Closure for the Seventh Generation

A report from the State and Tribal Government Working Group's Long-Term Stewardship Committee | **2017 Edition**

Appendix F | Compiled Site Surveys

STGWG
State and Tribal Government Working Group

NCSL

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This document contains 15 site survey responses included in the 2017 edition of the "Closure for the Seventh Generation" report. Staff at DOE field offices provided the initial responses to the survey questions, and staff from states and Native American tribes reviewed and provided additional information and revisions. Most survey responses were completed and reviewed between October 2016 and February 2017.

Visit www.ncsl.org/STGWG-LTS or contact NCSL staff at environment-info@ncsl.org for the complete 2017 edition and additional resources.

Canonsburg, Disposal Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Canonsburg Uranium Mill Tailings Radiation Control Act (UMTRCA), Pennsylvania, Site is owned by the U.S. Government. The remediated area is owned by the Commonwealth of Pennsylvania. The site is approximately 37 acres in area and located in a populated area, bordered by a stream and railroad tracks in a slight valley. The site is in western Pennsylvania, approximately 20 miles southwest of Pittsburgh.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

There are no federally recognized Indian tribes in Pennsylvania today.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.
Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

Between 1911 and 1957, the site first processed uranium ore for radium and then reprocessed uranium. The surrounding land is primarily residential and is moderately populated. Contamination occurred in the soils at the mill site and at vicinity properties where the tailings were used for construction purposes. Approximately 150 vicinity properties were impacted. Remedial actions to clean up the vicinity properties and the former mill site were completed in 1986.

The compliance strategy for groundwater cleanup at the Canonsburg site is no further remediation in conjunction with the applicable alternate concentration limits (ACLs) for uranium, the only remaining contaminant of concern for this site. The ACL for uranium in groundwater is 1.0 milligram per liter (mg/L), and the ACL for uranium in surface water is 0.01 mg/L. The most recent groundwater sampling results (2013) indicate that groundwater and surface water uranium concentrations remain well below site ACLs, resulting in no adverse impact to the point of exposures in Chartiers Creek. Groundwater uranium concentrations in a few monitoring wells remain above the maximum concentration limit of 0.044 mg/L.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

None.

e. Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).

The disposal cell contains 266,000 wet tons of tailings (mill tailings and other residues, contaminated soil, and building debris). The amount of radioactivity within the disposal cell is estimated to be 100 curies of radium-226.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

Cleanup complete.

i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).* N/A

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?* N/A

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).* N/A

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

Public Law (PL) 95-604, the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA), in accordance with standards promulgated by the U.S. Environmental Protection Agency in Title 40 *Code of Federal Regulations* (CFR) Part 192. Subpart B of 40 CFR 192 regulated cleanup of contaminated groundwater at the uranium-ore processing sites.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

There are no federally recognized Indian tribes in Pennsylvania today.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

The radioactive materials were encapsulated in a U.S. Nuclear Regulatory Commission (NRC) – approved disposal cell. The NRC general license for UMTRCA Title I sites is established in 10 CFR 40.27. The Canonsburg disposal site was included under the general license in 1996.

The groundwater compliance strategy for the Canonsburg site is “no remediation” and the application of an alternate concentration limit for uranium. The strategy includes groundwater monitoring and institutional controls. Results of groundwater modeling predict that concentrations of uranium in groundwater will decrease over time and will be below the standard within the 100-year time frame allowed in 40 CFR 192.

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) manages the site according to a Long-Term Surveillance and Maintenance Plan, which was reviewed and concurred with by NRC. LM conducts annual inspections, performs site maintenance, and monitors creek water and groundwater.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?

Final land use of the site is the disposal cell with a buffer zone. The site will be owned by the U.S. Government in perpetuity.

In accordance with 40 CFR 192.32, the disposal cell is designed to be effective for 1000 years, to the extent reasonably achievable, and, in any case, for at least 200 years.

b. Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.

The pentagon-shaped disposal cell occupies 6.8 acres in the eastern half of the site. It is a surface impoundment about 28-feet thick at the center. The bottom or “footprint” is about 8 feet below the previous surface of the ground. As built, the disposal cell appears as a knoll. The highest point, at the center, stands about 30 feet above surrounding grade. It is completely covered by a grass vegetative cover. The cell is lined with compacted clay to protect groundwater from contamination by radioactive materials. The cover is a multicomponent system designed to isolate the contaminated materials.

The DOE Office of Legacy Management manages the disposal site according to a site-specific Long-Term Surveillance Plan to ensure the disposal cell systems continue to prevent release of contaminants into the environment. Under provisions of this plan, LM conducts annual inspections of the site to evaluate the condition of surface features, mows the grass and controls other vegetation, performs other site maintenance as necessary, and monitors creek and groundwater to verify the continued integrity of the disposal cell and protection of public health and the environment.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

The site was evaluated and remediated according to UMTRCA regulations.

d. What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?

LM manages the disposal site according to a site-specific Long-Term Surveillance and Maintenance Plan in accordance with NRC requirements. LM conducts annual inspections, performs site maintenance, and monitors creek water and groundwater. The compliance strategy for groundwater includes groundwater monitoring and institutional controls.

LM has been successful in reducing the frequency of monitoring from annually to once every 5 years because of demonstrated and continued compliance with established site standards. Uranium concentrations monitored annually in the groundwater from all five wells from 1995 to 2010 were consistently less than approximately 0.35 mg/L and significantly below the NRC-approved ACL for uranium of 1.0 mg/L. The uranium concentrations of surface water in Chartiers Creek were below the target level of 0.01 mg/L for the same period of time. On July 16, 2012, NRC concurred that the frequency of monitoring could be reduced from annually to every 5 years.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

Sites remediated under UMTRCA are designed and constructed to last "for up to 1000 years, to the extent reasonably achievable, and, in any case for at least 200 years" [40 CFR 192, subpart A, 192.02(a)]. There is no termination of the general license for DOE's long-term custody of the site.

The DOE Office of Legacy Management manages the disposal site according to a site-specific Long-Term Surveillance Plan to ensure the disposal cell systems continue to prevent release of contaminants to the environment. Under provisions of this plan, LM conducts annual inspections of the site to evaluate the condition of surface features, mows the grass and controls other vegetation, performs other site maintenance as necessary, and monitors creek and groundwater to verify the continued integrity of the disposal cell and protection of public health and the environment.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

The site is owned by the U.S. Government. The DOE Office of Legacy Management manages the disposal site according to a site-specific Long-Term Surveillance Plan to ensure that the disposal cell systems continue to prevent release of contaminants to the environment.

LM samples groundwater and surface water every 5 years at the Canonsburg site to comply with requirements in the Long-Term Surveillance Plan and the subsequent Ground Water Compliance Action Plan. The purpose of the monitoring is to evaluate contaminant trends within the unconsolidated materials underlying the disposal site and to ensure that site contaminants do not contaminate Chartiers Creek.

In addition, LM maintains a perpetual easement with the Borough of Canonsburg, Pennsylvania, for the purpose of flood protection of the stream back along Chartiers Creek.

Two parcels of land at the Canonsburg site (totaling 3.531 acres) have been successfully transferred to private ownership and placed into beneficial reuse. The property transfers include deed restrictions that are protective of health and the environment. The Commonwealth of Pennsylvania is responsible for institutional controls related to the enforcement of property restrictions that limit excavation in the area, prohibit disturbance of the bank of Chartiers Creek, maintain access for monitoring, and prohibit residential use. The property transfer also included provisions for LM to access two monitoring wells and one point of exposure along Chartiers Creek.

In accordance with PL 95-604 (UMTRCA), 90% of remedial action funding was provided by the federal government and 10% was provided by the Commonwealth of Pennsylvania. DOE requests funds on an annual basis for continuing long-term monitoring and surveillance.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the State and/or Tribe.*

No proposed funding or funding provisions outside of the normal provisions provided through the UMTRCA general licensing process.

Energy Technology Engineering Center

I. Site Background and Remediation Description

a. *Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.*

The Santa Susana Field Laboratory (SSFL) is located approximately 30 miles northwest of downtown Los Angeles in the hills between the San Fernando Valley and Simi Valley, CA. SSFL was established in 1947 for the development and testing of liquid propellant rocket engines. The SSFL is a former rocket engine test and nuclear research facility consisting of 2,850 acres, and is divided into four administrative areas and two buffer zones. The Boeing Company, NASA, and the Department of Energy (DOE) currently are responsible for the investigation and remediation of portions of SSFL. DOE conducted research into sodium cooled nuclear reactors and starting in the early 1960s, the Energy Technology Engineering Center (ETEC) was established as a center of excellence for liquid metals technology. All operations ceased in the 1980s. Unlike most DOE sites, DOE does not own any land at SSFL, but rather leased the land on which it did work. The Boeing Company owns the portion of the site where DOE did work. DOE is responsible for the cleanup of the 480 acres of Area IV and the 182 acres of the Northern Buffer Zone. SSFL is adjacent to the town of Simi Valley to the north and the San Fernando Valley to the east.

The topography within SSFL has a high degree of variability, which influences the plants and animals that may be present. In the majority of Area IV, the land is relatively flat with a few large sandstone outcrops in scattered locations, primarily in the northern part of the study area. The southwestern portions of Area IV encompass hills that continue off the SSFL to the west and south.

The Northern Buffer Zone is distinguished by very steep north-facing slopes and massive sandstone outcrops. The Northern Buffer Zone adjacent to and north of Area IV is characterized by steep, nearly barren sandstone outcrops that parallel the northern border of Area IV to the west, giving way to relatively dense chaparral on less rocky slopes toward the northeastern boundary of Area IV.

b. *Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?*

The Santa Ynez Chumash Band of the Mission Indians (the Santa Ynez Band) is the federally recognized tribe with the closest association to the SSFL site. The SSFL is located near the boundaries of the Chumash, Fernandeño Tataviam, and Gabrielino Tongva Native American ethnographic groups. Each of these tribes used the area for plant gathering and processing, hunting, and gathering, and ceremonial purposes. The Burro Flats Painted Cave is a cave located on the part of the site managed by NASA. The Burro Flats Cave is listed on the National Register of Historic Places. This cave is considered one of the most elaborate and probably the best preserved painted petroglyph in California. The Santa Ynez Band has designated all of the SSFL including the area where DOE did work as a Sacred Site and a Traditional Cultural Property.

c. *Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and*

quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.
Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

As part of the operations of a research and development site, structures were constantly used, cleaned, and refurbished for a new purpose or demolished. Cleanup activities have been ongoing since the 1960s. DOE decontaminated and demolished most of its structures and facilities in Area IV to the standards in effect at the time decommissioning occurred in accordance with its authority under the Atomic Energy Act of 1954, as amended. The major periods of building demolition were 1975 through 1977 and 1995 through 2005. By 1980, all reactor operations had ceased, and nuclear research at ETEC was terminated in 1988. DOE has removed all nuclear materials from the site. Also during this time period, DOE removed any contaminated soil or building materials impacted by radionuclides when it was discovered.

The results of an extensive characterization effort of more than 10,000 samples found that the most frequently observed chemical constituents were polychlorinated biphenyls (PCBs), PAHs, TPH, dioxins, and metals (antimony, cadmium, chromium VI, mercury, selenium, and silver). The most frequently observed radionuclide constituents are cesium-137 and strontium-90.

From 2009 to 2012, US Environmental Protection Agency (EPA) conducted a complete radiological characterization study. This study reported the findings of surface and subsurface soil sampling and produced a definitive characterization of radionuclides present in the area where DOE did work. The effort included a Historical Site Assessment of past operations and radiological releases to identify locations for soil sampling, a gamma radiation scan (also to identify areas for soil sampling), collection and radiological analysis of 3,487 soil and 55 sediment samples, and radiological characterization of groundwater and surface water. Of these samples, man-made radioactive materials equal to or exceeding background levels (levels found in soils near SSFL not affected by past activities there) were detected in 423 samples (12 percent). Said another way man-made radionuclides were not detected above background levels in more than 88 percent of the total number of samples.

Cesium-137 and Strontium-90 were the two site-related radionuclides most frequently observed in USEPA's samples. The EPA study found that Cesium-137 exceeded background in 291 samples and strontium-90 exceeded background in 153 samples. However, only 9 of those samples exceeded DOE's cleanup standards. The chemical sampling results found that polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs) dioxins, and metals (antimony, cadmium, chromium VI, mercury, selenium, and silver wastes) were the most frequently observed chemicals in soil.

Over the years, as a mission was completed, and there was not a need for the building, the buildings were decontaminated, decommissioned and demolished. Today on-site 18 numbered structures remain.

There is residual contamination remaining in the soil, groundwater, and in some buildings. In a draft environmental impact study (EIS), published on January 6, 2017, DOE presents alternatives for remediation of all media—soil, groundwater, and buildings. The *Draft SSFL Area IV EIS* analyzes the potential environmental impacts of alternatives for conducting cleanup activities in Area IV of the SSFL and the adjoining Northern Buffer Zone (NBZ), located in Ventura County, California. Remediation is needed to clean up residual chemicals and radionuclides from historical DOE operations at the Energy

Technology Engineering Center (ETEC) in Area IV, in compliance with regulations, orders, and agreements. The alternatives analyzed in this draft environmental impact statement (EIS) involve the disposition of remaining DOE facilities and support buildings, remediation of soil and groundwater, and disposal of all resulting waste at existing licensed or permitted facilities in a manner that is protective of the environment and the health and safety of the public and workers. DOE proposes three sets of alternatives. Each set was developed to address a component of the SSFL Area IV and NBZ cleanup effort: soil remediation, building demolition, and groundwater remediation. The decision for any future action will be made as part of the completion of the EIS process and will be stated in the Record of Decision.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

Groundwater pump and treat actions continued until 2004. Decontamination, decommissioning, and demolition of buildings continued until 2007, when the decision was made to complete the National Environmental Policy Act process prior to any further action.

e. Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).

There are no active radionuclide or chemical hazardous waste disposal sites on-site.

f. To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.

The Draft EIS analyzes a range of alternatives of soil cleanup. This range is between 148,000 (for soil exceeding human health risk-based criteria) to 933,000 cubic yards (for soil exceeding background); most of this soil is contaminated with chemicals with approximately 91,000 cubic yards of soil with low levels of radioactive constituents, primarily cesium and strontium. For groundwater, the Draft EIS analyzes active monitored natural attention and on-site pump and treatment for TCE& PCE plumes, and removing the source of strontium. The Draft EIS analyzes no action for building removal and the potential of removing all remaining 18 buildings.

i. Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).

Depending upon the final decision in the Record of Decision, there are no plans for on-site disposal of soil or building demolition debris that would be reburied.

ii. Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?

The Draft EIS analyzes shipment of radioactive and chemical waste to several disposal facilities depending upon the waste acceptance criteria of the receiving facility.

The Draft EIS estimates approximately:

- 741,000 cubic yards of soil that is above background but below risk based levels and hazardous waste standards
- 52,000 cubic yards above risk based levels for chemicals, below hazardous waste standards, with radionuclides at or below background
- 49,000 cubic yards with chemicals above hazardous waste standards, and radionuclides at or below background
- 44,000 cubic yards with chemicals above background but below risk-based levels and hazardous waste standards with radionuclides above background, but below risk based levels
- 44,000 cubic hazardous with chemicals above risk based levels, that may be hazardous waste and radionuclides above background; and,
- 3,000 cubic yards with chemicals at or below background and radionuclides above risk-based levels.

iii. Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).

Depending upon the decision in the Record of Decision, there may be some groundwater contamination (i.e. tritium) that maybe allowed to naturally degrade. Some soil with Total Petroleum Hydrocarbons (TPH) values very close to background may also be allowed to naturally degrade.

II. Decision Processes

a. State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.

In the early 2000s, DOE decided to prepare an environmental assessment (EA) for the remaining cleanup activities. An EA is used to assess whether a proposed Federal action would have significant impacts on the environment. DOE issued the *ETEC EA* in March 2003. The *ETEC EA* evaluated the potential impacts of implementing additional cleanup and closure activities; including decontaminating and decommissioning the remaining sodium facility and other support facilities. DOE issued a Finding of No Significant Impact (FONSI) for the EA on March 31, 2003, and began cleanup activities by undertaking limited building demolition.

