 Most of the long-term radiation doses and LCF risks associated with the groundwater
37 pathway would be attributable to leaching of the Other Waste. By using robust engineering
38 designs and redundant measures to contain the radionuclides in the disposal unit (i.e., increasing
39 the time period of effectiveness of covers and stabilizing agents), the potential releases of
40 radionuclides would be delayed and reduced to very low levels, thereby minimizing the potential
41 groundwater contamination and its associated human health impacts in the future.

42
43 The modeling simulation conducted for the GTCC EIS is a simplified representation of
44 more complex soil and groundwater processes, and this simplification adds uncertainty to the
45 results. The RESRAD-OFFSITE computer code was used for this analysis, and input parameters
46 were determined on a site-specific basis, as available; most were obtained from previous
47 analyses performed at these sites. In addition, the site-specific distribution coefficients used as

1 input into the model calculations have inherent uncertainties
 2 associated with them, and it is difficult to assign values for the
 3 level and direction of uncertainty that exist in the distribution
 4 coefficients for each site and from site to site.

6 It is assumed in this EIS that a resident farmer would be
 7 located 100 m (330 ft) downgradient from the edge of the
 8 disposal facility and would develop a well as a source of
 9 drinking water. This assumption is considered to be conservative
 10 because the distance from the edge of the disposal facility to
 11 such an individual (given the current configurations of the
 12 alternative sites evaluated in this EIS) would be much longer.
 13 Use of a more realistic distance would result in much lower
 14 doses than those presented in this EIS. This distance adds a great
 15 deal of uncertainty and conservatism to the results presented in
 16 this EIS.

18 Finally, the human health impacts estimated for a
 19 hypothetical resident farmer (provided in Table S-3) are intended
 20 to serve as indicators of the performance or effectiveness of each
 21 of the land disposal methods at each of the sites evaluated and
 22 are expected to provide a metric for comparing the relative
 23 performance of the land disposal methods at these sites. When
 24 considering which GTCC disposal alternative to select, DOE
 25 will consider the potential dose to the hypothetical resident
 26 farmer as well as other factors described in Section S.7 of this
 27 Summary.

30 **S.6 PUBLIC INVOLVEMENT**

32 DOE is committed to communicating to the public
 33 information about the GTCC EIS to ensure that potentially
 34 affected communities, tribal groups, and other interested parties
 35 understand DOE's proposed action and are given the opportunity
 36 to participate in decisions that may affect them. DOE issued the
 37 Advance Notice of Intent on May 11, 2005 (70 FR 24775) and
 38 the NOI on July 23, 2007. DOE issued a printing correction for
 39 the NOI on July 31, 2007. DOE also established a public website at the same time it issued the
 40 NOI (www.gtcceis.anl.gov) in
 41 order to give the public access to information on the NEPA process, the EIS, and public
 42 involvement opportunities. The NEPA process followed by DOE for the GTCC EIS is shown in
 43 Figure S-24.

45 The NOI announced nine public scoping meetings and a comment period from July 23
 46 through September 21, 2007, during which time DOE solicited comments from stakeholders,

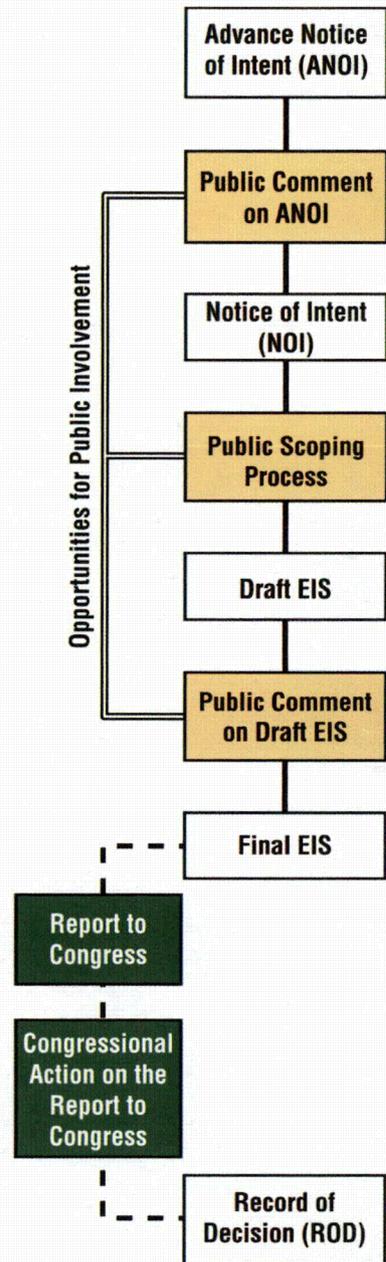


FIGURE S-24 GTCC EIS NEPA Process

1 including federal, state, and local agencies; American Indian tribal representatives; and the
2 general public to assist in defining the proposed action, alternatives, and issues requiring
3 analysis.

6 **S.6.1 Public Scoping Comments on the Notice of Intent**

8 DOE received 249 comment records via emails, faxes, letters, and transcripts of oral
9 comments. DOE considered all oral and written public comments in identifying the range of
10 alternatives for the EIS.

12 Comments received during the public scoping period focused on the amount of inventory
13 being included for evaluation in the EIS, the sites that would be considered, the disposal methods
14 or technologies that would be considered, the resource areas to be evaluated, and the impact
15 assessment methodologies. Representative comments and DOE responses are provided as
16 follows. The first set of comments presents those determined to be within the EIS scope, and the
17 second set presents those determined to be outside the scope of the EIS.

20 **S.6.1.1 Comments Determined To Be Within EIS Scope**

- 22 • *Disposal of GTCC LLRW and GTCC-like waste at the sites proposed in the
23 NOI should not be considered because these sites are still undergoing
24 cleanup. In addition, these sites either have regulatory conditions or site
25 characteristics (e.g., geology) that make them unsuitable for consideration in
26 the EIS.*

28 The basis for proposing the sites to be considered in the NOI and evaluated in
29 the EIS was their mission compatibility, in the sense that all of these sites
30 have radioactive waste disposal operations as part of their current missions.
31 These sites are thus considered viable for analysis for disposal of this waste in
32 the EIS. The scope of the EIS includes the identification of potential disposal
33 sites and the evaluation of the feasibility and effectiveness of these sites for
34 hosting a safe disposal facility for GTCC LLRW and GTCC-like waste.

- 36 • *The preferred alternative for disposal of GTCC LLRW and GTCC-like waste
37 should be a geologic repository.*

39 Disposal at WIPP, a geologic repository, is one of the alternatives evaluated in
40 the Draft EIS, and a preferred alternative in the Final EIS. In addition, DOE is
41 evaluating alternative methods of disposal (i.e., borehole, trench, and vault
42 disposal). NRC regulations governing disposal of GTCC LLRW contemplate
43 that nongeologic disposal alternatives may be approved (see
44 10 CFR 61.55(a)(2)(iv)).

- 1 • *More detailed characterization information should be provided on the waste*
2 *inventory, including the source of the waste, its location (by state), and its*
3 *specific characteristics. It is not clear how the volumes and activities for*
4 *stored and projected waste were developed, and the distinction between what*
5 *is considered stored versus what is considered projected is not clear either.*
6 *The sources of information and important assumptions used to develop this*
7 *information should be provided in the EIS, along with an indication of the*
8 *accuracy of the estimates.*

9
10 The GTCC EIS and supporting documents provide characterization
11 information on wastes to allow for a comparative analysis of potential
12 environmental impacts associated with the disposal of these wastes. The
13 approach used by DOE to develop the inventory information are provided in
14 the EIS and in supporting documents, including the identification of relevant
15 resources and DOE's due diligence in determining that current expected waste
16 quantity estimates remain valid, and are conservative and bounding for the
17 purposes of this comparative analysis (see Sections S.2.1 and S.2.4). The EIS
18 also provides information on the current location of GTCC LLRW and
19 GTCC-like waste producers (e.g., Table S-2 of this Summary).

- 20
21 • *The EIS should identify the quantity of mixed waste requiring disposal and*
22 *identify the process for working with the EPA and respective state agencies to*
23 *manage these wastes.*

24
25 The GTCC LLRW and GTCC-like waste inventory includes a very small
26 volume of mixed waste that may require disposal. It is assumed that the
27 generator of the waste will treat it to remove the hazardous waste
28 characteristic or obtain a waiver from the appropriate regulatory authority so
29 that the waste is no longer regulated as mixed waste. No mixed GTCC LLRW
30 or GTCC-like waste is assumed to be disposed of in the sites being evaluated
31 in the EIS. The volume of potential mixed waste is about 170 m³ (6,000 ft³).

- 32
33 • *What is the scope of the EIS and evaluation endpoints (e.g., period of time*
34 *with respect to risk of release)? The EIS should identify long-term monitoring*
35 *requirements for the disposal sites.*

36
37 The scope of the EIS addresses all aspects associated with disposal of GTCC
38 LLRW and GTCC-like waste. Impacts are evaluated at the various time
39 periods associated with the actions needed to safely dispose of these wastes.
40 The long-term impacts on groundwater are evaluated for 10,000 years or to
41 the point of maximum dose and LCF risk, whichever is longer. The EIS
42 identifies the need for long-term monitoring of disposal sites, as appropriate.

- 43
44 • *The EIS should incorporate available site-specific data for the generic*
45 *commercial facility evaluations. In addition, the evaluation of the disposal of*

1 *GTCC LLRW and GTCC-like waste in boreholes for all sites being evaluated*
2 *should be based on actual site data.*

3
4 Site-specific data were used to identify the important parameters necessary to
5 site and operate a disposal facility for GTCC LLRW and GTCC-like waste at
6 arid and humid generic sites. The analyses of the various disposal
7 technologies (including the use of boreholes) in the EIS were based on actual
8 site data to the extent necessary to provide reliable evaluations. A site-specific
9 evaluation would be done in a subsequent NEPA review as appropriate.

- 10
11 • *Consultation with tribal nations should be initiated early in the process.*

12
13 Tribes contributed to the preparation of the Draft EIS and participated in the
14 review of the Draft EIS by attending public meetings regarding GTCC and
15 submitting comments that are addressed in Appendix J of this EIS. Since the
16 receipt of tribal comments in 2011 on the Draft EIS, DOE has continued
17 routine consultation with tribes as part of normal operations at the DOE sites
18 evaluated in this EIS. DOE will continue to involve the tribes in the decision
19 making process for the disposal of GTCC.

- 20
21 • *The EIS should identify all federal and state agencies and any jurisdictional*
22 *authority by law and/or special expertise. Also, the EIS should address all*
23 *pertinent regulatory issues and standards, including NRC regulation of a*
24 *facility at a DOE site.*

25
26 The EPA is a cooperating agency on the EIS because of its expertise in
27 radiation protection. The NRC is a commenting agency. Pertinent regulatory
28 issues and standards associated with disposal of GTCC LLRW and GTCC-
29 like waste are addressed in the EIS.

30
31
32 **S.6.1.2 Comments Determined To Be Outside EIS Scope**

- 33
34 • *In addition to considering disposal at WIPP in the EIS, efforts should be*
35 *initiated to site and construct a new geologic repository for GTCC LLRW and*
36 *GTCC-like waste in case this repository is not acceptable.*

37
38 As discussed in the NOI (72 FR 40135), DOE does not plan to evaluate an
39 additional deep geologic repository facility because siting another deep
40 geologic repository facility for GTCC LLRW and GTCC-like waste would be
41 impractical due to the cost and time involved and the relatively small volume
42 of GTCC LLRW and GTCC-like waste.

- 43
44 • *Hardened on-site storage (HOSS) should be added to the alternatives*
45 *evaluated in the EIS. In addition, HOSS should be the preferred alternative.*
46

1 HOSS and other waste storage approaches beyond the No Action Alternative
2 are considered to be outside the scope of the EIS because they do not meet the
3 purpose and need for agency action. Consistent with Congressional direction
4 in Section 631 of the Energy Policy Act of 2005 (P.L. 109-58), DOE plans to
5 complete an EIS and a ROD for a permanent disposal facility for this waste,
6 not for long-term storage options. In addition, the No Action Alternative
7 evaluates storage of this waste consistent with ongoing practices.
8

- 9 • *The EIS should include disposal options for Class B and Class C LLRW in its
10 scope.*

11
12 Inclusion of Class B and Class C LLRW is beyond the scope of the EIS. DOE
13 is responsible under the LLRWPA (P.L. 99-240) for the disposal of GTCC
14 LLRW and DOE wastes. States and Compacts are responsible for the disposal
15 of Class A, B, and C LLRW.
16

- 17 • *The GTCC LLRW inventory needs to be expanded to address the disposal and
18 possible consolidation and concentration of Class B and Class C LLRW by
19 commercial nuclear utilities, resulting in additional GTCC LLRW.*

20
21 The waste inventory is based on the best available information on GTCC
22 LLRW, and it considers utility waste resulting from decommissioning
23 activities. Data on the GTCC LLRW that might be generated by the
24 concentration and consolidation of Class B and Class C LLRW are difficult to
25 ascertain at this time because of the speculative nature of these events. The
26 uncertainty that would be introduced in the EIS process by including this
27 potential volume is not warranted.
28

- 29 • *Additional radioactive wastes should not continue to be produced until there
30 is a waste disposal solution for these materials.*

31
32 This issue is beyond the scope of the EIS, which is limited to the evaluation of
33 the potential environmental impacts from using various disposal options for
34 GTCC LLRW and GTCC-like waste.
35

- 36 • *The EIS should address the increased sensitivity of children, the elderly,
37 pregnant women, and women in general to radiation exposure. The analysis
38 should not be based on a reference man but on the reference family concept.
39 In addition to radiation doses, estimates of the cancer risks should be
40 provided in the EIS to allow for a comparison to EPA carcinogenic risk
41 standards.*

42
43 The concerns with regard to the increased sensitivity of various elements of
44 the population are noted. The EIS presents a comparative analysis of the
45 potential radiation doses and LCF risks to members of the general public (as
46 represented by an adult receptor) from use of the various disposal alternatives

1 presented in the NOI. As such, the level of detail requested here is not
2 necessary for the purposes of the EIS, and the hazards associated with
3 management of these wastes are presented in terms of the annual dose and
4 LCF risk to a potentially exposed adult receptor.
5

6 The estimates for dose and LCF risk were based on a resident farmer receptor,
7 which is considered a conservative scenario that accounts for the largest
8 number of pathways of potential exposure. The primary pathway of concern,
9 however, is the ingestion of groundwater potentially contaminated with
10 radionuclides released from wastes at the proposed disposal facility. The
11 estimated dose and LCF risk to an adult receptor presented in the EIS are
12 considered conservative (relative to any other potential receptor) because the
13 ingestion rate assumed for water intake is the 90th percentile value for the
14 general public recommended by the EPA (i.e., two liters per day for 365 days
15 per year) (EPA 2000).
16

17 Follow-on NEPA evaluations will be conducted, as needed, to assess potential
18 human health impacts on a site-specific basis (accounting for sensitive
19 populations as applicable) when a disposal site or location is identified.
20

- 21 • *Further research on and/or investigation of other treatment and disposal*
22 *technologies currently being developed should be considered to ensure that*
23 *these wastes are managed safely. The hazards posed by GTCC LLRW and*
24 *GTCC-like waste are comparable to those from high-level radioactive wastes*
25 *and should be managed in a similar manner.*
26