In October 2004, the Natural Resources Defense Council, the Committee to Bridge the Gap, and the City of Los Angeles challenged the *ETEC EA* and Finding of No Significant Impact (FONSI) in a Federal district court, claiming DOE had violated NEPA; the Comprehensive Environmental Response, Compensation, and Liability Act; and the Endangered Species Act. In May 2007, the court issued its *Order Granting Plaintiffs' Motion for Summary Judgment* (Case 3:04-CV-04448-SC, May 2, 2007), which permanently enjoins DOE from transferring possession or otherwise relinquishing control over any portion of Area IV until DOE has completed an EIS and issued a ROD pursuant to NEPA. DOE suspended physical demolition and removal activities for its remaining facilities at ETEC, except for those activities necessary to maintain the site in a safe and stable configuration, until completion of the final EIS and ROD

In 2007, DTSC issued the *Consent Order for Corrective Action* (2007 CO) to DOE, NASA, and Boeing (as respondents), pursuant to DTSC's authority over hazardous waste under the California Health and Safety

Code, Section 25187. The 2007 CO requires the respondents to clean up all chemically contaminated soils and groundwater at SSFL to risk-assessment-based levels. The risk-assessment-based levels are based on a suburban resident scenario established for SSFL in the *Final Standardized Risk Assessment Methodology Revision 2 Addendum, Santa Susana Field Laboratory, Ventura County, California* (which assumed a receptor would be present on the site 24 hours per day, 350 days per year, for 30 years. This describes a risk-assessment methodology for determining the areas that would need remediation. A hypothetical future suburban residential land use was identified for the evaluation of risk; other plausible receptors (such as recreational users or workers) were also identified.

In 2010, DOE entered into the 2010 AOC with DTSC. The 2010 AOC superseded the 2007 CO with respect to soil remediation and changed the framework for the soils characterization and cleanup process for Area IV and the NBZ. The 2010 AOC stipulated that the soils cleanup standard would be based on LUT values, which are: (1) for chemicals, local background concentrations or method detection limits for those chemicals whose method detection limits exceed local background concentrations, and (2) for radionuclides, local background concentrations or minimum detection limits for radionuclides whose detection limits exceed local background concentrations. The 2010 AOC defines the minimum detection limit for a radionuclide as the smallest amount of activity that can be quantified for comparison with regulatory limits. The 2010 AOC indicates that, for soil remediation decisions, DOE is to compare the concentration of any chemical or radionuclide in each individual sample (not an average of samples in an area) with its respective LUT value. Thus, any soil samples that do not meet the LUT values for all chemicals or radionuclides would require a cleanup action to be taken. The 2010 AOC Agreement in Principle also includes exceptions to cleanup for Native American Artifacts and endangered/threatened species under the Endangered Species Act (ESA). Native American Artifacts is not defined and the Santa Ynez Band has requested consultation on such exceptions with both DOE and DTSC.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

The Santa Ynez Band is a cooperating agency on DOE's EIS. In July 2014, DOE, the National Aeronautics and Space Administration (NASA), The Boeing Company (Boeing), and the California Department of Toxic Substances Control (DTSC) hosted a summit to introduce the intended site cleanup to regional tribal groups and organizations.

One outcome of the July 2014 summit was the formation of the Santa Susana Field Laboratory Sacred Sites Council. Independently of DOE, NASA, Boeing, and DTSC, the summit attendees determined that the SSFL Sacred Sites Council would include representatives of the Santa Ynez Band of Chumash Indians, Fernandeño Tataviam and Gabrielino Tongva (the latter also includes the Kizh/Gabrieleno). The SSFL Sacred Sites Council serves as a central point for communication among the tribes and the various entities involved in cleanup at SSFL. Through periodic discussions conducted over teleconferences and during in-person meetings, the SSFL Sacred Sites Council coordinates tribal input to DOE, NASA, Boeing, and DTSC.

Recently, DOE has convened a group of Tribal Consulting Parties and has begun with this group to develop what will become a Programmatic Agreement under the National Historic Preservation Act. This group consists of representatives of each of the tribal entities that share an ancestral relationship to the Santa Susana Field Laboratory.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

Final decisions have not been made.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

The area where DOE did work is owned by a private company, The Boeing Company. Decisions related to future land use are theirs.

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

There are no current plans for any on-site disposal cells. Long term monitoring may be necessary for groundwater remedies depending upon the final remedial decisions.

c. *What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?*

No decisions have been made.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

No decisions have been made.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

No decisions have been made.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

No agreements have been made.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional* *controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*

No decisions have been made.

Fernald Preserve

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Fernald Preserve is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Resource Conservation and Recovery Act (RCRA) site. It was formerly known as the Feed Materials Production Center (FMPC). The FMPC was constructed in the early 1950s and production began in 1952 with National Lead of Ohio as the operating contractor. The Fernald Preserve is a 1050-acre U.S. Department of Energy (DOE) site in a rural, residential area 17 miles northwest of Cincinnati. The site is situated on a terrace that gradually drains to streams on the west and south portions of the site. Topography is dominated by the On-Site Disposal Facility (OSDF) on the eastern portion of the site and by a series of wetlands and open water that was established following site cleanup. Large-scale remediation was completed in 2006 and the site was transitioned to the DOE Office of Legacy Management. It was then renamed the Fernald Preserve in order to reflect the long-term stewardship mission of the site.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

The Fernald Preserve and surrounding area are located in a region of rich soil and many sources of water, such as the Great Miami River. Because of its advantageous location, the area was settled repeatedly throughout the prehistoric and historic times, resulting in diverse cultural resources. While currently there are no American Indian tribes in proximity to the site, over 148 prehistoric and 40 historic sites have been identified within 2 kilometers of the site. DOE is required to consider the effects of its actions on sites that are listed or eligible for listing on the National Register of Historic Places in compliance with the National Historic Preservation Act. Additionally, the Native American Graves Protection and Repatriation Act (Title 43 *Code of Federal Regulations* Part 10) requires that prehistoric remains and associated artifacts be identified and returned to the appropriate Native American tribe. Compliance with these requirements is addressed through a Programmatic Agreement for Archaeological Activities at the Fernald Preserve. This agreement was updated in 2012. DOE has conducted archaeological surveys prior to remediation activities in undeveloped areas of the site. These surveys have resulted in the identification of five sites that may be eligible for listing on the National Register of Historic Places. None of these sites were affected by construction activities. Prehistoric remains excavated during installation of a public water supply system adjacent to the site are reinterred on the site.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.

Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

Uranium metal products for the nation's defense programs were produced at the FMPC, including slightly enriched and depleted uranium. Smaller amounts of thorium metal also were produced. Production stopped in July 1989 and resources were focused on environmental restoration. In December 1989 the site was added to the U.S. Environmental Protection Agency (EPA) National Priorities List. In 1991 DOE officially ended production and the site was renamed the Fernald Environmental Management Project. In 1992 Fluor Daniel Fernald assumed contractor responsibility of the FMPC from Westinghouse Materials Company of Ohio. The site was renamed the Fernald Closure Project when the mission changed to environmental remediation.

CERCLA Remediation: The site was divided into five Operable Units (OUs) and a Remedial Investigation/Feasibility Study (RI/FS) was completed for each OU. Based on the results of the RI/FSs, Records of Decisions (RODs) were issued outlining the selected remedy for each OU.

- ROD for OU1, Waste Pits Area: The remedy for OU1 included removing all material from the waste pits, stabilizing the material by drying it, and shipping it offsite for disposal. OU1 cleanup activities ended in June 2005.
- ROD for OU2, Other Waste Units: The remedy for OU2 included removing material from the various waste units, disposing of material that met the onsite waste acceptance criteria (WAC) in the OSDF, and shipping all other material offsite for disposal. The WAC was developed by DOE and regulators, with input from stakeholders and the public, to strictly control the type of waste disposed of onsite. OU2 cleanup activities ended in November 2003.
- ROD for OU3, Production Area: The OU3 remedy included decontaminating and decommissioning all contaminated structures and buildings, recycling waste materials whenever possible, disposing of material that met the onsite WAC in the OSDF, and shipping all other material offsite for disposal. OU3 cleanup activities ended in October 2006.
- ROD for OU4, Silos 1–4: The OU4 remedy included removing and treating all material from the silos, dismantling the silos, and shipping the waste materials and silos debris offsite for disposal. OU4 onsite cleanup activities ended in March 2006.
- ROD for OU5, Environmental Media: OU5 includes all environmental media, such as soil, sediment, surface water, groundwater, and vegetation. Soil remediation included excavation of soils that exceeded risk-based final remediation levels for a list of contaminants of concern. The OU5 ROD describes the approved remediation method of pump-and-treat for groundwater until levels of uranium in groundwater are less than the drinking water standard. OU5 field activities related to the care and maintenance of the OSDF and aquifer restoration are ongoing.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

With the exception of the ongoing aquifer restoration, the majority of the comprehensive environmental remediation and ecological restoration of the site began in 1999 (after approval of the *Site-wide Excavation Plan* in 1998) and was completed in 2006 at a cost of $4.4 billion. This cleanup was one of the largest environmental cleanup operations ever undertaken in the United States. A groundwater extraction and treatment operation is the Fernald Preserve’s only remaining remediation activity.

The DOE Office of Legacy Management manages the Fernald Preserve to ensure the continued effectiveness of the site's environmental remediation and the ongoing viability of the ecological restoration. Environmental monitoring of the groundwater and surface water continues, as do periodic inspections and maintenance of the OSDF. The entire site is routinely inspected to identify areas of erosion, to control any invasive plant species, and to ensure that cleanup remedies remain protective of human health and the environment.

The Fernald Preserve is open to the public as a nature preserve. The 1050-acre site's natural features are being restored using native plants and grasses. Restoration activities at the site have created one of the largest man-made wetland systems in Ohio, along with open water, upland forests, a lengthy riparian corridor, and 387 acres of grassland that includes tallgrass prairie and savanna. The site's varied features and unique habitats are accessible on a 7-mile network of trails. More than 240 species of birds have been observed, and more than 100 different species have been documented as nesting at the Fernald Preserve.

The award-winning Fernald Preserve Visitors Center is the focal point of the site. Completed in August 2008, the Visitors Center began as a warehouse that was redesigned in cooperation with the University of Cincinnati College of Design, Architecture, Art, and Planning. Exhibits at the Visitors Center depict the diverse history of the Fernald site and tell the story from the time of the Native Americans through the arrival of settlers and farmers, the uranium-processing years, the environmental cleanup, and the legacy management period that continues today. The Visitors Center was the first building in Ohio to receive Platinum certification from the U.S. Green Building Council's Leadership in Energy and Environmental Design rating system. The Visitors Center has several spaces available for the public, including a community meeting room, a Resource Room, and a Program Shelter. Nature and history programs are routinely presented to the public.

A Declaration of Physical Completion occurred on October 29, 2006. The construction of the 75-acre OSDF and all site cleanup activities were completed, except for the ongoing actions necessary to achieve the final cleanup of the Great Miami Aquifer. Once the aquifer is restored, the wastewater treatment facility and associated infrastructure will be remediated. The primary contaminant of concern for groundwater is uranium. Other contaminants have been identified and will be removed during remediation of the uranium. Aquifer-restoration modeling results indicate that the pump-and-treat operation will be completed in 2035.

Ecological restoration followed remediation and was the final step to completing the cleanup of the site. Ecological restoration activities at the site are being implemented to address wetland mitigation requirements and to stabilize and revegetate areas impacted during remediation. Approximately 900 acres of the Fernald Preserve are being ecologically restored. These areas have been graded following excavations and then amended by seeding, planting, or otherwise enhancing them to create ecosystems comparative to native presettlement southwestern Ohio.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

The OSDF was constructed to permanently contain impacted materials derived from the remediation of the site. All materials placed within the OSDF were required to meet the OSDF waste acceptance criteria (WAC) established in the records of decision for OU2, OU3, and OU5. Soil containing nonradiological contaminant concentrations that exceeded the WAC was treated before placement in the OSDF or shipped offsite at an appropriate commercial or federal disposal facility. Soil with radiological contaminant concentrations that exceeded the WAC was shipped offsite for disposal. The OSDF contains approximately 2.95 million cubic yards of contaminated soil and debris. The WAC for the OSDF included the following maximum radiological constituent concentrations for soil: neptunium-237 (3.12×10^9 picocuries per gram [pCi/g]), strontium-90 (5.67×10^{10} pCi/g), technetium-99 (29.1 pCi/g), uranium-238 (346 pCi/g), and total uranium (1030 milligrams per kilogram).

f. To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.

i. Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).

Since closure of the OSDF in 2006, no waste has been disposed onsite and no waste will be disposed onsite in the future.

ii. Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?

All soils and sediments at the Fernald Preserve, with the exception of the groundwater restoration and treatment infrastructure, have been remediated and certified to ensure that area-specific contaminants of concern do not exceed soil final remediation limits (FRLs) as specified in the relevant RODs. When groundwater remediation activities are complete (projected to be complete in 2035), the remediation infrastructure will be removed, and the soil beneath will be remediated (if necessary) and certified. These areas include subgrade utility corridors and two remaining uncertified areas associated with the water treatment facility. The soils at the surface of the onsite utility corridors have been certified clean. In general, subgrade utility corridors are not likely to be contaminated above soil FRLs based on the fact that the contaminated water transported through the pipeline had uranium concentrations much lower than the soil FRL for uranium. The exception is the subsurface areas near former waste units where subsurface soils may be contaminated because the below-grade pipeline was installed on contaminated soil. Additionally, due to the operations in the water treatment facility footprint, it is anticipated that soils within the area may be slightly above FRLs. The volume of waste to be shipped offsite following completion of the aquifer remediation will be a fraction of the volume shipped offsite prior to site closure in 2006.

Discovery of contaminated debris continues to occur in portions of the site. Frost heave and surface erosion have uncovered a variety of items that have the potential for fixed radiological contamination. Suspect debris includes concrete, glazed tile, brick, asphalt, and metal. Debris is identified during site inspections and during construction and maintenance activities. Fixed radiological contamination has been documented on approximately 2 percent of the debris. No removable contamination has been associated with any debris. Most debris is not contaminated and is disposed of in a commercial landfill. The volume of radiologically contaminated debris collected at the site since closure in 2006 is estimated to be less than 100 cubic feet. This waste will continue to be disposed at an appropriate offsite facility.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

Following removal of the aquifer infrastructure, the remaining materials will include the soil and debris disposed of prior to 2006 in the OSDF. Additionally, any infrastructure required to transport leachate from the OSDF to treatment and discharge will also remain. Several buildings and site infrastructure will also remain, including access roads, parking areas, the Visitors Center, public amenities, storage facilities, utility corridors, and fencing and signage.

II. Decision Processes

a. *State the regulatory process(es) (i.e. CERCLA, RCRA, Orders, etc.) used at the site.*

The CERCLA process was used for characterization and remedy selection for major components of the site. The RCRA closure process was used for a number of Hazardous Waste Management Units (HWMUs). An integrated CERCLA/RCRA process was employed for closure of the remainder of the HWMUs.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

Both EPA and Ohio EPA were involved in the entire decision process and had final decision approval.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

The site was remediated to risk-based cleanup standards based upon an undeveloped park scenario. A balanced approach was developed for handling waste generated during the remediation. Small-volume, high-concentration waste was shipped offsite, while large-volume, low-concentration waste was disposed of in the OSDF. Approximately 80% of the remediation waste remained onsite. DOE, EPA, Ohio EPA, and stakeholders saw this balanced approach as the approach most likely to ensure that (1) high-concentration wastes left the site and (2) waste that could be safely managed onsite was kept onsite, which reduced costs and transportation risks. A variety of innovative approaches were used to engage stakeholders in cleanup decisions, including the use of scale models, games, and presentations. An envoy system was developed in order to provide updated information to local individuals and organizations. Fernald envoys were site employees that acted as liaisons between Fernald and various local community organizations.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

The final land use for the site is an undeveloped park. No other use of the facility is allowed. The site will remain in federal ownership in perpetuity. The Fernald Preserve remediation benefited from early dialogue among state and federal regulators, stakeholder organizations, elected officials, and members of the general public. The public insisted on a greater role in cleanup decisions early in the CERCLA process. Citizens groups such as the Fernald Citizens Advisory Board (FCAB), the Fernald Community Reuse Organization, the Fernald Health Effects Subcommittee, the Fernald Living History Project, and the Fernald Residents for Environmental Safety and Health were formed to provide avenues for citizen participation in the two-way communication path that was established. Stakeholders have been instrumental in the cleanup at Fernald. The FCAB produced the set of recommendations for final land use that were incorporated into cleanup and stewardship decisions.

b. Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.