27 Further research on treatment and disposal technologies is not needed to
28 ensure these wastes are safely managed and that disposal complies with the
29 LLRW PAA (P.L. 99-240), which makes the federal government responsible
30 for the disposal of GTCC LLRW. It would not be reasonable to analyze in
31 detail an essentially unlimited number of additional non-DOE or nonfederal
32 sites. Nevertheless, DOE also conducted a generic evaluation of commercial
33 disposal facilities on nonfederal lands in the EIS in order to provide, to the
34 extent possible, information regarding the potential long-term performance of
35 other (nonfederal) locations for siting a GTCC LLRW and GTCC-like waste
36 land disposal facility.
37
38

39 S.6.2 Public Comments on Draft EIS 40

41 All scoping comments received were considered in the preparation of the EIS. A Notice
42 of Availability (NOA) for the Draft GTCC EIS was published in the *Federal Register* on
43 February 25, 2011 (76 FR 10574), and it began a 120-day public comment period that ended on
44 June 27, 2011. All comments received on the Draft EIS were considered in the preparation of the
45 Final GTCC EIS.
46

1 DOE received a total of 1,196 comment records, which accounted for 3,982 individual
2 comments. Of the 1,196 comment records received, 154 were from organizations or federal or
3 state agencies; 495 were from private citizens; and 547 were campaign letters, emails, or web
4 comments received from six organizations (i.e., Snake River Alliance, Friends of the Gorge,
5 Concerned Citizens for Nuclear Safety, Nuclear Watch, Citizen Letter, and the Brookfield
6 Assisted Living Facility). Written comments were received via letter, email, or through
7 submission of a comment form provided at the public hearings or on the project website. Oral
8 comments are included in transcripts documenting each of the public hearings held on the Draft
9 GTCC EIS.

10
11 Comments were reviewed and responses prepared by policy experts, technical subject
12 matter experts, and NEPA experts. Comments were evaluated to determine whether alternatives
13 and analyses presented in the Draft EIS should be modified, whether additional or corrected
14 information is needed, and whether additional or revised text would clarify the information being
15 conveyed. The comments received have been summarized into 10 comment topics, which are
16 presented here, along with corresponding responses (detailed responses to each of the comment
17 records can be found in Appendix J, Section J.3):

- 18
19 1. *Disposal of GTCC LLRW and GTCC-Like Waste at a New Near-Surface Land*
20 *Disposal Facility at DOE Sites Evaluated (i.e., at the Hanford Site, INL Site,*
21 *LANL, SRS, NNSS, and the WIPP Vicinity) – Comments received*
22 *recommended that specific sites should be removed from consideration in*
23 *developing a GTCC LLRW and GTCC-like waste near-surface land disposal*
24 *facility.*

25
26 The disposal methods and sites evaluated in the EIS encompass the range of
27 reasonable alternatives for the disposal of GTCC LLRW and GTCC-like
28 waste, consistent with NEPA implementing regulations in the *Code of Federal*
29 *Regulations* at 40 CFR Parts 1500–1508. In this GTCC EIS, DOE analyzed a
30 range of disposal methods (i.e., geologic repository, near-surface trench,
31 intermediate-depth borehole, and above-grade vault) and federally owned sites
32 (i.e., Hanford Site, INL Site, LANL, NNSS, SRS, and the WIPP Vicinity, for
33 which two reference locations – one within and one outside the WIPP LWB –
34 were considered). DOE has determined that it was reasonable to analyze these
35 six sites because they currently have operating radioactive waste disposal
36 facilities, except for the WIPP Vicinity, which is near an operating geologic
37 repository and has basic infrastructure to support the facility.

- 38
39 2. *Disposal of GTCC LLRW and GTCC-Like Waste at WIPP – Commenters*
40 *were opposed to the possible use of WIPP for disposal of GTCC LLRW and*
41 *GTCC-like waste based on legal and technical considerations.*

42
43 DOE acknowledges that only defense-generated TRU waste is currently
44 authorized for disposal at the WIPP geologic repository under the WIPP LWA
45 as amended (P.L. 102-579 as amended by P.L. 104-201), and that legislation
46 would be required to allow disposal of waste other than TRU waste generated

1 by atomic energy defense activities at WIPP and/or for siting a new facility
2 within the land withdrawal area. It would also be necessary to revise the
3 *Agreement for Consultation and Cooperation between Department of Energy*
4 *and the State of New Mexico for the Waste Isolation Pilot Plant*, the WIPP
5 compliance certification with EPA, and the WIPP Hazardous Waste Facility
6 Permit. In addition, follow-on NEPA project-specific review, including
7 further characterization of the waste (e.g., radionuclide inventory and heat
8 loads) as well as the proposed packaging for disposal would have to be
9 conducted. The WIPP has been certified by the EPA as an acceptable facility
10 for the disposal of defense-generated TRU waste. The physical and chemical
11 characteristics of the GTCC LLRW and GTCC-like waste proposed for
12 disposal in the WIPP repository are comparable to the TRU wastes currently
13 being disposed of in the repository. Based on the GTCC EIS evaluation,
14 disposal of GTCC LLRW and GTCC-like waste at WIPP would result in
15 minimal environmental impacts on all resource areas evaluated, including
16 human health and transportation.

- 17
18 3. *Consideration of Other Alternatives Not Evaluated in Detail in the EIS*
19 *Including Use of HOSS, the Proposed Yucca Mountain Repository, a New*
20 *Geologic Repository, and Other Disposal Methods (e.g., Mined Cavities) and*
21 *Alternatives (e.g., Treatment of Waste and Alternative Sources of Energy) –*
22 *Some commenters requested that the EIS include HOSS as a reasonable*
23 *alternative for managing all or a portion of the GTCC LLRW and GTCC-like*
24 *waste inventory, and others indicated that the best approach for disposal of*
25 *GTCC LLRW and GTCC-like wastes would be to dispose of the entire*
26 *inventory in a new geologic repository.*

27
28 The use of HOSS and other approaches for long-term storage of GTCC
29 LLRW and GTCC-like wastes are outside the scope of this EIS because they
30 do not meet the purpose and need for agency action. Consistent with
31 Congressional direction in Section 631 of the Energy Policy Act of 2005
32 (P.L. 109-58), DOE plans to complete an EIS and a ROD for a permanent
33 disposal facility for this waste, not for long-term storage options. The action
34 alternatives evaluated in the GTCC EIS also did not include interim storage of
35 GTCC LLRW and GTCC-like waste until a geologic repository for spent
36 nuclear fuel and high-level radioactive waste becomes available because such
37 interim storage is outside the scope of the GTCC EIS. The purpose of the
38 GTCC EIS is to evaluate the range of reasonable alternatives for the safe and
39 secure disposal of GTCC LLRW and GTCC-like wastes.

- 40
41 4. *NEPA Process and Procedures – The Draft EIS does not comply with NEPA*
42 *because it did not identify a preferred alternative and because sufficient*
43 *opportunity for public comment was not provided. Many commenters*
44 *suggested that DOE do a better job of getting the word out about the EIS and*
45 *the public hearings.*
46

1 DOE believes that this EIS complies with NEPA. NEPA implementing
2 regulations, 40 CFR 1502.14(e), do not require a preferred alternative to be
3 included in a Draft EIS if an agency does not have one. DOE's notification
4 about the public hearings followed normal practices, with advance notice in
5 the Federal Register and notices in local media. DOE held nine public
6 hearings during the 120-day public comment period on the Draft GTCC EIS
7 which extended from February 25, 2011 through June 27, 2011 – a length of
8 time substantially longer than the 45-day minimum Council on Environmental
9 Quality requirement for public comment on a Draft EIS (40 CFR
10 Part 1506.10 (c)).
11

- 12 5. *Tribal and Cultural Resources Concerns – The EIS should consider American*
13 *Indian tribal concerns. Comments including those from the Santa Clara*
14 *Pueblo, the Pueblo de San Ildefonso, and the Confederated Tribes and Bands*
15 *of the Yakama Nation, raised several concerns that DOE proposals rely on*
16 *institutional controls.*
17

18 DOE appreciates the input provided by the Santa Clara Pueblo, the Pueblo de
19 San Ildefonso, and the Confederated Tribes and Bands of the Yakama Nation
20 on the EIS, both in the tribal narratives and in comments on the Draft EIS.
21 This input was considered by DOE in identifying a preferred alternative. DOE
22 initiated government-to-government consultations with potentially affected
23 American Indian tribes in a timely manner consistent with DOE Order 144.1.
24 These consultations were done at a time that DOE had compiled and
25 developed adequate information for the Draft EIS (including identification of
26 the GTCC LLRW and GTCC-like waste inventory) to allow for an informed
27 consultation with potentially affected American Indian tribes. In the EIS, it
28 was assumed that institutional controls of the land disposal units would be
29 maintained for 100 years and that corrective measures could be implemented
30 during this time period to ensure that the engineered barriers lasted for at least
31 500 years. This assumption is consistent with the institutional control time
32 frame given in both NRC and DOE requirements and was determined to be a
33 reasonable approach for assessing the long-term performance of the disposal
34 units in the EIS.
35

- 36 6. *Transportation Analysis and Impacts – Radioactive waste that has been*
37 *generated off-site should not be transported to the sites evaluated for disposal*
38 *and for which the EIS does not identify specific routes or the proportion of*
39 *wastes that would likely travel those routes. Commenters said that the*
40 *transportation analysis should consider larger-volume packages and that the*
41 *supporting information for the facility and transportation accident analyses*
42 *should have been available.*
43

44 Transportation of GTCC LLRW and GTCC-like waste from generating
45 facilities to a GTCC LLRW disposal facility is a required component of the
46 disposal process that would be identified for the GTCC LLRW and GTCC-

1 like waste because the disposal site(s) or location(s) would not be the same as
2 the generator sites as stated in the EIS. Based on the analysis conducted for
3 this EIS, the transportation of GTCC LLRW and GTCC-like waste to a
4 centralized disposal facility or facilities would result in lower overall human
5 health risks compared to the No Action Alternative and can be conducted in a
6 safe manner based in compliance with federal and state comprehensive
7 regulatory requirements. The primary radiological transportation risk to the
8 public for any alternative is from the low level of radiation emanating from
9 the transport vehicle. The EIS shows that such risks are small. The magnitude
10 of the collective population risk is primarily determined by the number of
11 routes, the length of each route, the number of shipments along each route, the
12 external dose rate of each shipment, and the population density along a given
13 route. The primary differences among alternatives from the standpoint of
14 transportation are the lengths of the routes as determined by the location of the
15 disposal sites (destination of the shipments). Thus, higher collective
16 population risks are associated with alternatives that require transportation
17 over longer distances. All alternatives involve routes that have similar
18 characteristics, with no significant differences for comparison among
19 alternatives; all require transportation through a range of rural and urban
20 areas. In addition, the routes used in the analysis are considered representative
21 routes because the actual routes used would be determined in the future. For
22 each disposal site, the routes most affected would be the interstate highways
23 that are closest to the site. The transportation analysis as presented in the EIS
24 is conservative in that consideration of the larger volume TRUPACT III and
25 spent nuclear fuel casks could result in potentially reduced impact estimates
26 than those presented due to fewer required shipments. However, while these
27 packages are viable options for transport of the GTCC LLRW and GTCC-like
28 waste, consideration of their use as an option in the EIS did not influence the
29 identification of the preferred alternative.
30

- 31 7. *Model Assumptions for Post-Closure Human Health Impacts – Commenters*
32 *indicated a number of issues associated with the long-term modeling in the*
33 *EIS, such as conceptual designs that were too generic, assumptions about*
34 *uniform environmental conditions, and other unsupported assumptions.*
35

36 The EIS analyses are based on conceptual engineering information and
37 necessitated the use of a number of simplifying assumptions. This approach is
38 consistent with NEPA, which requires such analyses to be made early in the
39 decision-making process. The various land disposal conceptual designs were
40 assumed to be constructed and operated in a comparable manner at each of the
41 various sites. In performing these evaluations, a number of engineering
42 measures were included in the conceptual facility designs to minimize the
43 likelihood of contaminant migration from the disposal units. No facility
44 design can guarantee that radionuclide migration from the facility would not
45 occur over and beyond a 10,000-year time period. It was assumed that these
46 measures would perform similarly for all conceptual designs, remaining intact

1 for 500 years after the disposal facility closed. After 500 years, the barriers
2 would gradually fail. It should be emphasized that project- and site-specific
3 engineering factors would be incorporated into the actual facility designs of
4 the site or sites selected in the ROD to dispose of GTCC LLRW and GTCC-
5 like waste. DOE recognizes that modeling potential releases of radionuclides
6 from the conceptual disposal sites far into the future approximates what might
7 actually occur and is therefore subject to technical uncertainty.
8

- 9 8. *Waste Inventory – The GTCC LLRW and GTCC-like waste inventory*
10 *addressed in the EIS is much too limited.*
11

12 The GTCC LLRW and GTCC-like waste inventory evaluated in the Draft EIS
13 included all GTCC LLRW and GTCC-like waste in storage as of 2008, plus
14 GTCC LLRW and GTCC-like waste including buried wastes at the West
15 Valley site, as well as wastes that could reasonably be expected to be
16 generated in the near future. For the purposes of this analysis, waste disposal
17 is assumed to occur from 2019 through 2083. The GTCC LLRW and GTCC-
18 like waste inventory includes stored and projected wastes from the
19 104 nuclear power plants currently in operation as well as from the
20 18 commercial reactors that have already been shut down. It also includes
21 projected GTCC LLRW from another planned 33 new reactors that have not
22 yet been constructed. It is not reasonable to extend data beyond existing
23 information on the commercial nuclear power industry to develop estimates of
24 GTCC LLRW that could result from future decommissioning of these
25 reactors, some of which may never be built. In addition, it is possible that new
26 reactor technology could change the projected volumes of GTCC LLRW. In
27 performing its due diligence in the preparation of this final EIS, DOE
28 determined the GTCC LLRW and the GTCC-like waste inventory estimates
29 used in the EIS to be conservative and bounding. This inventory remains valid
30 and is appropriate for use in the EIS and for the development of the preferred
31 alternative for disposal of GTCC LLRW and GTCC-like waste.
32

- 33 9. *Cumulative Impacts – Commenters suggested that the environmental impacts*
34 *of all potential sources of radioactive contamination at the site, in addition to*
35 *the impacts associated with transportation of the GTCC LLRW and GTCC-*
36 *like waste to the Hanford Site, need to be addressed in the cumulative impacts*
37 *analyses presented in this EIS.*
38

39 DOE has analyzed cumulative impacts at the Hanford Site in this GTCC EIS
40 and indicates that the disposal of GTCC LLRW and GTCC-like waste at the
41 Hanford Site could result in a radiation dose estimate to a nearby hypothetical
42 future resident farmer of about 49 mrem/yr within the first 10,000 years, and
43 most of this dose would be due to I-129 or Tc-99 in groundwater. Based on
44 the cumulative impacts discussed in the Hanford TC&WM EIS (DOE 2012),
45 when the impacts of Tc-99 from past leaks and cribs and trenches (ditches) are
46 combined, DOE believes it may not be prudent to add significant additional

1 Tc-99 to the existing environment. Therefore, one means of mitigating this
2 impact would be for DOE to limit disposal of off-site waste streams
3 containing these radionuclides at the Hanford Site.
4