The primary institutional controls for the disturbance and use of the OSDF include continued federal ownership, real estate restrictions (if necessary), and the prevention and unauthorized use of the OSDF and its associated buffer area. Engineered barriers, such as fencing, gates, signage, and locks, are also important institutional controls. The following stewardship and monitoring occurs at the OSDF: routine and nonroutine inspections of the OSDF cap and OSDF site area, routine OSDF cap and OSDF site area custodial care and preventive maintenance, and routine OSDF leachate and environmental monitoring. DOE continues to engage and educate the public regarding the OSDF through programs and exhibits at the Visitors Center.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

Because the site was remediated to regulator-approved FRLs, no contamination outside the OSDF will remain onsite following completion of the aquifer restoration and removal of the aquifer restoration infrastructure.

d. What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?

Institutional controls and other measures are being used at the Fernald Preserve to eliminate disturbances and monitor the use of the site, and to minimize human and environmental exposure to residual contaminants. Controls focus on ensuring that the Fernald Preserve remains in a configuration consistent with the designated land use and that unauthorized uses of the site do not occur. Prevention of unauthorized use is accomplished through informational devices, security, physical barriers, and routine inspections. The Visitors Center was established to house information on past, present, and future uses of the site.

Institutional controls for the site include the following:

- Federal ownership of the Fernald Preserve pursuant to the OU2 ROD
- A local well-permitting process administered through county officials
- The Environmental Covenant, Appendix B of the 2008 Consent Decree between the State of Ohio and DOE, which establishes activity and use limitations for the Fernald Preserve and restricts the use of groundwater as a drinking water supply
- Agreements with property owners for two off-property subgrade utility corridors that provide for operation, maintenance, alteration, repair, and patrol of the areas

Federal ownership of the Fernald Preserve is specified in the OU2 ROD. The entire Fernald Preserve must remain in federal ownership.

Drinking-water wells cannot be installed until a permit is obtained from the Hamilton County Health Department. DOE will ensure that the Hamilton County Health Department is aware of the off-property areas where groundwater contamination is greater than drinking water standards for uranium.

The Environmental Covenant, Appendix B of the Consent Decree, establishes activity and use limitations. The Legacy Management and Institutional Controls Plan is referenced in the Environmental Covenant and is used to ensure compliance with the Environmental Covenant. The list of prohibited activities and items is posted at the site entrance and includes alcohol and illegal drugs; firearms; removal or intentional damage of plants; mushroom gathering; soil excavation; removal or damage of archaeological materials; swimming and wading; camping; hunting, trapping, and fishing; dumping; fires, open flames, and smoking; tampering, manipulating, or damaging structures, fences signs, water control devices, or any other federal property; traveling off public roadways and trails; and pets of any kind. Land-use restriction changes that substantially alter the Environmental Covenant or the RODs need to be approved by EPA and Ohio EPA.

The site is currently manned. Additionally, point-specific institutional controls and the OSDF are inspected quarterly; site walkdowns are conducted annually. These inspections and walkdowns occur with the representatives of Ohio EPA.

e. What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.

The *Fernald Preserve, Fernald, Ohio, Comprehensive Legacy Management and Institutional Control Plan* (LMICP) contains the Legacy Management Plan, the Institutional Control Plan, the Operations and Maintenance Master Plan for the Aquifer Restoration and Wastewater Treatment, the Post-Closure Care and Inspection Plan for the OSDF, the Groundwater/Leak Detection and Leachate Monitoring Plan for the OSDF, the Integrated Environmental Monitoring Plan, and the Community Involvement Plan. The post-closure care of the site and the OSDF will continue for a minimum of 75 years. The site will remain in federal ownership for perpetuity.

f. Briefly describe the responsibilities of all the parties involved and any agreements (i.e. MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional *controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

It is the responsibility of DOE to enforce the institutional controls. Real estate notations may be used, should they become necessary (i.e., another organization would have the responsibility for managing the property). Notations on land records or similar restrictive real estate licenses will be in place for the Fernald Preserve and offsite property that is impacted by the Fernald Preserve activities. DOE will ensure that real estate notations remain in place as long as they are needed. In addition, if the management of any portion of the site is transferred from DOE to another federal entity, DOE will ensure that the controls remain in place. According to the OU2 and OU5 RODs, the Office of Legacy Management will annually review deed restrictions, if implemented, to ensure that they remain in effect with local authorities. A review of notations or real estate restrictions and other institutional controls are also part of the CERCLA Five-Year Reviews.

g. Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the State and/or Tribe.

Funding for long-term surveillance and maintenance is provided through the U.S. Department of Energy, Office of Legacy Management through an annual budget request process. A grant with the State of Ohio is also in place to provide funding for oversight.

Formerly Utilized Sites Remedial Action Program (FUSRAP), Missouri Sites

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

General

The U.S. Army Corps of Engineers (USACE) is administering a program for the management and remediation of radioactive contamination at the Formerly Utilized Sites Remedial Action Program (FUSRAP) sites in St. Louis, Missouri. In 1974, the U.S. Congress authorized the U.S. Atomic Energy Commission (AEC), a predecessor to the U.S. Department of Energy (DOE), to institute the FUSRAP. FUSRAP was initiated to identify and remediate mandated sites where residual radioactivity remains from activities conducted under contract to the Manhattan Engineer District (MED) and AEC during the early years of the nation's energy program, or from other operations assigned via congressional legislation. Congress authorized USACE to take over management of FUSRAP in October 1997.

There are four FUSRAP sites in the St. Louis area:

- The St. Louis Downtown Site (SLDS)
- The St. Louis Airport Site (SLAPS)
- The SLAPS Vicinity Properties (VPs)
- The Latty Avenue Properties (which includes the Hazelwood Interim Storage Site [HISS] and Futura)

These sites are located in two general locations: the downtown area and the North St. Louis County area. The SLDS consists of the Mallinckrodt Inc. (Mallinckrodt) facilities where the ore was processed and adjacent VPs. The North St. Louis County area consists of the SLAPS, SLAPS VPs, and the Latty Avenue Properties.

SLAPS, HISS, and Futura are on the U.S. Environmental Protection Agency's (EPA's) National Priorities List (NPL). The NPL is a list of sites identified for remedial action under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

St. Louis Downtown Site (SLDS)

The SLDS is located in an industrial area on the eastern border of St. Louis, approximately 18 kilometers (11 miles) southeast of the North St. Louis County area. SLDS consists of the Mallinckrodt property and adjacent commercial and city-owned properties, collectively referred to as the vicinity properties. Mallinckrodt is 90 meters (300 feet) west of the Mississippi River. The site covers approximately 18 hectares (45 acres) and contains many buildings that house Mallinckrodt offices and non-MED-related or

AEC-related chemical processing operations. Mallinckrodt in downtown St. Louis separated uranium from ore from 1942 to 1957. These processing activities, conducted under MED and AEC contracts, resulted in radioactive contamination at Mallinckrodt in downtown St. Louis. Subsequent disposal and relocation of processing wastes resulted in radioactive contamination at the SLDS VPs and at the North St. Louis County sites. A levee/flood wall, located to the east of SLDS, protects the area from floodwaters.

The Mallinckrodt facility is bordered by a large metals recycling company (McKinley Iron Works) to the north; the Mississippi River, a defunct food processing company (PVO Foods), and City of St. Louis property to the east; a large lumber yard (Thomas and Proetz Lumber) to the south; and North Broadway and small businesses to the west. Additionally, the Norfolk and Western Railroad (now Norfolk Southern); the Chicago, Burlington, and Quincy Railroad (now Burlington Northern and Santa Fe); and the St. Louis Terminal Railroad Association have active rail lines passing in a north/south direction throughout the facility. These businesses, along with businesses and properties in the blocks surrounding Mallinckrodt, as well as roadways and railroads make up the VPs. An extensive network of utility lines across the site includes underground sewer, sprinkler, water, and natural gas lines; overhead electricity and telephone lines; and plant process pipes. Some of the sewers and subsurface utilities (e.g., electricity) are owned by municipal or public utility companies. Runoff from the property is directed to a sewer system that discharges to a publicly owned treatment works, which discharges to the river.

St. Louis Airport Site

SLAPS is an unincorporated property in North St. Louis County. It is bounded on the north and east by McDonnell Boulevard, on the south by Banshee Road and Norfolk and Western Railroad, and by Coldwater Creek on the west. SLAPS is approximately 21 acres in size. A water main runs along the northern boundary of SLAPS, and a gas line crosses the northwest corner of SLAPS and runs parallel to the property on the north. There are overhead utility lines on the western end of SLAPS. There are no permanent buildings on SLAPS; however, there are several temporary structures being used to facilitate the remedial activities at the other North St. Louis County sites.

St. Louis Airport Site Vicinity Properties

The SLAPS VPs include Coldwater Creek; publicly owned lands, privately owned commercial and residential properties along Coldwater Creek; and roads, railroads, and privately owned commercial and residential properties along haul routes from SLAPS to HISS. There are approximately 78 SLAPS VPs. These properties have various uses, such as industrial, commercial, residential, and recreational activities. Coldwater Creek flows for 153 meters (500 feet) along the western border of SLAPS and continues for 24 kilometers (15 miles) in a northeasterly direction through Hazelwood, Florissant, unincorporated areas of the county, and along the northern edge of the unincorporated community of Black Jack until the creek discharges into the Missouri River.

The Latty Avenue Properties

The Latty Avenue Properties are located approximately 1 mile north of SLAPS in an area that is primarily commercial and industrial. The Latty Avenue Properties include the HISS property and Futura, both of which are NPL sites, and eight additional properties that border Latty Avenue. These properties cover approximately 11 acres of land.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

There are no federally recognized American Indian Tribes in current proximity to these sites.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site. Please be concise and specific in your description, including which remedial actions were taken since 1999 to the present and those planned for the future if any.

St. Louis Downtown Site

Mallinckrodt Chemical Works was contracted by MED and AEC from 1942 until 1957 to process uranium ore for the production of uranium metal. The process involved the digestion of uranium ore using nitric acid. Residuals of the process, including spent ore; process chemicals; and radium, thorium, and uranium were inadvertently released into the environment through handling and disposal practices. Residuals from the process had elevated levels of radioactive radium, thorium, and uranium. From 1942 to 1945, Plants 1, 2, and 4 (now Plant 10) developed uranium processing techniques, produced uranium compounds and metal, and recovered uranium metal from residues and scrap. Mallinckrodt, under contract to AEC, decontaminated Plants 1 and 2 from 1948 through 1950 to meet the AEC criteria then in effect, and AEC released the plants for use without radiological restrictions in 1951.

Starting in 1946, the newly constructed Plant 6 produced uranium diode from pitchblende ore. Uranium ore was digested in acid and filtrate to form uranyl nitrate, which was extracted and denigrated to produce uranium oxide. Hydrofluoric acid was used to fluorinate the uranium oxide to create uranium tetrafluoride (green salt). The green salt was combined with magnesium and heated to produce uranium metal and magnesium fluoride.

During 1950 and 1951, Plant 4 (now Plant 10) was modified and used as a metallurgical pilot plant for processing uranium metal until it was closed in 1956. During this period, operations began at Plants 6E, 7, 7E, 7N, and 7S. AEC operations in Plant 6E ended in 1957. AEC managed decontamination efforts (removal of radiologically contaminated buildings, equipment, and soil disposed offsite) in Plants 4 and 6E to meet AEC criteria in effect at that time and returned the plants to Mallinckrodt in 1962 for use without radiological restrictions. Since 1962, some buildings have been razed, and new buildings have been constructed at Plants 4 and 6. Plant 7, used to produce green salt, was also used to store reactor cores and to remove metallic uranium from slag by a wet grinding mill/flotation process. Following decontamination to meet AEC criteria, Plant 7 was released for use with no radiological restrictions in 1962. Plant 7 is currently used primarily for material storage. The company’s name was changed to Mallinckrodt in 1974.

In 1977, a radiological survey conducted at SLDS found that alpha and beta-gamma contamination levels exceeded guidelines for release of the property for use with radiological restrictions (Oak Ridge National Laboratory 1981). Elevated gamma radiation levels were measured at some outdoor locations and in some of the buildings formerly used to process uranium ore. Soil samples determined that radium-226 concentrations in soil were present to as high as 2700 picocuries per gram (pCi/g) above background and uranium-238 concentrations were as high as 20,000 pCi/g above background in subsurface soil. Additionally, radon and radon daughter concentrations in two buildings exceed guidelines for nonoccupational radiation exposure. In response to this, a remedial investigation was conducted to characterize the nature and extent of contamination (Bechtel National Incorporated [BNI] 1994).

Operations that produced radiologically contaminated materials that could have led to contamination in the sewers and drains include the MED/AEC contract work, niobium (columbium)–tantalum processing work, and the euxenite processing performed under separate U.S. Nuclear Regulatory Commission source material license number 226, which was performed under subcontract for the U. S. government. However, the MED/AEC operation comprised the majority of the radioactive materials processed at Mallinckrodt.

In accordance with the 1998 SLDS Record of Decision (ROD), remedial actions have been conducted at accessible soil areas at many properties at SLDS where MED/AEC-related contamination was detected above the ROD remediation goals. Final status survey evaluations (FSSEs) are developed to document that the accessible soil areas meet the cleanup standards documented in the ROD. Areas where inaccessible soils remain at SLDS sites continue to be evaluated.

Sampling and remediation at SLDS continues. See response to 1d for further information.

St. Louis Airport Site

MED acquired SLAPS in 1946 to store uranium-bearing residuals from SLDS from 1946 until 1966. In 1966, these residuals were purchased by Continental Mining and Milling Company of Chicago, Illinois; removed from SLAPS; and placed in storage at Latty Avenue under an AEC license. After most of the residuals were removed, site structures were demolished and buried on the property along with approximately 60 truckloads of scrap metal and a vehicle that had become contaminated (EPA 1989). Clean fill material was spread over the disposal area from 0.3 to 1.0 meters (1 to 3 feet) deep to achieve surface radioactivity levels acceptable at that time. In 1973, the U.S. government and the City of St. Louis agreed to transfer ownership of SLAPS by quitclaim deed from AEC to the St. Louis Airport Authority.

In 1982, a radiological characterization of the ditches to the north and south of SLAPS and of portions of Coldwater Creek (BNI 1983) indicated radioactivity levels exceeding DOE guidelines that were then in effect.

In 1986, a radiological and limited chemical characterization of SLAPS determined that radioactive impacts extended as deep as 5.5 meters (18 feet) below grade (BNI 1987). A radiological characterization of the North St. Louis County properties was subsequently conducted from 1986 through 1990 to further define the extent of radioactive contamination and to evaluate possible disposal alternatives.

St. Louis Airport Site Vicinity Properties

An Engineering Evaluation/Cost Analysis (EE/CA) Environmental Assessment for the proposed decontamination of properties in the vicinity of HISS was released to the public in spring 1992. In 1995 the EE/CA was approved with the modification that any soil excavated under the document be shipped to an out-of-state disposal facility. Between 1995 and 1997 DOE worked to remove contaminated soil from the road rights-of-way of 30 VPs along Frost, Hazelwood, and Latty Avenues. In October 1997, FUSRAP management was transferred from DOE to USACE under the Energy and Water Appropriations Act.

In 1998 USACE removed and backfilled 450 cubic yards of contaminated soil and concrete in support of the city of Florissant's upgrade of the St. Denis Bridge over Coldwater Creek.

Sampling and remediation work has continued at the SLAP sites. See response to 1d for further information.

The Latty Avenue Properties

In 1966, Continental Mining and Milling Company of Chicago purchased the wastes stored at SLAPS and began moving them to HISS for storage. In 1967, the Commercial Discount Corporation of Chicago purchased the residues and shipped much of the material to Canon City, Colorado, after drying. Cotter Corporation purchased the remaining residues in 1969 and dried and shipped more material to Canon City in 1970. In 1973, the remaining undried material was shipped to Canon City and leached barium sulfate was mixed with soil and transported to a St. Louis County landfill. During these activities, improper storage, handling, and transportation of materials caused the spread of materials along haul routes and adjacent VPs.

In 1979, the owner of HISS excavated approximately 13,000 cubic yards from the western half of the property before constructing a manufacturing facility. The material excavated at this time was stockpiled on the eastern half of the property. In 1984, BNI performed remedial action activities including clearing, cleanup, and excavation of an area of the property that contained office trailers and a decontamination pad. This action created about 14,000 cubic yards of additional contaminated soil, which was stockpiled at HISS.

In 1986, DOE provided radiological support to the cities of Hazelwood and Berkeley for a drainage and road improvement project. Soil with constituents in excess of DOE remedial action guidelines was excavated and stored at HISS. This action resulted in an additional 4600 cubic yards of material being placed at HISS in a supplemental storage pile.

In 1996, the owner of the property to the east of the HISS, Stone Container Corporation, expanded its facility. The owner stockpiled approximately 8000 cubic yards of soil on the southwestern corner of the property.