- 5 10. *Statutory/Regulatory and Policy Issues – Commenters indicated that any*
6 *facility used for the disposal of GTCC LLRW and GTCC-like waste will have*
7 *to be licensed by the NRC as provided in Section 3(b)(1)(D) of the LLRWPA,*
8 *and, as such, disposal criteria would need to be established. Commenters*
9 *suggested that since GTCC LLRW is commercially generated radioactive*
10 *waste, it should be disposed of at a commercial site and not at one or more*
11 *DOE sites. Commenters also questioned how the requirement for NRC*
12 *licensing of a GTCC LLRW disposal facility would be done if this facility was*
13 *located at a DOE site, especially if such a facility was used for commercial*
14 *GTCC LLRW and GTCC-like waste. Commenters suggested that the NRC*
15 *should have been a more active participant in this process to ensure that the*
16 *proposed alternatives could actually be implemented.*
17

18 DOE determined that the most efficient approach was to address both GTCC
19 LLRW and GTCC-like waste, which have many similar physical and
20 radioactive characteristics, in a single NEPA process. DOE's intent is to
21 facilitate the overall process for addressing the disposal needs of both waste
22 types.
23

24 The LLRWPA (P.L. 109-58) specifies that GTCC LLRW, designated a
25 federal responsibility under section 3(b)(1)(D) that results from activities
26 licensed by the NRC, is to be disposed of in an NRC-licensed facility that has
27 been determined to be adequate to protect public health and safety. However,
28 unless specifically provided by law, the NRC does not have authority to
29 license and regulate facilities operated by or on behalf of DOE. Further, the
30 LLRWPA does not limit DOE to using only non-DOE facilities or sites for
31 GTCC LLRW disposal. Accordingly, if DOE selects facility operated by or on
32 behalf of DOE for disposal of GTCC LLRW for which it is responsible under
33 section 3(b)(1)(D), clarification from Congress would be needed to determine
34 NRC's role in licensing such a facility and related issues. In addition,
35 clarification from Congress may be needed on NRC's role if DOE selects a
36 commercial GTCC LLRW disposal facility licensed by an Agreement State
37 rather than by NRC.
38

39 The NRC served as a commenting agency on the GTCC EIS and therefore did
40 not actively participate in the preparation of the GTCC EIS. Issues associated
41 with potential regulatory changes or NRC licensing would be addressed as
42 necessary to enable implementation.
43
44

1 S.7 WHAT DID DOE CONSIDER IN DEVELOPING THE PREFERRED 2 ALTERNATIVE? 3

4 DOE is selecting a combination of alternatives as the preferred alternative identified in
5 the Final GTCC EIS and discussed in Section S.8 of this summary. DOE's preferred alternative
6 would fulfill DOE's statutory mission and responsibilities and considers (1) comments received
7 on the Draft GTCC EIS from the public; (2) DOE and NRC requirements for the disposal of
8 LLRW, such as those as found in 10 CFR Part 61 and DOE Order 435.1, Radioactive Waste
9 Management; and (3) environmental, technical, economic and other findings presented in the
10 GTCC EIS.

11
12 The following text summarizes key considerations related to the alternatives analyzed in
13 the EIS. In addition to public comments, these considerations include waste type characteristics,
14 disposal method considerations, and disposal location considerations.

15 16 17 S.7.1 Public Comments 18

19 DOE has considered all comments received on the Draft EIS in identifying the preferred
20 alternative presented in the Final GTCC EIS. See Section S.6 for additional information
21 regarding the public involvement process for the GTCC EIS. The Draft GTCC EIS considered
22 the public scoping comments on the NOI that were received, and it evaluated the conceptual
23 designs for enhanced land disposal methods as alternatives to the deep geologic disposal method,
24 which the NRC currently considers to be an acceptable method for disposing of GTCC LLRW.
25 A summary of the public comments on the Draft GTCC EIS is in the Final GTCC EIS, and a
26 synopsis of that summary is presented in Section S.8 of this summary.
27
28

29 S.7.2 Waste Type Characteristics 30

31 The three types of GTCC LLRW and GTCC-like waste (activated metals, sealed sources,
32 and Other Waste) addressed in the EIS come from different sources and have different physical,
33 chemical, and radiological characteristics. In addition, some waste types differ in terms of their
34 availability for disposal at specific times. Thus, it might be appropriate to use different disposal
35 methods for different waste types. Key factors related to the three GTCC LLRW and GTCC-like
36 waste types that might determine whether one disposal method would be more appropriate than
37 another include the following:
38

- 39 • *Radionuclide inventory.* The GTCC LLRW and GTCC-like waste include a
40 wide range of radionuclides. Sealed sources generally consist of one (or
41 possibly a few) radionuclides, whereas activated metal waste and the Other
42 Waste type contain a larger number of radionuclides. Some of these
43 radionuclides (such as strontium-90 [Sr-90] and Cs-137) have relatively short
44 half-lives of about 30 years, whereas others (such as Pu-239) have half-lives
45 of more than 10,000 years. Both the total inventory and mix of radionuclides
46 are important to consider when selecting (an) appropriate disposal method(s)
47 for a particular waste type.
48

1 A number of TRU radionuclides decay to radioactive progeny, and the
2 presence of these in-growth radionuclides needs to be addressed. Also, some
3 radionuclides emit significant amounts of gamma radiation (such as Co-60
4 and Cs-137), whereas others emit very little or no such radiation. The
5 activated metals are expected to have the highest gamma exposure rates of the
6 three waste types, and the sealed sources are expected to have the lowest
7 exposure rates. The Other Waste is divided into CH and RH wastes, because
8 some of the Other Waste could contain significant concentrations of fission
9 products and neutron activation products that could decay and release
10 significant amounts of gamma radiation, whereas others might have very little
11 of these radionuclides.

12
13 The concentrations of long-lived radionuclides in waste determine how long it
14 will remain hazardous. Many of the GTCC-like wastes have long-lived TRU
15 radionuclides, and so they will remain hazardous for many thousands of years.
16 Similar wastes are currently being disposed of in a geologic repository
17 (WIPP) because of this concern. Also, the relative mobility of the
18 radionuclides in groundwater systems varies widely; some radionuclides (such
19 as Tc-99 and I-129) are quite mobile, while radioactive metals tend to bind
20 with the soil particles and move more slowly in the environment.

- 21
22 • *Waste form stability.* While all of the GTCC LLRW and GTCC-like waste are
23 solids, some are much more durable than others. It is assumed that activated
24 metal wastes would retain their integrity for very long periods, while the
25 Other Waste would be stabilized in a grout matrix to ensure the integrity of its
26 waste form. Sealed sources are also very robust and are expected to retain
27 their form for long time periods. Waste form stability influences the longevity
28 of a disposal facility, with forms that could degrade more quickly being a
29 long-term concern.
- 30
31 • *Size.* Some GTCC activated metal wastes are large metallic items that can be
32 disposed of more readily in a near-surface trench or vault than in a borehole or
33 geologic repository (WIPP). Use of boreholes or a geologic repository might
34 require more waste handling to make the physical size of the waste
35 manageable than use of trenches or vaults and could result in greater worker
36 doses.
- 37
38 • *Availability for disposal.* While some GTCC LLRW and GTCC-like waste are
39 currently in storage and available for disposal, much of the GTCC LLRW and
40 GTCC-like waste will not be generated for several decades (see Figure S-6).
41 The activated metal wastes are mainly associated with commercial nuclear
42 power plants, and most of them are expected to operate for 20 years or more.
43 Excess or unwanted radioactive sealed sources represent a national security
44 concern, so their disposal is a high priority.
- 45

46 On the basis of these factors, it is important to take into account the characteristics of a
47 specific waste type with the site and disposal method under consideration to ensure the timely,

1 cost-effective, and safe disposal of GTCC LLRW and GTCC-like waste. Sealed sources (which
 2 are generally small and durable) might be good candidates for borehole disposal, whereas other
 3 large wastes (such as activated metal wastes) might be better suited for trenches and vaults.
 4 Many of the sealed sources recovered by the DOE GMS/OSRP for national security or public
 5 health and safety purposes meet the criteria for disposal at existing DOE facilities (when
 6 GMS/OSRP recovers sealed sources, DOE typically takes ownership of the sources and may
 7 dispose of them at DOE facilities if they meet waste acceptance criteria for such facilities). The
 8 long-term hazards associated with GTCC LLRW and GTCC-like waste might preclude the use
 9 of certain disposal sites and methods, especially those that could result in groundwater
 10 contamination.