In 1989, EPA placed HISS and Futura on the NPL. This list required the cleanup to proceed under the guidelines of CERCLA as amended by SARA.

In July 1990, DOE and EPA Region VII signed a Federal Facilities Agreement that established a procedure and schedule for remediation of the Latty Avenue Properties.

In 1992, an EE/CA Environmental Assessment for the proposed decontamination of HISS and impacted soil from three adjacent Latty Avenue Properties was released to the public. The EE/CA was approved in 1995 with a modification that any soil excavated under the document be shipped to an out-of-state disposal facility.

In October 1997, FUSRAP management was transferred from DOE to USACE by Congress through the Energy and Water Development Appropriation Act. Since that transition was effected, Latty has fallen under the responsibility of the St. Louis District USACE.

Contaminants
Primary radiological contaminants at the St. Louis FUSRAP sites are radium, thorium, and uranium. Other FUSRAP contaminants of concern are listed below.

actinium	barium	molybdenum	selenium
antimony	cadmium	nickel	thallium
arsenic	chromium	protactinium	vanadium

Impacted Media
Affected media include surface and subsurface soils, structures, groundwater, and surface water.

The extent of contamination has not been fully characterized at SLDS nor the SLAPS VPs.

Quantity of Waste Before and After Remedial Actions
The volumes listed below are the volumes that have been shipped from the respective sites through fiscal year 2016.

Site	Volume (cubic yards)
SLDS (including Vicinity Properties)	294,853
Latty Avenue Properties	224,838
SLAPS	405,194
SLAPS VPs	78,674

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

St. Louis Downtown Site

In March 2005, the *Memorandum for Record: Non-Significant Change to the Record of Decision for the SLDS* was published; it provided specific clarifications regarding the delineation of the SLDS boundary.

Removal and remedial actions have been completed at approximately 37 vicinity properties for the accessible soils operable unit at the SLDS. Upon completion of these removal and remedial actions, an FSSE was conducted. The FSSE results indicated that residual radiological and nonradiological contaminants of concern did not exceed the remediation goals specified in the ROD.

In 2014, a *Record of Decision for the Inaccessible Soil Operable Unit Associated with Group 1 Properties at the St. Louis Downtown Site* was issued. This ROD establishes that no further action is required for inaccessible media at select properties in order for the properties to be protective of human health and the environment. Additional properties are under consideration for inclusion in the Group 1 properties via an Explanation of Significant Difference (ESD).

Sampling and remediation activities continue both on the site and at vicinity properties. This includes the sampling and remediation of buildings, soil, material under buildings once the buildings are removed, as well as streets, sewers and utility corridors.

St. Louis Airport Site

In September 2005 the North County ROD was signed. This ROD addressed not only the St. Louis Airport Site, but also the Latty Avenue Properties and the SLAPS VPs.

CERCLA removal actions were conducted from May 1999 through September 2005 in nine work areas at SLAPS in accordance with an EE/CA. This included the East End, the Radium Pits, the East End Extension and right-of-way, Phase 1 work area, Phases 2 and 3 work areas, Phases 4 and 5 work areas, and Phase 6 (EE/CA) work area.

A CERCLA remedial action was conducted from September 2005 through December 2006 at SLAPS in accordance with a ROD for the Phase 6 (ROD) work area.

Upon completion of these removal and remedial actions, an FSSE was conducted. The FSSE results indicated that residual radiological and nonradiological contaminants of concern did not exceed the remediation goals specified in the ROD, and there were no inaccessible areas within the site boundaries of the SLAPS.

St. Louis Airport Site Vicinity Properties

In 1999, 550 cubic yards of contaminated soil were removed from VP-56. USACE also renegotiated the St. Louis Utility Response Plan for all underground utilities affected by contamination from the MED/AEC. USACE trained and supported all affected utility companies.

In March 2000, USACE excavated approximately 5000 cubic yards of radioactively contaminated materials from a portion of SLAPS VP-38. Currently, the USACE field project office complex and onsite laboratory facility are on the remediated portion of VP-38.

In accordance with CERCLA requirements, a Five-Year Review was initiated in January 2003 to ensure that human health and the environment are being protected by the response action being implemented. USACE released the report documenting the findings of the review in August 2004. A second report was issued in October 2010 and a third in July 2015.

In September 2005, the North County ROD was signed. This ROD addressed not only the St. Louis Airport Site but also the Latty Avenue Properties and the SLAPS V Ps.

Removal and remedial actions have been completed at approximately 55 of 78 vicinity properties. Upon completion of these removal and remedial actions, an FSSE was conducted. The FSSE results indicated that residual radiological and nonradiological contaminants of concern did not exceed the remediation goals specified in the ROD.

From 2013 to present, the sampling focus turned to Coldwater Creek.

Sampling of Coldwater Creek and the surrounding flood prone areas is being performed in 1 mile segments moving from upstream to downstream. Sampling along the creek has identified properties requiring remediation. These properties mark the first remediation activities necessary in public and residential areas for the site. A general trend has been noticed that the concentrations of samples exceeding the ROD remediation goals have been decreasing as the sampling progresses downstream. However, this decrease has occurred more slowly than expected.

Along with these activities, nine utility supports have occurred this year as sewer, gas and electrical work is done in areas not yet scanned and sampled, or areas previously considered inaccessible due to the utilities present.

Utility support activities are expected to continue after remediation is considered to be complete by the USACE, and the sites are returned to DOE Legacy Management (LM). How these requests will be handled once the sites are returned to LM has yet to be determined.

The Latty Avenue Properties

Between September 2000 and October 2001, the waste piles located on HISS were completely removed and disposed of in accordance with the EE/CA.

Between 2008 and 2011, the ground surface of HISS was remediated and the remaining building and sanitary sewers were surveyed. In 2012, the remediated areas were restored (e.g., they were revegetated and fencing was replaced) to preremediated conditions.

Between 2012 and 2015, FSSEs were conducted at the remainder of the Latty Avenue Properties. The majority of the properties required at least some amount of remediation. The FSSE results indicated that residual radiological and nonradiological contaminants of concern did not exceed the remediation goals specified in the ROD. There were no inaccessible areas within the site boundaries of the HISS, but there are at Futura.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

There is no onsite disposal of waste; all waste is shipped to a properly licensed, out-of-state disposal facility.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

    i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

There will be no onsite disposal of waste.

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*

The main waste generated at the St. Louis sites is soil. All waste is shipped via rail to a properly licensed, out-of-state disposal facility. USACE estimated that it would excavate and ship approximately 29,000 cubic yards of contaminated soil in FY 16; this is enough to fill about 320 railcars. Estimates for remaining material to be shipped to an out-of-state disposal facility are difficult because ongoing sampling continues to identify new areas requiring remediation.

In addition, it is also important to note that as all of these sites are privately owned (DOE does not own any portion of the sites where contamination has been found). As owners change their plans for their property, additional remediation can arise as buildings are demolished, and previously inaccessible contamination can now be removed and shipped to a disposal facility. Property ownership changes may also result in the opportunity for contamination to be removed that was previously considered "inaccessible," thereby also increasing the amount of material to be shipped.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

The amounts of inaccessible soils have not been fully determined due to the ongoing sampling and remediation activities that continue at SLDS, and SLAPS VPs. Soil beneath buildings, railroads, railroad right of ways, roadways and utility corridors is anticipated to be the main source of inaccessible contamination. The extent is still being evaluated.

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

All sites are being investigated and evaluated under CERCLA. SLAPS, HISS, and Futura are on EPA's NPL.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

The remedies at the sites were selected with concurrence from the Missouri Department of Natural Resources.

Since the signing of the first Cooperative Agreement with the USACE in 1998, the Missouri Department of Natural Resources has continued to be an integral member of the regulatory team throughout the document development, sampling and remediation processes. Staff review technical documents on the sampling of sites of concern, the planned of clean ups of sites as well as the post clean up status of sites. Staff provide comments on these draft documents, and also perform oversight at active remediation at sites, observe sampling and take confirmatory samples at sites, act as a resource for the local community and actively participate in the various meetings that take place as the planning occurs for sites to be sampled, potentially remediated, and finally returned to use.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure, including unrestricted use and unlimited exposure.*

The FUSRAP sites in St. Louis are unique to many of those that have previously been encountered by DOE and the USACE. The properties USACE has been charged with cleaning up are not under the ownership of DOE or any part of the federal government. Rather, the sites are owned by corporations, private entities, individuals or local governments. As such, the USACE and DOE must abide by the decisions of the property owners. If buildings or other structures inhibit the removal of contamination, that material will remain in place, and be considered to be "inaccessible". This contamination may end up remaining long after USACE has declared remediation work complete and will therefore result in covenants or restrictions on the property. In addition, a significant number of areas considered to be inaccessible are under current road and rail ways. Although roadway contamination may become accessible areas as public works projects allow for remediation work to occur simultaneous to road improvements, contamination in railroads and rail road right of ways is much more difficult to access due to the private ownership of railroads and the difficulty in gaining long term access to them for material removal. Therefore, numerous issues such as these made clean closure for all areas of the SLDS and North St. Louis County–area sites determined to be technically and financially impracticable.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

The cleanup goals for the North St. Louis County–area sites and SLDS are remediation to risk-based standards based on residential land use scenarios. However, there are expected to be areas that do not meet these goals that will require land use restrictions.

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

There are no disposal cells, nor are any planned for these sites; all waste is shipped to a properly licensed, out-of-state disposal facility.

c. *What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?*

Soil sorting, soil washing and phytoremediation were evaluated during the Feasibility Study process, but these remedies were not selected because the technologies indicated that they would not be effective in reducing the volume, mobility, or toxicity for the type of soils and contaminants present at the North St. Louis County sites. Treatment was also not found capable of achieving cleanup criteria at the SLDS.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

As remediation is still ongoing across most of the sites, no agreements associated with institutional controls or long-term stewardship have been implemented at present.

USACE has responded in general by stating that it intends to develop an institutional controls plan and a long-term monitoring plan. It is anticipated that environmental covenants will be necessary at some locations due to contamination that will remain in place at the properties.

e. What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.

As remediation is still ongoing at the sites, at this time there have not been any long-term stewardship plans or procedures developed for any of the sites. However, because inaccessible materials will be left behind at multiple locations, long term stewardship/monitoring will be required. Five year reviews for the sites have already been underway for a number of years.

f. Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components, including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.

Per the MOU between DOE and USACE (DOE and USACE 1999), upon completion of FUSRAP activities by USACE, DOE will be responsible for the surveillance, operation and maintenance, and enforcement of institutional controls imposed on the site or vicinity properties.

In addition, through the review and commenting on various decision documents such as the Records of Decisions and the already completed Five Year Reviews, the Missouri Department of Natural Resources has continued to state that our agreement and support of these decisions has been contingent on a future three party FFA that will include DOE, EPA and MDNR in regards to the development of long term stewardship decisions, plans, and documents.

Prior to the sites transferring into DOE long term stewardship status, processes must be developed to address the long term issues of private properties with inaccessible materials, and how to respond to utility support needs promptly when contacted.

g. Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often funding is obtained, legal funding drivers, and so on) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the State and/or Tribe.

Funding will be provided through an annual budget request process conducted by the DOE Office of Legacy Management. Existing FFA(s) with funding requirements will transfer from USACE to DOE upon completion of remediation.

Upon transfer of these sites to LM, Missouri Department of Natural Resources requests funding from DOE for continued oversight. The department's approval of decision documents throughout the remediation process has been contingent on the inclusion of the state as a member of the FFA upon its renegotiation. It is expected that as the sites transfer into LM the FFA will require renegotiation/revising as LTS specific issues that are not included in the original FFA will need to be added. Any additional funding of oversight beyond the FFA requirements will be determined by LM at the time of transfer.

Hanford Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Hanford Site is located within the semi-arid Pasco Basin of the Columbia Plateau in southeastern Washington State and occupies approximately 580 square miles north of the confluence of the Yakima and Columbia Rivers. With restricted public access, the diverse geographic features and land provide a buffer for areas once used for nuclear materials production and waste storage and disposal. The Columbia River flows through the northern part of the site and forms part of the eastern site boundary before turning south. Rattlesnake Mountain and the Yakima and Umtanum ridges form the southwestern and western boundaries, and the Saddle Mountains form the northern boundary. The closest population centers include Richland, Pasco, and Kennewick, collectively known as the Tri-Cities, which are located to the southeast of the site.

The climate of the Hanford Site is influenced by the Pacific Ocean and Cascades to the west, along with other mountain ranges to the north and east. In addition to the Columbia River, natural surface waters include Rattlesnake and Snively springs and West Lake. With its shrub-steppe ecosystem, the site contains terrestrial and aquatic species, some of which are considered rare and/or declining or are of significant interest to federal, state, or tribal governments.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

DOE interacts and consults with three federally recognized tribes affected by Hanford operations including the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe. Those Tribes were deemed "affected" through application under the Nuclear Waste Policy Act (1982) based on the potential affects to treaty rights and resources. In addition, the Wanapum People who still live near Hanford at Priest Rapids, are a non-federally recognized tribe who have strong cultural ties to the site and have consulted with DOE since its formation in the 1940s. Each of these tribes has strong cultural and spiritual ties to the Hanford area, and historically attended to various portions of the site for a number of purposes. These purposes included winter and seasonal villages, hunting and fishing, gathering medicinal and food plants, grazing, trade, and ceremonial and spiritual purposes. The U.S. Department of Energy's Richland Office (DOE-RL) and Office of River Protection (ORP) have expressed an interest in working together with the tribes to increase access and use, and to protect cultural resources. Past and current site operations have had a severe impact on the tribes due to limitations on access to the area and its resources. Residual contamination has also continued to impact many resources.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.

Please be specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

During the 45 years of Hanford's plutonium production mission, extensive dumping of liquid and solid waste caused widespread contamination of the groundwater and soil. The federal government disposed of an estimated 450 billion gallons of contaminated liquids through discharges to open pits, cribs, and trenches, resulting in the contamination of more than 80 square miles of groundwater as well as the deep vadose zone. More than one million gallons of high-level waste has leaked from more than 60 of Hanford's 177 underground waste storage tanks. More than 360 waste disposal trenches – which encompass 43 linear miles – hold an estimated 15 million cubic feet of waste, some of which is highly mobile and long-lived.

Monitored Natural Attenuation, rather than treatment, will be relied on for some of the groundwater plumes for a combination of reasons – such as wide dispersion of some of the contaminants or a lack of effective technology to remove certain contaminants from the groundwater. Groundwater pump-and-treat operations are being employed in former operational areas along the river corridor, specifically for remediation of the 100-K, 100-D and 100-H areas.

The contamination in the deep vadose zone – although a threat to re-contaminate the groundwater well into the future – poses technical and financial challenges, simply because of the depth and the difficulty to access.

Much of the solid waste that was disposed to the soil will likely remain where it is, as it either does not pose a hazard to people or the environment, or the costs of remediation far exceed the value of the risk reduction.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

For additional information on the accomplishments associated with cleanup activities, please see attached "Cleanup Progress at Hanford" fact sheet from October 2016.

e. Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).

To date, more than 18 million tons of low-level radioactive waste and mixed waste (both radioactive and hazardous) have been removed to the site's CERCLA disposal facility – the Environmental Restoration Disposal Facility (ERDF).[1] Most of that material has consisted of contaminated soil and building debris. Some highly radioactive waste streams, such as glove boxes and a test reactor, have also been disposed in ERDF.

The State of Washington regulates two mixed low-level waste disposal trenches on the Hanford Site. Combined, DOE has disposed of about 11,000 cubic meters of waste.

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[1] Department of Energy website <http://www.hanford.gov/page.cfm/ERDF> (accessed 2/27/2017).

DOE has also placed into a large disposal pit, 127 nuclear reactor compartments of Navy submarines and surface ships (with more to come). The hazard is primarily from activated metals. The reactor compartments will eventually be buried.

f. Describe the amount of cleanup (in volume, curies and types of waste streams) remaining at the site.

In total, there is approximately 437 million curies of radioactive waste requiring cleanup at the Hanford Site. Of this total, 215 million curies reside in underground storage tanks. 150 million curies are stored as cesium and strontium capsules and 50 million curies are stored as irradiated fuel in the Canister Storage Building. 18 million curies are within facilities, whether in pipes, filters, or other infrastructure-related materials. 2.5 million curies are buried in the ground in storage facilities or in liquid waste disposal sites. Finally, approximately 1.5 million curies have leaked into the soil and groundwater beneath the storage tanks.[2]

i. Describe the amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite.