13 S.7.3 Disposal Methods

15 Key factors considered in identifying a
 16 preferred disposal method for GTCC LLRW
 17 and GTCC-like waste include (1) protecting the
 18 inadvertent human intruder, (2) leveraging
 19 operational experience, (3) minimizing
 20 institutional controls, and (4) achieving cost-
 21 effective disposal. Each of these factors is
 22 discussed here.

25 S.7.3.1 Inadvertent Human Intrusion

27 An inadvertent intruder is a person who
 28 might occupy the disposal site after closure and
 29 engage in normal activities, such as agricultural activities or the construction of buildings, or
 30 other pursuits in which the person might be unknowingly exposed to radiation from the waste
 31 (10 CFR 61.2). Human intrusion impacts might be mitigated by the waste form and packaging,
 32 institutional controls, and engineered and natural barriers (e.g., grouting and depth of disposal).
 33 All four disposal methods analyzed in this EIS include a combination of some or all these
 34 mitigation features.

37 S.7.3.2 Construction and Operational Experience

39 All four disposal methods have been used to some degree in the United States or other
 40 countries to dispose of radioactive waste similar to the three waste types analyzed in the GTCC
 41 EIS.

- 43 • *Deep geologic disposal.* The DOE WIPP facility is currently the only
 44 operating deep geologic repository in the United States. Since it began
 45 operations in 1999, the facility has successfully received more than 64,000 m³
 46 (2,300,000 ft³) of CH and RH TRU waste generated by DOE atomic energy

Disposal Method Considerations

Factor	Criterion
Inadvertent human intrusion	Favors methods that minimize the potential for inadvertent human intrusion
Construction and operational experience	Favors methods that have been successfully used in the past to manage similar wastes
Post-closure care	Favors methods that minimize the potential need for long-term maintenance after the facility has closed
Cost	Favors methods that result in cost-effective waste disposal

1 defense activities. This waste includes radioactive sealed sources, debris, and
2 other waste similar to GTCC LLRW and GTCC-like waste. Most of the
3 GTCC-like waste is similar to waste currently being disposed of at WIPP,
4 except that it may not be authorized for disposal at WIPP under the WIPP
5 LWA as amended (P.L. 102-579 as amended by P.L. 104-201).
6

- 7 • *Boreholes.* DOE demonstrated the use of borehole facilities to dispose of
8 radioactive waste at NNSS (formerly NTS), which operated from 1984
9 through 1989 and received DOE waste similar to GTCC LLRW. Borehole
10 disposal is receiving increased attention from the International Atomic Energy
11 Agency as an option for disposal of disused sealed sources. Currently, there
12 are no NRC-licensed borehole facilities in the United States. The advantages
13 of the borehole method are as follows: (1) it may be amenable to receiving
14 intermittent or low-volume waste like GTCC LLRW and GTCC-like waste;
15 (2) it is visually unobtrusive; (3) it has the potential for robust long-term
16 isolation of wastes; and (4) no workers need to enter the disposal borehole,
17 which thereby minimizes worker hazards. Boreholes also provide the greatest
18 amount of natural shielding (the surrounding soil) of any of the three land
19 disposal methods. A disadvantage of the borehole method is the low volume
20 capacity of the borehole and the much higher volume of unused space
21 surrounding each borehole. Consequently, a very large number of boreholes
22 (approximately 930 boreholes) would be required to manage the entire GTCC
23 LLRW and GTCC-like waste volume. As mentioned above, the technology
24 might be better suited to specific waste types (e.g., sealed sources), for which
25 fewer boreholes would be required. Also, use of boreholes may be limited by
26 underground injection control regulations or other requirements, such as the
27 Safe Drinking Water Act.
28

- 29 • *Trenches.* Trenches are used for the disposal of LLRW in the United States
30 and at a number of sites around the world. Commercial facilities dispose of
31 Class A, B, and C LLRW in trenches and vaults. In addition, DOE uses
32 trenches to dispose of its LLRW, including LLRW comparable to GTCC
33 LLRW (e.g., Sr-90 radioisotope thermoelectric generators) on the basis of
34 performance assessment analyses (systematic analyses of the potential risks
35 posed by waste management systems). SRS currently disposes of large
36 equipment (e.g., large cesium sources and other LLRW) in trenches by using
37 the components-in-grout technique. This technique allows large equipment to
38 be disposed of in trenches, and the waste form is surrounded with grout on all
39 sides (bottom, sides, top). This approach will limit future subsidence and the
40 release of radionuclides. The conceptual design for the trench that is evaluated
41 in the GTCC EIS employs a deeper (11-m or 35-ft deep) and narrower (3-m or
42 10-ft wide) design than conventional belowground, near-surface radioactive
43 waste disposal facilities in order to protect the facility from inadvertent human
44 intrusion. Potential operational advantages of the trench include (1) its visual
45 unobtrusiveness, (2) its ease of construction, and (3) the relative ease with
46 which the wastes can be disposed of. Potential disadvantages include (1) the

1 increased possibility of exposing workers to radiation hazards (i.e., more than
2 that presented by boreholes), unless temporary covers or shields would be
3 used, and (2) the possibility that this method might provide less protection
4 from future intrusion into the wastes, as compared to boreholes and deep
5 geologic disposal.

- 6
7 • *Vaults.* Vaults similar to the design presented in the GTCC EIS have been
8 operated by DOE at SRS and other DOE facilities for the disposal of LLRW.
9 This disposal method is more commonly used in humid environments, where
10 belowground disposal methods might be limited by shallow groundwater. The
11 conceptual design for the vault includes thick reinforced concrete walls,
12 floors, and ceilings. To further isolate the waste, an engineered cover system
13 is included in the design. Potential advantages of the vault include these: (1) it
14 can be inspected visually and be more easily monitored than the other
15 alternative land disposal methods; (2) because of its high visibility,
16 inadvertent human intrusion is unlikely; and (3) it does not rely on waste
17 packages for structural support (i.e., structural support is provided by the
18 concrete cells). Potential disadvantages include these: (1) its active
19 maintenance requirements (including active institutional controls) are likely to
20 be more extensive than those of the other methods because of its visibility and
21 exposure to the elements; (2) the costs to construct and operate it are higher
22 than those of the other alternative land disposal methods; (3) it has a higher
23 potential for exposing workers to radiation hazards than the other land
24 disposal methods, unless temporary shielding or waste covers are used; and
25 (4) it could attract intentional intruders because of its visibility.
26
27

28 **S.7.3.3 Post-Closure Care Requirements**

29
30 Some disposal methods might need to rely more on post-closure care than others.
31 Because an above-grade vault is exposed to the elements, it might require more active
32 institutional controls than the trench, borehole, and deep geologic disposal methods, extending to
33 times beyond the period of active institutional control normally considered when evaluating the
34 safety of waste management facilities. If post-closure care is not maintained, vaults could pose a
35 greater potential for radiological exposures to the public. Consequently, maintenance of active
36 institutional controls is considered particularly important for this technology to achieve post-
37 closure safety. Long term post-closure care requirements for the trench, borehole, and deep
38 geologic methods should be less.
39
40

41 **S.7.3.4 Construction and Operating Costs**

42
43 The estimated cost to construct and operate a GTCC LLRW and GTCC-like waste
44 disposal facility ranges from \$250 million for disposal at a new trench facility to \$570 million for
45 disposal at the WIPP geologic repository, as shown in Table S-5. The cost estimates for each
46 disposal method are based on the assumption that all GTCC LLRW and GTCC-like waste would

TABLE S-5 Costs of GTCC LLRW and GTCC-Like Waste Disposal Alternatives^a

Disposal Method	Cost to Construct Facility (in millions of \$) ^b	Cost to Operate Facility (in millions of \$) ^c	Total Cost to Construct and Operate Facility (in millions of \$)
WIPP	14	560	570
Borehole	210	120	330
Trench	88	160	250
Vault	360	160	520

- ^a Costs are rounded to two significant figures.
- ^b Construction costs for the WIPP facility are for 26 new rooms. Construction costs for the borehole, trench, and vault disposal facilities are for 930 boreholes, 29 trenches, and 12 vaults (consisting of 130 total vault cells), respectively, and the supporting infrastructure.
- ^c The operational cost for WIPP is based on the actual per-shipment cost for fiscal year 2008. Operational costs assume 20 years of facility operations for the borehole, trench, and vault disposal methods. On the basis of the assumed receipt rates, the majority of the wastes would be available for emplacement during the first 15 years of operations. The actual start date for operations is uncertain at this time and dependent upon, among other things, the alternative or alternatives selected, additional NEPA review as required, characterization studies, and other actions necessary to initiate and complete construction and operation of a GTCC LLRW and GTCC-like waste disposal facility. For purposes of analysis in the GTCC EIS, DOE assumed a start date of disposal operations in 2019. However, given these uncertainties, the actual start date could vary.

1
2
3
4
5
6
7
8
9

be disposed of by that method, although different combinations of disposal methods could be used for the different waste types. Costs for facility permits, licenses, transportation, packaging, and post-closure activities are not included in the estimates.

S.7.4 Disposal Location Considerations

The GTCC EIS evaluates six federal locations for the potential disposal of GTCC LLRW and GTCC-like waste, of which one is in a humid environment (SRS) and five are in semi-arid or arid environments (Hanford, INL, LANL, NNSS, WIPP/WIPP Vicinity). In addition, the GTCC EIS evaluates generic commercial locations in four regions of the United States. On the basis of the results presented in the GTCC EIS, key factors to be

Disposal Location Considerations	
Factor	Criterion
Human health risk	Favors alternatives that reduce human health risk to both workers and the public.
Cultural resources	Favors alternatives that avoid adverse impacts to known cultural sites.
Laws, regulations, and other requirements	Favors alternatives that would not be inconsistent with current laws and other requirements.

1 considered in identifying a preferred disposal location for GTCC LLRW are potential human
2 health risks for the post-closure long-term phase (including potential cumulative human health
3 impacts from the post-closure phase); cultural resources and tribal concerns; and existing laws,
4 regulations, and other requirements.

7 S.7.4.1 Human Health Impacts

9 Potential human health impacts include (1) potential exposure of workers and the general
10 public to radiation during routine conditions and accidents and (2) direct impacts on workers and
11 the public from industrial and transportation accidents. All potential impacts were considered in
12 developing the preferred alternative. A primary consideration is the potential long-term (post-
13 closure) impacts on members of the general public who might be exposed to radioactive
14 contaminants released from the waste packages that are transported in groundwater and migrate
15 to an accessible location, such as a groundwater well. Consequently, potential cumulative long-
16 term human health impacts at each of the sites evaluated would likewise be of primary
17 consideration. For example, the long-term doses and LCF risks estimated for the GTCC
18 proposed action for the Hanford Site should be considered relative to the findings presented in
19 the *Final Tank Closure and Waste Management Environmental Impact Statement for the*
20 *Hanford Site, Richland, Washington* (TC&WM EIS) (DOE 2012). According to the TC&WM
21 EIS, receipt of off-site waste streams that contain specific amounts of certain isotopes,
22 specifically I-129 and Tc-99, could cause an adverse impact on the environment. The Tc-99
23 inventory from off-site waste streams evaluated in the TC&WM EIS shows potential impacts
24 that are less significant than those of I-129. However, when the impacts of Tc-99 from past leaks
25 and cribs and trenches (ditches) are combined, DOE believes it may not be prudent to add
26 significant additional Tc-99 to the existing environment. Therefore, one means of mitigating this
27 impact would be for DOE to limit disposal of off-site waste streams containing I-129 or Tc-99
28 at Hanford.

30 With regard to transportation impacts, the optimal location would be one that is close to
31 the waste-generating sources. This location would minimize the overall transportation distance
32 and would have the lowest potential impacts on human health. However, most of the waste
33 generators are located in the eastern half of the United States, and these areas have more humid
34 climates than do sites in the western part of the country. The more humid sites (SRS and generic
35 Regions I and II) were shown to generally have greater long-term impacts from the groundwater
36 pathway, and this concern is a major consideration in identifying an acceptable location for a
37 GTCC LLRW and GTCC-like waste disposal facility. This does not mean that a site in a humid
38 region could not be used for such a facility. Rather, a facility in a humid environment would
39 have to rely more on engineering measures and institutional controls to ensure that the long-term
40 hazards were maintained at acceptable levels.

43 S.7.4.2 Cultural Resources and Tribal Concerns

45 Cultural resources include, among other things, definitive locations of traditional cultural
46 or religious importance to specified social or cultural groups, such as American Indian tribes

1 (“traditional cultural properties”). DOE consulted with participating tribes who have cultural or
2 historical ties to DOE sites being analyzed in the GTCC EIS. Tribal perspectives, comments, and
3 concerns (e.g., environmental justice issues) identified during the consultation process were
4 considered by DOE in selecting disposal alternative(s) for analysis in this EIS. DOE will
5 continue to consult the tribes throughout the implementation of the disposal.

6 7 8 **S.7.4.3 Laws, Regulations, and Other Requirements**

9
10 A number of laws, regulations, and requirements (including state permits) apply to the
11 disposal alternatives considered in the GTCC EIS. These include requirements that generally
12 apply to all proposed disposal locations as well as those that apply to a specific site (e.g., WIPP
13 LWA as amended [P.L. 102-579 as amended by P.L. 104-201] and other required state permits).
14 DOE considered all applicable laws, regulations, and other requirements in developing the
15 preferred alternative. In 10 CFR Part 61, “Licensing Requirements for Land Disposal of
16 Radioactive Waste,” the NRC classifies LLRW into four classes (Classes A, B, and C, and
17 GTCC LLRW) on the basis of the concentrations of short-lived and long-lived radionuclides
18 (10 CFR 61.55). By controlling isotope concentrations in each class, the NRC regulations seek to
19 control potential radiation exposures to future receptors, including inadvertent human intruders
20 (e.g., a water well driller) after the period of active institutional control has ended. The NRC
21 states in 10 CFR 61.7(b)(5) that GTCC LLRW is “generally unacceptable” for near-surface
22 disposal but also recognizes that “there may be some instances where waste with concentrations
23 greater than permitted for Class C waste would be acceptable for near-surface disposal with
24 special processing or design.”

25
26 The NRC regulations require GTCC LLRW to be disposed of in a geologic repository, as
27 defined in 10 CFR Part 60 or 63, unless proposals for an alternative method are approved by
28 NRC under 10 CFR 61.55(a)(2)(iv). The NRC regulations identify one approved method for the
29 disposal of GTCC LLRW and GTCC-like waste (a geologic repository), but they acknowledge
30 that other disposal methods could be approved.

31
32 In addition to protecting individuals from inadvertent intrusion, the preferred disposal
33 alternative must protect the general population and involved workers from potential releases of
34 radioactivity during facility construction and disposal operations. Long-term impacts after
35 completion of the disposal operations and closure of the disposal facility also need to be
36 considered. DOE developed the preferred alternative by considering these aspects along with the
37 various other environmental resource areas discussed in this EIS. DOE structured the GTCC EIS
38 so that the preferred alternative could be identified on the basis of a waste type, site, and disposal
39 method. The preferred alternative is discussed in Section S.8 of this Summary.