ERDF was designed to be expanded as needed. It currently holds about 18 million tons of contaminated waste. Additional expansions will occur to meet future disposal needs, as building demolition and waste site cleanup occurs in Hanford's Central Plateau.

As previously mentioned, there is 56 million gallons of radioactive waste stored in underground storage tanks. The intent is to solidify this waste through a process called vitrification, which mixes the waste with glass-forming materials. The molten glass is then poured into stainless steel canisters where the glass will harden. The tank waste will be separated into two waste streams – one with higher concentrations of radioactivity, and one with much lower radioactivity. By volume, the lower-activity waste stream is expected to make up about 90 percent of the tank waste. It is estimated that will create between 65,000 and 80,000 canisters of waste. That waste will be disposed at Hanford in shallow burial in the Integrated Disposal Facility.[3] The higher concentration waste will initially be stored on site, then eventually be disposed in a deep geologic repository.

ii. Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?

An estimated 8,000 to 13,500 canisters of vitrified high-level waste is destined to go to a national geologic repository. So too will some 2,100 metric tons of spent nuclear fuel as well as some additional miscellaneous spent nuclear fuel.

Hanford has already shipped 649 truckloads of transuranic off of the site for disposal at the Waste Isolation Pilot Plant in New Mexico. As many as 6,450 additional shipments are predicted once Hanford resumes shipping around 2024.

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[2] Gephard, R.E., & R.E. Lundgren, *Hanford Tank Cleanup: A Guide to Understanding the Technical Issues* at 3 (Battelle Press Sept. 1998)

[3] Department of Energy website http://www.hanfordvitplant.com/vitrification-101 (accessed 2/27/2018).

iii. Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete.

There are approximately 1,500 locations in the Hanford Central Plateau where waste has been spilled, leaked, buried or otherwise disposed. DOE's baseline estimate for the amount of waste to be excavated and buried in ERDF is approximately 2.5 million tons. This baseline would leave residual contamination at a large number of the 1,500 waste sites that would have to be addressed by technology other than remove-treat-dispose.

II. Decision Processes

a. State the regulatory process (i.e., CERCLA, RCRA, Orders, etc.) used at the site.

The Hanford Federal Facility Agreement and Consent Order, often referred to as the Tri-Party Agreement (TPA), is a legally binding agreement between the DOE, the U.S. Environmental Protection Agency (EPA), and the State of Washington that, along with the Resource Conservation Recovery Act (RCRA) Site-Wide Permit, establishes the guidelines and framework for achieving the cleanup of the Hanford Site. There are two regulators at Hanford as identified in the TPA – EPA and the Washington State Department of Ecology (Ecology).

At Hanford, both the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and RCRA are used in regulating the cleanup.

CERCLA is applicable for waste sites where hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure. It is regulated by EPA. CERCLA requires a review every five years for waste sites where contaminants remain to evaluate the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment. The five-year review requirement applies to all remedial actions selected under CERCLA §121. The methods, findings, and conclusions of the five-year reviews are documented in the five-year review report.

RCRA is our Nation's primary law governing the treatment, storage and disposal of solid and hazardous waste. EPA authorized Ecology to implement the State's equivalent hazardous waste program in lieu of the federal RCRA program. The State program incorporates aspects of the federal RCRA program and implements the State's Hazardous Waste Management Act and Dangerous Waste Regulations. Ecology is therefore the regulator that issues a Dangerous Waste (RCRA) permit for Hanford Site activities and oversees the Hanford Air Operating Permit in conjunction with the Washington State Department of Health.

In addition, there are separate Consent Decrees that have been issued by the federal district court of Eastern Washington to address continuing missed milestones in the TPA related to tank retrievals and tank waste treatment. The most recent amended consent decree was issued by the court in March 2016.

The Washington Department of Health is provided funding by DOE and monitors air, water and other media.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

The U.S. government has a unique political and legal relationship with tribal governments as defined by treaties, the U.S. Constitution, court decisions defining the federal trust responsibility, and executive orders. Additional federal laws and regulations requiring DOE to consult with Native American tribes on certain issues include the American Indian Religious Freedom Act (42 U.S.C. 1996), the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 et seq.), Archaeological Resources Protection Act of 1979 (16 U.S.C. 470), National Historic Preservation Act of 1966 (NHPA; 16 U.S.C. 470), and the Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601).

The DOE and EPA have legal, policy, and moral obligations to engage in government-to-government consultation with the elected leaders and staff of the Hanford-affected Tribes. These consultations include presentations by DOE and EPA on the status of cleanup activities and also provide the opportunity for the tribes to provide comments directly to these agencies. Though tribal comments are not necessarily always reflected within a final Record of Decision, there is some discussion between DOE and the tribes that provides for an opportunity for input. Some tribal input may be incorporated in a ROD, but not all input leads to changes in a final ROD.

DOE works primarily with the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation (CTUIR), and the Confederated Tribes and Bands of Yakama Nation, each of which negotiated treaties with the U.S. government (Treaty with The Nez Percés [U.S. Government 1855a]; Treaty of Walla Walla [U.S. Government 1855b]; Treaty with The Yakama [U.S. Government 1855c]) in 1855. Each Treaty includes provisions that reserve the rights of the tribes to fish at all usual and accustomed places, hunt, gather roots and berries, and pasture horses and cattle on open and unclaimed land, among other rights. Located in Priest Rapids, the Wanapum, which once resided on lands that are now the Hanford Site with historic ties to the area, has a long-standing relationship with DOE. Additionally, DOE provides financial assistance through cooperative agreements with the Nez Perce Tribe, CTUIR, and Confederated Tribes and Bands of Yakama Nation, and supports tribal involvement in the decision-making processes at Hanford on both remedial activities and the natural resource damage assessment. The Nez Perce, CTUIR, and Yakama each hold seats on the Natural Resource Trustee Council that is implementing injury assessment activities at Hanford.

The role of Indian tribes at the Hanford Site is guided by Department of Energy American Indian Tribal Government Interactions and Policy (DOE O 144.1), which communicates departmental, programmatic, and field responsibilities for interacting with American Indian governments. This Order incorporates policy and consultation guidance in working with Native American tribes. There is not as of yet an implementation plan associated with this Order, which is necessary so that it can be better defined and understood by both DOE and the Tribes. DOE will consult with any American Indian or Alaska Native tribal government with regard to any property to which that tribe attaches religious or cultural importance, which might be affected by a DOE action. The policy outlines the trust relationship that DOE has with the tribes and commits the agency to institute government-to-government relations with the tribes. DOE O 144.1 Attachment 3, "Office of Environmental Management, Office of Nuclear Energy, Office of Science, and the National Nuclear Security Administration (NNSA) Framework to Provide Guidance for Implementation of U.S. Department of Energy's American Indian and Alaska Native Tribal Government Policy," provides additional guidance on how tribal consultation is to be conducted.
As Hanford Site cleanup progresses, Native American tribes review various aspects of cleanup activities, including how these activities will affect cultural, natural, and biological resources, and the tribes' future ability to use and consume the resources that once existed at the site.

In addition, Section 10.10 of the Hanford Tri-Party Agreement Action Plan identifies certain actions to be taken to involve Indian Tribes in the cleanup. For example, DOE provides copies of key documents and other pertinent materials to the tribes at the same time that they are provided to EPA and Ecology.

As mentioned above, the State of Washington regulates a portion of the cleanup through its delegated RCRA authority.

The State of Oregon's Department of Energy is provided funding by DOE and is provided opportunities to weigh in on Hanford work, though it has no decision-making authority.

c. Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.

Final Records of Decision (RODs) pursuant to CERCLA are currently in development for the 100-D/H and 100-N Areas. In the Columbia River Corridor, RODs for the 300 Area and the 100-F Area have been completed. In Central Hanford's 200 Area, RODs have been completed for plutonium waste sites and the 200-West Area groundwater. RODs are drafted by DOE and its regulators and are available for public review and comment. DOE, EPA and Ecology have also met with tribes regarding the RODs.

Cleanup decisions along the Columbia River shoreline have generally achieved a cleanup level of unrestricted surface use under a resident farmer exposure scenario, but have not specifically allowed for unrestricted use/unrestricted exposure by tribal members. The central part of Hanford is considered an industrial area, and the cleanup decisions completed there have been developed using an industrial worker exposure scenario.

Final decisions on closure of RCRA units are reflected in the Hanford Site-Wide RCRA permit, for the decisions that have been made to date. Decisions on closing the remaining RCRA facilities have not yet been made, but are in development.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. What was the final land use chosen? Are there restrictions on other resources? How long are these restrictions necessary? What process was used to select the land use?

The majority of the Hanford Site land will remain under federal ownership and control by the Department of Energy. The Hanford Reach National Monument was established in 2000 through Presidential Proclamation and is primarily managed by the United States Fish & Wildlife Service with a portion managed by DOE. The Hanford Comprehensive Land Use Plan Environmental Impact Statement (HCP-EIS) led to a ROD decision that DOE will plan land use for the Hanford Site for at least 50 years.[4] One of the elements of the land use plan implementing procedures are administrative procedures for reviewing and approving use requests. The planned land use for the majority of Hanford is

[4] Department of Energy, *Final Comprehensive Land Use Plan Environmental Impact Statements*, DOE/EIS-0222-F at 1-1 (Sept. 1999).

conservation/mining, while the central part of Hanford is planned for industrial use (waste management).

The HCP-EIS is a DOE document. The Hanford-affected Tribes, the State of Oregon, and others have repeatedly expressed concerns about how that document can limit future land use choices. DOE conducts cleanup to meet a certain designated future land use, which then may limit or restrict future use of the land. The Tribes are particularly concerned how this may impact traditional Tribal uses of the land and its resources. In fact, the Tribes and DOE essentially "agreed to disagree" on the extent of the applicability of certain tribal treaty rights in order to allow the land use planning process to proceed. However, the HCP-EIS specifically states that the future land use designations identified within it are not intended to influence the resolution of any treaty rights dispute between the Tribes and DOE.[5]

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

DOE has issued several final Records of Decision for waste disposal facilities, indicating that some waste will remain at Hanford forever and that institutional controls will be necessary far into the future. This includes the Environmental Restoration Disposal Facility, the Integrated Disposal Facility, two RCRA mixed-low-level waste disposal trenches, and a disposal trench for Navy reactor compartments. Each of these disposal facilities will eventually be covered by an engineered surface barrier. In addition, a final decision has also been made to collapse a processing canyon in place and cover it with an engineered surface barrier. Similar disposition of Hanford's remaining four processing canyons is expected. DOE is also considering fairly extensive capping throughout Hanford's Central Plateau, including the underground high-level waste tank farms, liquid waste disposal sites, and solid waste disposal trenches. The regulatory processes for those decisions will occur in coming years.

c. *What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?*

Remove, treat (as necessary) and dispose (RTD) has been the preferred approach to cleanup along the Columbia River shoreline. To date over 18 million tons of waste have been disposed in the ERDF. When the disposed waste doesn't meet LDR standards, grouting/macro-encapsulation has been a preferred treatment method. A recent ARAR waiver for ERDF allows disposal of high-dose radioactive waste with grouting in situ rather than prior to placement.

Pump-and-treat has been the preferred approach to groundwater treatment, though several types of chemical barriers have been experimented to either lock the contaminants in place or change their toxicity.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

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[5] Department of Energy, *Final Comprehensive Land Use Plan Environmental Impact Statements*, DOE/EIS-0222-F at 1-32 (Sept. 1999).

The Hanford LTS Program Plan (DOE-RL 2010-35) establishes the work activities required to implement the Hanford LTS program. RL has contractually directed Mission Support Alliance (MSA) to manage the LTS Program on those portions of the Hanford site where CERCLA closure activities have met the requirements of the respective decision documents. RL's direction is specific to areas within the River Corridor and does not include areas of the Central Plateau, Hanford Reach National Monument lands, or any work activities associated with the Hanford Groundwater program.

The specific contractual work activities associated with Hanford LTS include:

- Program Management
    - Project Management
    - Information Management
    - Communications
- Manage site specific and site wide Institutional Controls
- Annual assessment of ICs and reporting
- Surveillance and Maintenance of Waste Site remedies
- Surveillance and Maintenance of the six reactors in Interim Safe Storage (ISS)
- Manage inactive Underground Injection control (UIC) wells, pre-Hanford wells and sewage systems
- Prepare the CERCLA five-year review report
- Manage the balance of re-vegetation monitoring requirements and re-plant failed vegetation areas

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

The RL Hanford LTS Program will execute the LTS work activities until the property is transferred to DOE Legacy Management (LM) which is currently estimated to occur around 2060. During that period of time, RL will continue to evaluate the work activities in the LTS program to identify the most efficient and cost-effective methods to manage the site. Currently, the CERCLA surveillance and maintenance activities in the LTS Program are a small portion of the Hanford Site work scope. As the groundwater program continues to make progress, RL may decide to include groundwater treatment systems that are operating properly and successfully into the LTS program. Similarly, waste sites with engineered barriers on the Central Plateau may too be transitioned to the LTS Program. To facilitate a smooth transfer to LM in 2060, it is anticipated that the majority of the site will be a part of the LTS Program prior to that time.

Currently, the Surveillance and Maintenance activities associated with LTS are included in the LTS Surveillance and Maintenance Plan (HNF-54166) and the Surveillance and Maintenance Plan for 105-C, 105-D, 105-DR, 105-F, 105-H and 105-N/109-N Safe Storage Enclosures (DOE/RL-2016-21). HNF-54166 is updated as new geographic areas in the River Corridor and new work activities are added to the LTS program. These two plans form the foundation of Surveillance and Maintenance activities for LTS.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if* *applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

The Hanford Site Tri-Party Agreement results in decisions that require long-term monitoring for some waste sites where natural attenuation (including radioactive decay) is part of the selected remedy. There are no agreements specific to LTS. The current LTS work scope is included in the MSA Contract and funded by RL. The LTS scope is managed by MSA under the Real Estate Services group. RL is responsible for oversight of the mission support contract with MSA.

Once lands are transferred to LTS there must be a process to ensure that Tribal concerns and rights under the Treaties are respected and observed.

The Hanford-affected tribes each have a responsibility to their people to manage the resources that underpin their treaty reserved rights and resources. Each tribe has a Cooperative Agreement with the USDOE to engage technical and policy staff on issues at Hanford including the nexus of LTS activities and treaty resources. In support of this effort the Confederated Tribes of the Umatilla Indian Reservation has a Memorandum of Understanding with the USDOE to define a path to increase site access for tribal members.

g. Provide a summary of any funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the State and/or Tribe.

The Department of Energy funds the LTS program as part of the MSA contract. Funding is dependent on the funding DOE receives on an annual basis. There is currently no legal driver for LTS, but the Tribes believe that DOE should include an LTS line item that receives some minimum percentage of funding. Funding is provided by DOE to the States of Washington and Oregon, the Confederated Tribes and Bands of the Yakama Nation, the CTUIR and the Nez Perce Tribe. In addition, each tribal organization receives funding from other agencies such as the Bonneville Power Administration to monitor and manager river resources, including those that reside in the stretch of the Columbia River that flows past the Hanford Site. For example, the CTUIR and the Yakima Nation have a long-standing project to tag and monitor fall Chinook salmon along the Hanford Reach.

Idaho National Laboratory Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The INL Site is located in southeastern Idaho and occupies 890 mi^2 (570,000 acres) in the northeastern region of the Snake River Plain. Populations potentially affected by cleanup activities include government, contractor, and subcontractor personnel who are employed at the INL Site; Shoshone-Bannock tribal members whose aboriginal homelands included the INL Site area; ranchers who graze livestock in areas on or near the INL Site; occasional hunters on or near the INL Site; visitors to the INL Site; highway travelers along U.S. Highway 20/26; residential populations in neighboring communities; and users of the Snake River Plain Aquifer, which extends from the Montana border in the north to the Magic Valley in south-central Idaho, and flows under a good portion of the INL Site. Currently, over half of the INL Site is open to grazing through BLM-administered permits. No residents are located within the INL Site boundary. Regionally, the INL Site is nearest to the cities of Idaho Falls and Pocatello and to U.S. Interstate Highways I-15 and I-86. The INL Site extends nearly 39 mi from north to south and is about 36 mi wide in its broadest southern portion. The U.S. Department of Energy (DOE) administers the land within the INL Site. Access to the INL Site is controlled. For cleanup decision making purposes it is assumed that the INL Site will remain under government ownership and control until at least 2095 and during that time no residential development (e.g., housing) will occur within the INL Site boundary. The boundary is currently static. Portions of the INL Site will be managed beyond 2095 under the long-term stewardship program.