40 41 42 **S.8 PREFERRED ALTERNATIVE IDENTIFIED**

43
44 In developing the preferred alternative for the disposal of GTCC LLRW and GTCC-like
45 wastes, DOE considered national security concerns, the projected timing of waste generation and
46 the potential long-term impacts on human health and the environment at the various disposal

1 locations evaluated in the GTCC EIS. DOE also took into consideration applicable laws and
2 requirements (e.g., WIPP LWA as amended [P.L. 102-579 as amended by P.L. 104-201], the
3 LLRWPA [P.L. 99-240]; other required state permits), costs, compliance with agreements,
4 public input on the Draft EIS, national and state priorities, and other appropriate information.
5

6 Given the diverse characteristics (e.g., different radionuclide inventories, range of
7 physical conditions, and derived from both commercial and DOE sources) of GTCC and GTCC-
8 like waste analyzed in this EIS, the preferred alternative selected is not limited to one disposal
9 technology. The preferred alternative for the disposal of GTCC and GTCC-like waste is the
10 WIPP geologic repository (Alternative 2) and/or land disposal at generic commercial facilities
11 (Alternatives 3-5). These land disposal conceptual designs could be altered or enhanced, as
12 necessary, to provide the optimal application at a given location. The preferred alternative does
13 not include land disposal at DOE sites. In addition, there is presently no preference among the
14 three land disposal technologies at the generic commercial sites. The factors considered during
15 the development of the preferred alternative include those discussed in Section S.7 and in the
16 GTCC EIS in Section 2.9: public comment provided on the draft GTCC EIS; disposal site
17 impacts including potential human health impacts, cultural resources and tribal concerns; waste
18 types impacts including radionuclide inventory and characteristics and availability for disposal;
19 and disposal method impacts including inadvertent human intrusion, construction and operation
20 and cost. The analysis in this Final GTCC EIS has provided the Department with the integrated
21 insight needed to identify a preferred alternative with the potential to enable the disposal of the
22 entire waste inventory analyzed in this EIS. Due to the uncertainty regarding the need for
23 legislative changes and/or licensing or permitting changes, further analysis will be needed before
24 a Record of Decision is announced. The Department has determined that the preferred alternative
25 would satisfy the needs of the Department for the disposal of GTCC and GTCC-like waste.
31

32 As required by NEPA, DOE will not issue a ROD sooner than 30 days after the issuance
33 of the Final EIS. Prior to issuing a ROD regarding which disposal alternative to implement, DOE
34 must submit a Report to Congress to fulfill the requirement of Section 631(b)(1)(B)(i) of the
35 Energy Policy Act of 2005 (P.L. 109-58) and await action by Congress. Section 631(b)(1)(B)(i)
36 requires that the report include all alternatives under consideration and all the information
37 required in the comprehensive report to ensure safe disposal of GTCC LLRW that was submitted
38 by the Secretary to Congress in February 1987.⁵
39
40

⁵ In accordance with the requirements in section 3(b)(3) the LLRWPA, the 1987 report
(http://www.gtceis.anl.gov/documents/docs/DOE_NE-0077.pdf) included: (1) an identification of the
radioactive waste involved, including the source of such waste, and the volume, concentration, and other relevant
characteristics of the waste; (2) an identification of the federal and non-federal options for disposal of the waste;
(3) a description of actions proposed to ensure the safe disposal of the waste; (4) a description of the projected
costs of undertaking such actions; (5) an identification of the options for ensuring that the beneficiaries of the
activities resulting in the generation of the waste bear all reasonable costs of disposing of such wastes; and (6) an
identification of any statutory authority required for disposal of the waste.

S.9 PRIMARY CHANGES MADE TO THE EIS

On the basis of the public comments received (as summarized in Section S.6.2), the primary change made to the Draft EIS to prepare the Final EIS was the addition of Appendix J, which provides a comment response summary that addresses the comments received on the Draft EIS as well as detailed responses to individual comments, in addition to the discussion of the preferred alternative for the disposal of GTCC LLRW and GTCC-like wastes, which is presented in Section S.8. In performing its due diligence in preparation of this Final EIS, DOE reviewed the waste quantity data and determined that the current expected waste quantity estimates remain valid, are conservative and bounding for the comparative analysis in the Final EIS, and revisions to this information are not necessary. Information that related to census data was also updated to reflect the 2010 census data for the Final EIS; including, for example, socioeconomic, transportation, and environmental justice impacts. The transportation accident analysis was reviewed, and the source terms used in the accident consequence assessment were included in the presentation of the analysis. Other revisions (for clarification or editorial purposes) were also made as a result of public comments received on the Draft GTCC EIS. Finally, site information was also updated on the basis of the further review conducted by DOE Field Offices and information from annual site environmental reports (for the year 2014).

S.10 REFERENCES

Argonne (Argonne National Laboratory), 2010, *Supplement to Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste Inventory Reports*, ANL/EVS/R-10/1, prepared by Argonne, Argonne, Ill., for U.S. Department of Energy, Office of Environmental Management, Oct.

DOE (U.S. Department of Energy), 2012, *Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington*, DOE/EIS-0391, Dec.

EPA (U.S. Environmental Protection Agency), 2000, *Estimated per Capita Water Ingestion in the United States, Based on Data Collected by the United States Department of Agriculture's 1994-1996 Continuing Survey of Food Intakes by Individuals*, EPA-822-R-00-008, Office of Water, April.

GAO (U.S. Government Accountability Office), 2003, *DOE Action Needed to Ensure Continued Recovery of Unwanted Sealed Radioactive Sources*, GAO-03-483, April.

INL (Idaho National Laboratory), 2011, *Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site*, DOE/EA-1793, Final, Dec.

Melillo, J.M., T.C. Richmond, and G.W. Yohe (editors), 2014, *Climate Change Impacts in the United States: The Third National Climate Assessment, U.S. Global Change Research Program*. Available at <http://nca2014.globalchange.gov/downloads>. Accessed May 6, 2014.

- 1 NCRP (National Council on Radiation Protection and Measurements), 2009, *Ionizing Radiation*
2 *Exposure of the Population of the United States*, NCRP Report No. 160, Bethesda, Md.
3
- 4 NRC (U.S. Nuclear Regulatory Commission), 2006, *The Radiation Source Protection and*
5 *Security Task Force Report*, submitted by the Chairman of the NRC on behalf of the Radiation
6 Source Protection and Security Task Force to the President and U.S. Congress, Aug. 15.
7
- 8 NRC, 2010, *The 2010 Radiation Source Protection and Security Task Force Report*, submitted
9 by the Chairman of the NRC on behalf of the Radiation Source Protection and Security Task
10 Force to the President and U.S. Congress, Aug. 11.
11
- 12 NRC, 2014, *The 2014 Radiation Source Protection and Security Task Force Report*, submitted
13 by the Chairman of the NRC on behalf of the Radiation Source Protection and Security Task
14 Force to the President and U.S. Congress, Aug. 14.
15
- 16 Sandia, 2008, *Basis Inventory for Greater-Than-Class-C Low-Level Radioactive Waste*
17 *Environmental Impact Statement Evaluations*, Task 3.2 Report, Rev. 1, prepared by Sandia,
18 Albuquerque, N.M., for U.S. Department of Energy, Office of Environmental Management,
19 May.
20
- 21 White House, 2004, "Government-to-Government Relationship with Tribal Governments,"
22 Memorandum for the Heads of Executive Departments and Agencies, press release, Sept. 23,
23 www.epa.gov/tribal/pdf/president-bush-2004/pdf. Accessed March 30, 2010.
24

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13

This page is intentionally left blank.