The Snake River Plain is a large flat valley surrounded by mountains. Air masses crossing this mountain barrier lose most of their moisture before entering the Snake River Plain. Because of this rain shadow effect, the INL Site receives only about 8.6 in. of average annual precipitation, and the region is classified as semiarid. As noted above, the Snake River Plain Aquifer underlies the INL Site, and is one of the most productive aquifers in the U.S. The Snake River Plain Aquifer serves as a drinking water and irrigation supply source for much of southeastern Idaho. It was designated as a sole source aquifer by the U.S. Environmental Protection Agency (EPA) in 1991.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

The INL Site is located within the vast aboriginal homelands of the Shoshone and Bannock people. The Shoshone and Bannock people were forcibly placed on a reservation set aside for the various bands of Shoshone and Bannock. The reservation that the Shoshone and Bannock people now reside on is known as the Fort Hall Reservation which is located 50 miles southeast of the INL Site. Since the construction of the nuclear site (INL), access for Tribal purposes was greatly impacted. The INL Site once provided subsistence to tribal people with the abundance of big game, small game, burrowing animals, plants and water. The Site also provided important sacred areas to the Tribal people. It was also the main travel corridor to important fishing, hunting and gathering areas. The presence of facilities has greatly impacted Tribal hunting, gathering, and limited access to sacred sites and travel. The INL Site also hosts hundreds of pre-contact archaeological and sacred sites; and with the INL Site being only about 10%

surveyed for archaeological resources, there are thousands of unknown pre-contact archaeological sites within the INL Reservation. Past DOE projects and missions have substantial adverse impacts to resources on the INL Site, with the construction of facilities, test bombing ranges and overall ground disturbances. Future projects, involving construction and generation and storage of waste on the INL Site will continue to have adverse impacts to the unknown sites.

c. *Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.*
   Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

Twenty five CERCLA records of decision (ROD) have been issued for INL Site cleanup between 1991 and 2009. These RODs are all now being implemented to address a wide range of radioactive, organic and inorganic contaminant release sites, including unexploded ordnance from historic military activities. The greatest number of contaminated sites includes relatively small areas where the contaminants were released through spills or pipeline leaks. When these sites are found to pose an unacceptable risk to human health and the environment the contaminated soil is typically removed and disposed at an onsite CERCLA disposal cell. The most significant cleanup efforts, which are ongoing at the INL Site, involve: 1) remediation of a ground water plume of Trichloroethylene (TCE) caused by waste water being historically disposed by injecting it into the subsurface via an injection well. This is being addressed by a combination of in-situ bioremediation, pump and treat, and natural attenuation. 2) Remediation of a historic 100-acre subsurface disposal area where transuranic and organic contamination were disposed in pits and trenches. This site is being addressed by a combination of exhumation and offsite disposal of the most highly contaminated areas, vacuum extraction of subsurface organic vapors, and ultimate installation of a surface barrier.

d. *Describe any additional cleanup accomplishments undertaken or completed since 1999.*

See above response, specifically the 25 records of decision that have all been implemented.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

There is a single disposal facility for wastes generated by CERCLA remediation activities at the INL Site. It is a modern, engineered disposal cell with synthetic liners, leak detection, and leachate collection capabilities. This facility receives a variety of organic, inorganic and low-level radioactive contaminated materials, e.g., soils and demolition debris. The disposal cell has an approximate capacity of 390,000m^3. As of the end of FY2015, approximately 290,000 m^3 (approaching 75% capacity) have been disposed of in the cell to date. Information regarding total curie count disposed of in the ICDF landfill cell can be found in the FY2015 Annual Performance Assessment and Composite Analysis Review for the ICDF Landfill located in the INL Administrative Records repository at https://ar.icp.doe.gov.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

There are currently no plans for onsite disposal of remediation-derived waste beyond the capacity of the single disposal cell noted above, which is anticipated to take several years. Waste types that will be disposed will continue to be contaminated soils and demolition debris. However, a detailed estimate has not been completed.

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*

The single largest CERCLA remediation-derived waste stream that is to be shipped offsite for disposal is the exhumed buried waste from the 100-acre subsurface disposal area noted above. The vast majority of this waste is transuranic and is planned to be disposed at the Waste Isolation Pilot Plant (WIPP) in New Mexico. To date, over 7,500 cubic meters of this waste has been exhumed and packaged and over 5,700 cubic meters has been shipped to WIPP for disposal. When exhumation of the subsurface disposal area is completed it is anticipated that the amount of waste exhumed for WIPP disposal will approach 10,000 cubic meters. Much smaller amounts of remediation-derived waste is also sent for offsite disposal at commercial facilities or DOE’s Nevada site as necessary.

It should be noted that in addition to remediation-derived waste, DOE also manages other radioactive waste streams:

- The INL Site stores spent nuclear fuel and high-level radioactive waste that is ultimately destined for offsite disposal in a geologic repository.
- DOE is in the process of treating over 65,000 cubic meters of stored transuranic waste for disposal at WIPP. About 51,000 cubic meters have already been sent to WIPP or commercial disposal sites.
- Remote-handled low-level radioactive waste that is generated from ongoing site nuclear operations is disposed onsite in accordance with applicable requirements and standards, e.g., DOE Orders).
- Contact-handled low-level radioactive waste generated during site nuclear operations is sent for offsite disposal at commercial facilities or DOE’s Nevada site.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

No attempt has been made to estimate the total amounts of contaminated materials that are expected to be left in place once remediation is complete. CERCLA cleanup decisions are risk-based, following the CERCLA process. Cleanup decisions documented in CERCLA RODs are made following the CERCLA criteria. Two notable areas where waste will be left in place are the CERCLA disposal cell noted above with an estimated capacity of 390,000 m^3; and the 100-acre subsurface disposal area noted above, which will ultimately be capped after 5.69 acres of the most highly contaminated waste has been exhumed and shipped offsite for disposal at WIPP in accordance with the CERCLA ROD.

II. Decision Processes

a. State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.

Wastes generated on an ongoing basis by site operations are managed in accordance with applicable environmental regulations, e.g., RCRA. However, environmental remediation at the INL site falls under CERCLA and the 1991 CERCLA-based Federal Facility Agreement/Consent Order jointly signed by DOE with the state of Idaho and U.S. EPA Region 10. In accordance with CERCLA, the substantive requirements of environmental requirements are applied in each CERCLA ROD using the CERCLA process for establishing Applicable, or Relevant and Appropriate Requirements (ARAR). The 1995 Settlement Agreement between DOE, the State of Idaho and the U.S. Navy requires treatment and offsite disposal of radioactive waste.

b. How are the tribe(s) and/or the state(s) involved in the decision process?

As a signatory to the CERCLA FFA/CO, the state of Idaho has direct regulatory authority over CERCLA remediation at the INL Site. The Idaho Operations Office has a formal, government-to-government relationship with the Shoshone-Bannock Tribes (Tribes) of Fort Hall, Idaho. The federal government's trust responsibility to the Tribes provides a unique government-to-government relationship that provides communication and formal consultation between DOE and Tribes. The protection of reserved rights on aboriginal lands of the INL Site is important to The Shoshone-Bannocks Tribes. Shoshone-Bannock Tribes (The Tribes) do not have a regulatory role on the INL Site; however, the Tribes have an oversight role on activities affecting Tribal interests, which is established through the Agreement in Principle, signed by the Tribes and DOE. The Agreement captures the essence of their formal relationship and commits both parties to focus and formally interact on areas of mutual concern that includes, but is not limited to, impacts, or potential impacts to the environment, and cultural resources on the INL Site. DOE and DOD provides notifications required through NEPA and NHPA processes that may occur on the INL Site. Communication and notifications are provided to the Tribes as agreed upon through the AIP and required by federal regulations. Tribes respond formerly through communication exchanges (email, formal letters, comments) and provide input from the Tribes' subject matter experts (SMEs) on decisions that could potentially impact the Tribes' safety, environment, or cultural resources. The Tribes' input to the decision process is part of project development and risk assessment during evaluation of paths forward. The Department and its contractors routinely hold meetings on the Fort Hall Reservation to brief the Fort Hall Business Council (the elected governing body), and other members of their technical staff on project activities. We also solicit their opinion and comments and they become part of our records of decision. Communication is initiated by each of the governments on activities that potentially impact the Tribes and their original ancestral lands located on the INL Site. Tribes engaged regularly through communication with the Tribal Liaison, DOE representatives, and the DOE-ID Manager. Furthermore, consultation provides the Tribes with a forum between the Tribal Council and DOE on areas where more discussion and resolution is needed. These engagements ultimately lead to conclusions and agreements to resolve any issues between the Tribes and DOE.

c. Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.

As noted above, there have been 25 CERCLA Records of Decision (RODs issued for INL Site cleanup between 1991 and 2009. These RODs were issued in accordance with CERCLA and are signed after public comment by all three agencies (DOE, EPA, state of Idaho) who are signatories to the INL Site's CERCLA agreement, the FFA/CO. In accordance with CERCLA, cleanup decisions are risk-based, addressing the CERCLA cleanup criteria. These RODs and supporting documentation are available to the public at the INL site CERCLA Administrative Record and Information Repository Web site at https://ar.icp.doe.gov/. Other non-CERCLA closure decisions for ongoing operations will be made in accordance with applicable regulations, e.g., RCRA.

CERCLA requires that the agencies evaluate remedial actions every 5 years to determine if the selected remedies remain protective of human health and the environment. The third INL Site-wide 5-Year Review covering the period from October 1, 2009, to September 30, 2014 concluded that the remedies selected at the INL Site are currently protective, or expected to be protective upon completion. The Idaho Department of Environmental Quality and the EPA reviewed and concurred on the findings. The 5-Year Review report can be found on the INL Administrative Record where it was posted during February 2016.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?

CERCLA decisions as documented in CERCLA RODs are risk-based and made in accordance with CERCLA criteria. Land use assumptions vary from residential to industrial scenarios based on the expectation, negotiated among the agencies who are signatories to the CERCLA agreement, that the DOE will maintain access control through at least 2095. Therefore, remedial action objectives are based on that expectation. However, there is no actual expectation or planning that the majority of the INL Site will ever be released from Federal Government control.

b. Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.

As noted above there is only one CERCLA disposal cell for CERCLA-generated waste disposal on the INL Site. It is a modern, double-lined cell with leak detection and leachate collection capability. Where contamination has been left in place, LTS falls under a regulatory agency approved Institutional Control Operations and Maintenance Plan, which requires ongoing maintenance and at least annual inspections. In addition, a formal CERCLA statutory review is conducted every five years to evaluate and verify that the remedies in place remain effective and will meet remedial action objectives. This is all conducted under full regulatory agency review by the state of Idaho and EPA as signatories to the site CERCLA agreement, the FFA/CO.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

As noted, all CERCLA decisions are based on CERCLA criteria for remedy selection, which emphasize reduction in toxicity, mobility, or volume through treatment. Therefore, the feasibility of treatment technologies applicable to the specific contamination being addressed is evaluated prior to issuing each CERCLA ROD. Among the key treatment technologies that have been used are: vacuum extraction of organic vapors from the vadose zone and destruction of those vapors via catalytic oxidation; treatment of pumped TCE contaminated ground water using an air stripper; and in-situ bioremediation of an organic ground water plume. The treatment technologies that have been evaluated but not ultimately selected include in-situ vitrification, thermal treatment, and soil washing.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

For the CERCLA remedies where contamination has been left in place, LTS requirements are documented in and directed by the INL Site-wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions. This plan was approved by regulatory agencies that also monitor its implementation, including review of annual reporting and annual inspections. The plan is updated as necessary to ensure all LTS requirements remain current. For example, CERCLA statutory 5-year reviews, which are conducted every five years for all remedies requiring LTS, may result in recommendations for adjustments to LTS requirements. This plan is the mechanism for implementing such recommendations.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

As noted above, the LTS plan is the INL Site-wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions. In general, institutional controls required by the plan include restrictions on land use, access and zoning as well as physical barriers, signage and administrative methods to preserve information and data for the purpose of informing current and future generations of hazards and risks. In addition, CERCLA RODs may require environmental monitoring to verify effectiveness. In these cases individual monitoring plans, approved by regulatory agencies, are maintained. These plans, as with all key CERCLA documents, are available at the INL site CERCLA Administrative Record and Information Repository Web site at https://ar.icp.doe.gov/.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

As noted above, the LTS plan is the INL Site-wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions. The plan was approved by regulatory agencies (i.e., EPA and the state of Idaho) who are parties to the CERCLA agreement, the FFA/CO. Compliance with the requirements of the plan is also monitored by these regulatory agencies, including review of annual reporting and annual inspections

The Tribes do not have a formal agreement with DOE regarding their role in long-term stewardship. The Tribes are looking forward to working with DOE to include in the formal AIP for the Tribes future responsibilities in long-term stewardship. We understand that DOE's trust-responsibility and DOE Order 144.1, communication and notifications are still required when the Tribes' could be potentially impacted by activities on the INL site.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*

Funding for LTS at the INL Site is included in the funding provided for most operations and cleanup activities by the U.S. Congress as part of the Energy and Water appropriation via the standard Federal Government budgeting and appropriations processes. Funding requests are based on estimates for completing specific scope requirements, such as those required by the INL Site-wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions. Oversight by the state of Idaho is funded via a grant from DOE that is renewed every five years. No funding is currently provided to the EPA that is funded by Congress independently. Pursuant to the provisions of the negotiated Agreement in Principle, between the DOE and the Shoshone-Bannock Tribes, and the negotiated funding agreement, the Tribes, through the Tribal/DOE office (the Tribes' Department), have discretionary authority to utilize) for Tribal Technical Staff and consultants to be involved and provide input on activities of Tribal concern. Involvement in environmental monitoring, cultural surveying, public safety and communication on operations allow the Tribes' to remain informed and serve as a Tribal presence on the INL Site. Although the existing negotiated funding provides a broadness of activities, future negotiations can potentially provide more funding and Tribal responsibility for long-term stewardship activities.

Los Alamos National Laboratory

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The U.S. Department of Energy (DOE) owns the Los Alamos National Laboratory (LANL). LANL is located in north-central New Mexico, approximately 60 air miles north-northeast of Albuquerque and 25 miles northwest of Santa Fe. The 43 square-mile site is on the Pajarito Plateau. The ephemeral and intermittent streams that drain the Plateau have created numerous narrow finger-like mesas, whose tops range in elevation from approximately 7,800 feet on the flank of Jemez Mountains to 6,200 feet at their eastern edge above the Rio Grande Valley. The eastern margin of the plateau stands 300 to 900 feet above the Rio Grande.

Since its inception in 1943, the Laboratory's primary mission has been nuclear weapons research and development. Its current central mission is reducing global nuclear danger.

Present DOE plans call for continued operation of LANL for the foreseeable future.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

The Laboratory shares a boundary with the Pueblo of San Ildefonso Sacred Area site. The Technical Area 54 waste disposal areas share this boundary. In addition, the Chromium groundwater plume is in close proximity to this site.

In addition to the Pueblo de San Ildefonso, Santa Clara Pueblo, Pueblo of Jemez, and the Pueblo de Cochiti are Pueblos that have agreements (known as "Accords") and cooperative agreement grants with the Department of Energy.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.
Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

The following is a description of the environmental remediation and legacy waste program work at LANL. This work is conducted under the responsibility of the DOE Office of Environmental Management's Los Alamos Field Office (EM-LA).

The EM-LA cleanup scope includes legacy waste remediation and disposition, soil and groundwater remediation, and the demolition, deactivation and disposition of excess buildings and facilities.

The EM investigation and cleanup, where required, of an estimated 2,123 legacy potential release sites and disposal of approximately 10,000 cubic meters of legacy radioactive waste above ground at LANL has been ongoing for over 26 years (1989 to 2016). To date, 1,168 potential release sites have been investigated and cleaned up where required; the remaining 955 potential release sites remain to be cleaned up. An estimated 5,000 cubic meters of legacy waste remains, of which approximately 2,400 cm is retrievably stored below ground.

The remaining legacy cleanup activities are organized under campaigns as follows: (note: Material Disposal Area (MDA) cleanup campaigns are covered under section IIIb below)

1. Royal Demolition Explosive (RDX) Characterization Campaign

   Technical Area (TA) 16, located in the southwestern corner of the Laboratory, was established to develop explosive formulations, cast and machine explosive charges, and assemble and test explosive components for the nuclear weapons program. Present-day use of this area is essentially unchanged, although facilities have been upgraded and expanded as explosives and manufacturing technologies advanced. TA-16 is bordered by Bandelier National Monument along State Highway 4 to the south and by the Santa Fe National Forest along State Highway 501 to the west.

   The RDX Characterization Campaign includes: 1) potential interim measures or surface activities to prevent further migration of RDX resulting from historical activities and 2) characterization of the intermediate/regional groundwater through well installation, tracer studies and source control necessary to conduct a corrective measures evaluation.

2. RDX Remedy Campaign

   Upon completion of the interim measures campaign, a corrective measures implementation report and will be executed after receiving the statement of basis decision from NMED. Potential corrective measures that may be applied to this problem include pump & treat system that consists of pumping and treatment of contaminated groundwater from extraction wells followed by treatment and land application or injection to the subsurface of the treated water; in-situ bioremediation; and monitored natural attenuation.

3. Chromium Interim Measure and Characterization Campaign

   Hexavalent Chromium (CrVI) is present in the subsurface in the vadose zone (including in perched intermediate groundwater) and regional aquifer beneath Sandia and Mortandad canyons. Investigations identified the probable Cr source was cooling tower effluent released near the head of Sandia Canyon between 1956 and 1972. Chromium was transported down the canyon in surface-water flow with a portion of the releases absorbed into the surface, migrating vertically to the water table.

   Interim measures is expected to control the movement of the chromium plume while characterization activities provide the data necessary to determine the final remedy which is presumed to be long-term pump and treat system that removes chromium from the regional aquifer. The characterization work will be conducted to determine whether extraction can achieve active long-term chromium removal from the regional aquifer and if in-situ remediation is an option.

4. Chromium Final Remedy Campaign

   Building on the Chromium Interim Measure and Characterization Campaign, DOE will analyze the results and develop a corrective measures implementation upon approval of the statement of basis decision from NMED. The current plan is to develop a pump & treat system that will continue to extract contaminated groundwater and that will flow through treatment units to remove the contamination and inject the clean water back into the aquifer. This remedy will be very similar to the interim measures except at a much higher rate of groundwater extraction. Additionally, the final remedy will likely include an in-situ remediation technology that will assist in reducing the hexavalent chromium into the less toxic form of trivalent chromium.

5. Supplemental Investigation Reports Campaign

   This campaign includes preparation and submission of ten supplemental investigation reports and, where appropriate, submission of requests for Certificates of Completion (a certificate of completion is issued by NMED for sites that are determined not to need any further investigation or cleanup actions).

   Previous investigations were conducted for the ten aggregate areas listed below and the results were reported in Investigation Reports (IR). Following submittal of these IRs, NMED updated its position on defining nature and extent of contamination. Therefore, the data for aggregate areas, where IRs have already been submitted, will be reevaluated to determine if existing data is sufficient to determine the nature and extent of contamination for SWMUs and AOCs in each of the ten aggregate areas and whether each SWMU or AOC poses an unacceptable risk to human health and the environment. The supplemental IRs will present the data and evaluated based on NMEDs new position.

   These aggregate areas include the following:
   - S-Site Aggregate Area (Submitted)
   - Potrillo and Fence Canyons Aggregate Areas (Submitted)
   - Threemile Canyon Aggregate Area (Submitted)
   - TA-49 inside the Nuclear Environmental Site Boundary (Submitted)
   - TA-49 outside the Nuclear Environmental Site Boundary (Submitted)
   - Cañon de Valle TA-14
   - North Ancho Canyon Aggregate Area
   - Lower Sandia Canyon Aggregate Area
   - Upper Cañada del Buey Aggregate Area
   - Upper Mortandad Canyon Aggregate Area (Submitted)

6. Historical Properties Completion Campaign

   This campaign involves additional investigation and remediation as necessary for: 1) sites located in the historical location of the Laboratory at or adjacent to what is now the Los Alamos Townsite and 2) former Laboratory properties that were transferred and are private properties or that require access through private property.

- Rendija Canyon Aggregate Area triennial ordnance surveys and biennial asphalt survey/removals
- Pueblo Canyon Aggregate Area Phase II submit requests for certificates of completion
- Upper Los Alamos Canyon Aggregate Area cleanups and Phase II IR
- Middle Los Alamos Canyon Aggregate Area PCB cleanup at AOC 02-011(a), ECO-Risk studies, and Phase II IR

7. Technical Area (TA)-21 Demolition and Cleanup Campaign

   This campaign includes the removal and remediation of buried waste lines and contaminated soils to be performed as part of the DP Site Aggregate Area investigation. Demolition of facilities and slabs are not part of the Consent Order and will be executed under DOE requirements; the facilities to be demolished include the DP West slabs and the Radiological Liquid Waste Treatment Facility, TA-21-257, enabling access to the SWMUs and AOCs.

8. Southern External Boundary Campaign

   This campaign includes, as appropriate, initial investigations, remediation of media above soil screening levels, risk assessments, and certificates of completion for three aggregate areas. Aggregate Areas have generally been investigated from north to south across the Laboratory. These three areas are in the border area between the Laboratory, Bandelier, and White Rock populated areas.

   This campaign shall be conducted in the following areas:

   - Chaquehui Canyon Aggregate Area Initial Investigation (43 sites remaining to investigate)
   - South Ancho Canyon Aggregate Area Initial Investigation (11 sites remaining to investigate)
   - Lower Water/Indio Canyon Aggregate Area Initial Investigation (7 sites remaining to investigate)
   - North Ancho Canyon Aggregate Area Phase II (26 sites remain for further investigation)
   - Potrillo/Fence Canyon Aggregate Area Phase II (26 sites remain for further investigation)

9. Sandia Canyon Watershed Campaign

   This campaign includes completion of several investigations that are already in progress in the central portion of the Laboratory for certain Aggregate Areas, it contains approximately 49 SWMUs/AOCs, in the following Aggregate Areas:

   - Upper Sandia Canyon Aggregate Areas Phase II Investigations
   - Lower Sandia Canyon Aggregate Areas Phase II Investigations
   - Upper Mortandad Canyon Aggregate Area Phase II Investigation
   - Upper Cañada del Buey Aggregate Area Phase II Investigation

10. Known Cleanup Sites Campaign

This campaign includes soil removal from nineteen sites that previous investigations identified have hazardous contaminants at concentration that exceed the target risk levels of 10-5 lifetime excess cancer risk for carcinogenic contaminants and a hazard index (HI) of 1 for non-carcinogenic contaminants.

The scope includes planning, procurement, readiness, surveys, mobilization, cleanup, waste management, sample collection, sample analysis, data analysis, risk screening, and report preparation activities. The estimated total volume of soil/debris to be removed and the associated waste type is included. Potential waste types include industrial waste, low-level radiological waste, PCB waste and mixed PCB wastes.

The sites to be included in this campaign were selected by reviewing the information contained in existing investigation reports. The objective was to identify those sites where further activity and/or cleanup was recommended. Following the review of existing information, nineteen sites were identified as sites known to require a prioritized cleanup. Eighteen of these sites require soil/debris cleanup totaling 7,178 cubic yards (CY).

Sites:
03-049(a) 6 cubic yards (CY) of PCB waste
03-049(b) 22 CY total; 7 CY industrial, 15 CY mixed PCB
03-049(e) 19 CY industrial
50-006(d) 2,000 CY low level
46-004(q) 111 CY mixed PCB
16-026(b) 17 CY industrial
36-001 2,519 CY total; 519 CY industrial, 1,800 CY low level, 200 CY mixed PCB
15-008(b) 355 CY low level
15-007(c)-00 4 CY low level
36-008 1,430 CY low level
C-36-003 500 CY PCB
14-006 12 CY low level
14-009 15 CY low level
39-002(a) 56 CY mixed PCB
39-007(a) 10 CY low level
39-001(a) 75 CY PCB
39-001(b) 10 CY PCB
53-001(a) 19 CY PCB
15-010(b), a settling tank estimated to contain100 gallons of liquids requiring disposal as an industrial waste.

All sites will be cleaned up to the approved risk-based cleanup criteria to achieve risk reduction at each location. Chemicals of potential concern (COPCs) will be identified to focus the cleanups on the constituents driving the risk. Confirmatory samples will be collected to verify that cleanup objectives have been achieved. Waste samples will be collected to characterize wastes for off-site disposal.

11. Pajarito Watershed Campaign

This campaign includes initial investigations in some Aggregate Areas for which investigation has not yet occurred as well as completion of those investigations that are already in progress for other Aggregate Areas in the central portion of the Laboratory. For these areas, this campaign includes remediation, as appropriate, for media above soil screening levels. This campaign includes the following:

- Starmer/Upper Pajarito Canyon Aggregate Area Initial Investigation (77 SWMUs/AOCs)
- Sites in this aggregate include septic tanks, outfalls, sumps, drain lines, and a number of soil contamination areas associated with burned-in-place, WWII-era HE storage and process buildings at TA-08, -09, -22, -40, and -69. Two 900-ft wells will be installed to provide characterization and long-term monitoring of water quality and water levels at TA-09.
- Two-mile Canyon Aggregate Area Initial Investigation (58 SWMUs/AOCs)
- Sites in this aggregate include industrial wastewater sumps, outfalls, waste lines, sump, storm drainages, a construction debris landfill site, storage areas, tank and associated equipment at TA-03; three inactive firing sites, a storage area, and a decommissioned building at TA-06; and a septic system and scrap burn site at TA-40.
- Three-mile Canyon Aggregate Area Phase II Investigation (25 SWMUs/AOCs)
- Sites in this aggregate include active and inactive firing sites, surface disposal areas, buildings, septic tank outfalls and sumps, and miscellaneous sites such as the radioactive lanthanum site, sandbags, aluminum pipe, a one-time HE burn area, and shafts at TA-12, -15 and -36.
- Lower Pajarito Canyon Aggregate Area Initial Investigation (47 SWMUs/AOCs)
- Sites in this aggregate include firing sites and impact areas, storm drains/drain lines/outfalls, holding tanks and contaminated soil at TA-18.

12. Upper Water Watershed Campaign

This campaign includes initial investigations in some Aggregate Areas for which investigation has not yet occurred as well as completion of those investigations that are already in progress for other Aggregate Areas. For these areas, this campaign includes remediation, as appropriate, for media above soil screening levels. This campaign includes the following:

- Cañon de Valle TA-15 Initial Investigation (20 SWMUs/AOCs)
- Cañon de Valle TA-16 Initial Investigation (101 SWMUs/AOCs)
- Cañon de Valle TA-14 Phase II Investigation (23 SWMUs/AOCs)
- Upper Water Canyon Aggregate Area Initial Investigation (129 SWMUs/AOCs)
- S-Site Canyon Aggregate Area Phase II Investigation (61 SWMUs/AOCs)

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

As described above, the EM investigation and cleanup, where required, of an estimated 2,123 legacy potential release sites and disposal of approximately 10,000 cubic meters of legacy radioactive waste above ground at LANL has been ongoing for over 26 years (1989 to 2016). To date, 1,168 potential release sites have been investigated and cleaned up where required; the remaining 955 potential release sites remain to be cleaned up. An estimated 5,000 cubic meters of legacy waste remains, of which approximately 2,400 cm is retrievably stored below ground.

e. Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).

Waste.
The Laboratory produces several waste types: Low-level, transuranic, radioactive liquid, chemical and mixed low-level. Chemical waste includes Resource Conservation and Recovery Act (RCRA) hazardous waste and other regulated waste such as asbestos and polychlorinated biphenyls, or PCBs. The remaining legacy waste campaigns are further described in section I.f. below.

Low-level waste.
Low-level is disposed of on site at a location known as the Technical Area (TA) 54, Area G. This site has been used for disposal since 1957. The volume of low-level waste disposed to date at Area G is approximately 250,000 cubic meters. There are no plans for future retrieval of these low-level wastes. The Laboratory generates approximately 3,000 to 5,000 cubic meters of low-level waste each year. A volume reduction program is part of present practices.

LLW minimization is driven by the requirement of DOE Order 5820.2-A(DOE 1988), the limited capacity of the on-site disposal facility, and other federal and DOE regulations.

Transuranic.
As much as 95 percent of legacy TRU waste at the Laboratory may be mixed TRU waste; that is, waste containing hazardous components as regulated by RCRA. Approximately 5,000 cubic meters of TRU and mixed TRU waste is in interim storage in Area G. Legacy and newly generated waste of this type will be disposed of at the Waste Isolation Pilot Plant (WIPP).

DOE expects shipments will resume in 2017, continuing until 2030-2035 under current budget targets. The Laboratory generates between 100 and 200 cubic meters of TRU waste (including mixed TRU waste) yearly. Starting in 1997, LANL began to retrieve TRU waste from earthen-covered pads.

Over 10,000 cubic meters of TRU and mixed TRU wastes were stored at the Laboratory.
Of this volume, an estimated 5,000 cubic meters of legacy waste remain, of which 2,400 cubic meters are considered buried TRU and MTRU wastes, and can be removed from inventory waste to be sent to WIPP.

The remaining volume is considered retrievably stored, and under consideration for shipment to WIPP. Much of the legacy waste may have to be repackaged for shipment to WIPP, generating significant volumes of secondary waste (both repackaging volume and waste generated by repackaging).

Radioactive liquid.
Radioactive liquid waste management involves collection and treatment of radioactive contaminated water-based waste. Separation processes are used to concentrate the radioactive constituents into a solid. The solid is either disposed of as low-level waste at TA-54, Area G, or stored as a transuranic waste at Area G pending shipment to WIPP. The treated waste waters discharge into Mortandad Canyon which drains through San Ildefonso Pueblo lands to the Rio Grande. There is an Environmental Protection Agency national pollutant discharge elimination system (NPDES) permit. Chemical waste. LANL generates about 750 cubic meters of chemical waste each year. All these wastes are shipped off site for treatment and disposal.

Radioactively contaminated asbestos waste is disposed of on site at TA-54, Area G.

Mixed low-level waste.
These wastes are radioactive and subject to the Atomic Energy Act, and also meet hazardous waste criteria set forth by RCRA, as well as the New Mexico Hazardous Waste Act. The Laboratory generates between 50 and 75 cubic meters yearly of such waste. The Laboratory plans to ship mixed low-level waste to DOE sites in Idaho and Tennessee that have capabilities for treatment of mixed waste, as well as to commercial waste treatment and disposal facilities located out of state that are permitted to treat/dispose of hazardous waste and licensed to manage radioactive materials.

By-product materials. The waste is not categorized by by-product or source.
The total curies is not readily available; about 1 million curies have been disposed at Area G.
Waste contained in shafts. About 200 shafts contain tritium waste, high activity waste, animal tissues, PCB waste, and beryllium.

f. To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.

i. Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).

Current plans are to ship all legacy cleanup derived waste off-site.

ii. Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?

The types of wastes and disposition pathways are described in Section I.e. above. Disposition pathway of wastes depend on waste type, and for non-TRU waste, commercial facilities for waste treatment and disposal are considered where appropriate. The following is list activities from the Radioactive Waste Disposition Campaign that describes the amount and type of TRU waste to be dispositioned from below ground at Technical Area -54:

1. Hot Cell Liners/Other

Retrieval of waste from shafts contain 5 Hot Cell Liners, 5 Tritium Packages, and a single waste package referred to as the 17th RH Canister. These vertical lined shafts extend above grade, have concrete caps or steel plates covering the top of the staff and were augured vertically into the mesa in Area G at TA-54. A corrugated metal liner was then inserted in the hole and gravel was placed in the bottom. Concrete caps were placed on top of the shafts containing the Tritium Packages and the 17th RH Canister and steel plates were placed atop the shafts containing the Hot Cell Liners.

2. Corrugated Metal Pipes

Galvanized metal pipes, known as CMPs, of approximately 20-foot length and 30-inches diameter with continuous welded seams and non-radioactive concrete plugs of approximately 12-inches thick poured into the ends. The CMPs waste unit category consists of a total of 158 corrugated metal pipes filled with cement from a batch treatment process that mixed Portland cement with several liquid waste streams containing americium and plutonium at the Technical Area (TA) 21.

The CMPs were filled with cemented waste from late 1975 to 1978 and maintained in a vertical configuration in a pit at MDA T. The CMPs were retrieved from storage, decontaminated, painted, and transported to TA-54 in 1986. The 158 CMPs were placed in two horizontal rows end-to-end and stacked two high. After all of the CMPs were placed, they were covered with plywood and tarps and about six feet of soil.

3. Pit 9

Pit 9 TRU waste category consists of approximately 3,882 metal drums, 191 fiberglass-reinforced plywood (FRP) boxes, and six other containers stored on an asphalt pad in an underground pit located in the north-central portion of Area G. Waste containers were placed into Pit 9 from November 1974 through November 1979. In general, FRP boxes were stacked along the perimeter of the asphalt pad and drums were stacked in the center of the FRP boxes.

The stack of waste containers is divided up into four cells of approximately equal size, with crushed tuff placed between the cells to serve as a firebreak. One cell was constructed with an access shaft that allows inspection of 48 drums stored in the pit. After waste was placed into a cell, the entire stack of waste within the cell was covered with plywood, plastic sheeting, and crushed tuff to the original grade of the pit. Additional cover was placed over portions of the pit once filled.

4. Trenches A-D

Trenches A-D, located in the south-central portion of TA-54 and oriented northwest-southeast, contain arrays of sealed concrete casks with a capacity to hold two 30-gal drums stacked one above the other. The four trenches have a total of 420 concrete casks, but only 357 casks were used to store TRU waste.

5. 33 Shafts

TRU wastes from 1979 to 1987 is contained in 33 lined shafts, located in the eastern portion of Area G. Radioactivity in these shafts is significant, requiring remote handling, but the total volume of waste amounts to only a few cubic meters. The 33 Remote Handled-TRU shafts are each about three feet in diameter and 18 feet deep, containing 13 feet long by 8.5 inch diameter ¼-inch thick carbon steel pipe liner, with a steel plate welded to the bottom and a steel cap attached to the top. These liners in turn contain a total of about 290 one-gallon steel and plastic cans that were gravity-dropped into the pipes at the time of emplacement.

Recent field inspections revealed 23 of the 33 pipes have been encased in concrete, which complicates retrieval, transportation, and planned nuclear processing operations for off-site disposal.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

The campaigns associated with Material Disposal Areas (MDAs) are dependent on the remedy selection process and may or may not be excavated, depending on the remedy selection. The TA-54 legacy TRU waste (described above) has a designated disposal pathway to WIPP if excavated, and the TA-54 legacy TRU waste will be integrated into the final remedy for Area G.

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

The framework for investigation and remediation of contamination resulting from historical releases of hazardous waste and hazardous constituents at LANL is governed by separate regulatory requirements. The scope of licenses, permits, and agreements include pollution prevention and protection of public health and the environment, as well as nuclear safety, worker protection, hazardous materials transportation, waste management, and emergency planning. Additionally, the EPA requires surface water protection through compliance with the Individual Permit.

2016 Consent Order

The 2016 Consent Order is the state cleanup order regulated under the New Mexico Environment Department (NMED) and is the principal regulatory driver for legacy cleanup. The Consent Order contains requirements for investigation and cleanup as well as enforceable deadlines for achieving desired end-states to include submitting corrective action documents such as investigation work plans, investigation reports, periodic monitoring reports, and corrective measure evaluations. A fundamental approach to executing requirements of the Consent Order is through a Campaign structure which bundles contaminated sites and pursues investigation and remediation as a project. The LCE aligns this approach and this document provides a summary description of those Campaigns.

Radiological Regulatory Authority

Investigation and remediation of radionuclides at LANL is conducted under DOE's authority pursuant to the Atomic Energy Act of 1954 (AEA) as amended and is not subject to requirements under the Consent Order.

The Federal Facilities Compliance Order/Site Treatment Plan (FFCO/STP-NMAD, 1995) stipulates treatment requirement for MTRU wastes.

A Natural Resources Trustee Council will assess the injuries to Natural Resource uses.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

Legacy cleanup work under the 2016 Consent Order is regulated under the New Mexico Environment Department (NMED) and Tribes are part of the public participation process that is part of the regulations. To the extent possible, EM-LA shares pertinent cleanup plans with potentially impacted tribes, i.e., the Pueblo de San Ildefonso.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

LANL plans to continue operating for foreseeable future. Closure is not presently expected.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

The site will remain in perpetuity. Portions of the site will have restricted access and land use for the foreseeable future.

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

All Campaigns involving Material Disposal Areas (MDAs) will require an approved remedy following the New Mexico Hazardous Waste regulatory process, which includes public involvement. The Campaigns for MDAs include implementation of a remedy resulting from NMED's statement of basis and selection of a remedy derived from a Corrective Measure Evaluation report. The campaigns will include development of a corrective measures implementation plan, implementation of the remedy, and development of the corrective measures report. The following is a list of MDAs requiring Corrective Action:

MDA C is located at Los Alamos National Laboratory's Technical Area 50 (TA-50), is approximately 11 acres in size and consists of 115 subsurface disposal units (7 pits and 108 shafts). MDA C was in operation from 1948 to 1974. A subsurface volatile organic compound (VOC) vapor plume is present in the vadose zone beneath MDA C. The sources of VOC vapors at MDA C are thought to be associated with wastes disposed of in the pits and shafts at the site, with VOCs being a component of the waste rather than a primary waste form.

MDA A is an inactive subsurface legacy disposal site situated in Technical Area 21 (TA-21) on the eastern end of Laboratory on Delta Prime (DP) Mesa. Portions of MDA A are currently managed as a nuclear facility. The entire 1.25 acre is fenced and radiological controls are in place. Two types of waste streams were disposed of in separate areas at the site. Combustible and noncombustible radioactive solid wastes were disposed of in the central pit and the two eastern trenches, and radioactive (including plutonium) liquid wastes were stored in two underground tanks.

Central Pit and Two Eastern Trenches There is very little documentation that details the types of chemicals and quantities of radionuclides in the pit and trenches. Available historical records are limited and, as with MDA B, this contributes to the need for enhanced safety controls. Radionuclides and possibly hazardous chemicals were disposed of in the eastern trenches from 1945 to 1946, and the combined volume is estimated to be approximately 28,000 ft3. The central pit received contaminated waste debris from 1969 to 1978, and its volume is approximately 500,000 ft3. The trenches and the pit are covered with 6 ft. of clean soil.

Underground Tanks Aqueous plutonium residues were discharged into two 50,000 gallon underground storage tanks from 1945 to 194 7. These two tanks are located on the west end of the site and are covered by 18 in. of soil, an 8-in. reinforced-concrete slab, and 3 to 5 ft. of overburden soil. Each tank is 12 ft. in diameter and 63 ft. in length. Liquid wastes containing plutonium-239/240 and americium-241 were to be stored until improved chemical-recovery methods could be developed. From 197 5 to 1981, much of the liquid fraction of the waste was pumped from the tanks through access holes cut in the concrete and the tops of the tanks. Work was halted when the pumps began to remove sludge, leaving a heel of liquid and sludge in the bottom of each tank. All pipes and access holes were covered in 1985 and backfilled.

MDA T is also located in TA-21 just west of MDA A and is one of the first disposal areas used at LANL. Construction of four absorption beds for disposal of DP-West liquid waste was completed in 1945. Untreated waste from the processing of plutonium at TA-21 was released to the pits from 1945 to 1952. MDA T consists of four absorption beds used to dispose of liquid waste; a retrievable waste storage area; a series of disposal shafts; an acid holding tank and acid sump; a caisson built at the northwest corner of absorption bed 1 in 1959; an inactive container storage area for alcohol, acetone, and Freon; and two surface spills of radioactive waste. MDA T is a 2.2 acre radiological waste disposal site currently classified as a hazard category 2 nuclear facility due to the radiological inventory in the disposal shafts. It is managed in accordance with a documented safety analysis for surveillance and maintenance at nuclear environmental sites

This campaign includes completion of additional characterization of the pit and trench wastes at MDA-A and performance of moisture monitoring at MDA T including installation of instrumentation of boreholes, application of water to berm area, and monitoring of boreholes for moisture to conduct corrective measures evaluations for both MDA A and MDA T. These CMEs will result in NMED’s statements of basis and selections of a remedy, and then the campaign will implement the remedies.

MDA AB is approximately a half-acre radiological waste disposal site currently classified as a hazard category 2 nuclear facility due to the radiological inventory in the disposal shafts. It is managed in accordance with a documented safety analysis for surveillance and maintenance at nuclear environmental sites. Routine inspections are performed semi-annually and the results are documented. Event-driven inspections are performed after significant weather events, off-normal occurrences, etc. and are documented. These inspections result in maintenance work orders to remain compliant with the nuclear safety requirements.

MDA H is an approximately 0.3 acre site composed of nine subsurface shafts used for the disposal of security-classified solid-form waste. Waste was disposed in the nine shafts over an approximately 26-year-period. Wastes disposed include lithium hydride, high explosives, metals, radionuclides, classified materials, and volatile organic compounds. The waste disposed of at MDA H may be sensitive to sparks, friction, heat, physical impact, pinching, air, and/or moisture.

MDA L is an approximately 2.58 acre site that is decommissioned (i.e., removed from service) subsurface site established for the disposal of nonradioactive liquid chemical waste. The disposal units at MDA L are covered with asphalt to house ongoing Resource Conservation and Recovery Act–permitted chemical waste storage and mixed-waste storage activities. The subsurface disposal units of MDA L, along with the Area L landfill units, are interspersed across the northern-half of Area L.

MDA L consists of 1 inactive subsurface disposal pit (Pit A) and 12 inactive disposal shafts. The Area L landfill consists of 3 inactive surface impoundments (B, C, and D) and 22 inactive disposal shafts. A subsurface volatile organic compound (VOC) vapor plume is present in the vadose zone at MDA L. The primary sources of subsurface VOC vapors are the two shaft fields at MDA L, and they appear to be a continuing source of VOC vapors.

MDA G is an approximately 65-acre site located within Area G that comprises all subsurface pits, trenches, and shafts located within the disposal units. The low-level waste disposal units are regulated by DOE. The MDA G CME is part of a comprehensive, integrated approach to remediation and closure of all subsurface units at Area G. The performance assessment and composite analysis for Area G will establish the technical requirements for closure needed to meet the performance objectives for radiological protection of the public from radionuclides disposed of at the site. These technical requirements will be incorporated into the design of the final remedy during the corrective measures implementation phase of the project. Retrievably stored transuranic (TRU) waste will be removed before the implementation of the preferred remedy.

c. *What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?*

Final remedies for remaining cleanup actions have not been determined, and will follow the corrective measures process as outlined in New Mexico Hazardous Waste Regulations.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

Monitoring of the environment has been expanded at the request of the four Indian Pueblos that have signed ACCORDS with DOE concerning LANL. The ACCORDS promise information and resources for independent analysis by the Pueblo. Generally, institutional controls are mainly handled by DOE and the Laboratory.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

There is no current LTS plan for the site. LTS for the LANL cleanup is not expected until 2032 or beyond. LTS requirements for individual remediated sites will be in accordance with requirements specified in closure plans. LTS, as a program, will either be transferred to the DOE Office of Legacy Management, or, similar to Sandia National Laboratories and Lawrence Livermore National Laboratory, transferred to the National Nuclear Security Administration.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

There is no one institutional control agreement for LANL.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*

EM-LA budgets in accordance with federal and DOE budget formulation guidance for the EM mission requirements for Los Alamos National Laboratory. In addition, EM-LA and the National Nuclear Security Administration, Los Alamos Field Office (NA-LA) jointly fund the cooperative agreement grants with the four Accord Pueblos, as well as providing funding for a grant to the state of New Mexico Oversight Bureau to perform independent monitoring activities.

Maxey Flats, Disposal Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Maxey Flats, Kentucky, Disposal Site is a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Resource Conservation and Recovery Act (RCRA) site. It is an inactive, low-level radioactive waste disposal site in eastern Kentucky about 10 miles northwest of Morehead. The Commonwealth of Kentucky owns the Site of approximately 770 acres, including a buffer zone of 230 acres. The site is in the Knobs physiographic region, which is characterized by hills and relatively flat topped ridges.

The disposal cell is located on a spur of Maxey Flats, one of the larger flat-topped ridges in the region. The site is bounded by steep slopes on the west, east, and south and is approximately 350 feet above the adjacent valleys. The land surrounding the site is primarily mixed woodlands and open farmland. The area is sparsely populated and mostly undeveloped. The few residences in the area have a public water supply system.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

There are no American Indian Tribes in the proximity of the Maxey Flats site; therefore, no impact has been imposed.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.
Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

In 1963, the Commonwealth of Kentucky issued a license to Nuclear Engineering Company Inc. (NECO) to bury low-level radioactive waste at Maxey Flats. From May 1963 to December 1977, radioactive waste was disposed of in 46 large unlined trenches up to 680-feet long, 70-feet wide, and 30-feet deep. The trenches covered approximately 27 acres of land within a 45-acre fenced portion of the site.

The trench wastes were deposited in both solid and solidified-liquid form. Some wastes arrived at the site in containers such as drums, wooden crates, and concrete or cardboard boxes. Other wastes were disposed of loosely. The trenches were backfilled with 3–10 feet of soil to serve as a protective cover. After 1977, six additional trenches were excavated for the disposal of waste material generated onsite.

Containment structures known as “hot wells” were used to bury small volumes of wastes that had higher radioactivity. The hot wells were 10–15 feet deep and constructed of concrete, coated steel pipe, or tile and capped with a large slab of concrete.

Environmental monitoring beginning in the early 1970s confirmed that radionuclides were leaching from the buried materials and migrating through the shallow groundwater. In December 1977, the Commonwealth of Kentucky directed NECO to cease the receipt and burial of radioactive wastes. About 4.5 million cubic feet of waste was buried in the trenches during the facility’s years of operation.

The radiological waste at the site has been estimated to contain about 2.4 million curies of byproduct material (i.e., material that became radioactive by neutron activation in nuclear reactors), about 553,000 pounds of source material, about 950 pounds of special nuclear material (plutonium, uranium-233 [^{233}U], and uranium enriched in the isotopes ^{233}U or ^{235}U), and more than 140 pounds of plutonium.

The NECO license to receive low-level waste was terminated in 1979, and operational responsibilities for the site were transferred to the Commonwealth of Kentucky. Private companies, such as Westinghouse Electric Corporation, were hired as the site custodians with responsibility to stabilize and maintain the site. Stabilization and maintenance activities included installing a temporary cover over the approximately 27 acres of trench area, establishing surface water controls, and monitoring both subsidence and waste containment.

In 1986, the U.S. Environmental Protection Agency (EPA) placed the Maxey Flats facility on the National Priorities List, which comprises hazardous waste sites that are to be addressed under CERCLA (which is also called Superfund). EPA notified 832 parties who had generated or transported radioactive waste that was received at the Maxey Flats facility that they were potentially responsible for site cleanup. The parties included private companies, hospitals, research institutions and laboratories, the U.S. Department of Defense, the U.S. Department of Energy, and the Commonwealth of Kentucky.

In March 1987, 82 parties signed an Administrative Order by Consent to begin preparation of a Remedial Investigation/Feasibility Study, which included a complete evaluation of site hydrogeology, current site conditions, a risk assessment, and alternatives for remedial action. In 1991, EPA issued a Record of Decision (ROD) for the Maxey Flats disposal site (MFDS) and announced that the remedy selected was natural stabilization. This remedy would allow the materials in the trenches to subside naturally to a stable condition, after which a permanent, engineered cap would be placed over the entire area of buried contaminants.

The 1991 ROD identified 12 radionuclides and 11 nonradionuclides as indicator contaminants in groundwater, surface water, and soils at the site. Tritium, the most abundant and the most mobile of the indicator contaminants, was selected as the primary contaminant of concern. Following an evaluation of historical data, post-ROD data, site hydrogeology, and realistic exposure pathways, investigators concluded that compliance testing and environmental monitoring should focus on the migration of tritium through water. EPA and the Commonwealth of Kentucky agreed that other contaminants would not be analyzed in water samples unless any annual average concentration of tritium exceeds 50% of the screening level during the previous 5 years.

The remedy was divided into four phases: the initial closure period (22 months), the interim maintenance period (35–100 years), the final closure period (10 months), and the custodial maintenance period (in perpetuity).

Contaminants. The primary contaminant at the site is tritium (HTO). Other contaminants include 11 organics, As, Na, Mn, ^{99}Tc, ^{233}U, ^{234}U, ^{235}U, ^{238}U, ^{238}Pu, ^{239}U, ^{240}U, ^{60}Co, ^{90}Sr, ^{14}C, and ^{226}Ra.

Impacted media. Affected media include surface and subsurface soils, groundwater, and surface water. Forest resources on the slopes adjacent to the site have also been impacted via uptake of contaminated groundwater.
The vertical extent of groundwater and soil contamination in the subsurface beneath the disposal trenches has not been characterized sitewide. Laterally, the highest contamination is confined to surface and subsurface soils, groundwater, and surface water on MFDS property.

Remedial actions at the site are required under the MFDS ROD and Consent Decree. The goal of remedial action is to remove leachate from the disposal trenches in order to stop present and future releases to the environment. The following are the principle components of the remedial action:

- Dewatering or removal of leachate from the disposal trenches
- Solidification of leachate
- Disposal of solidified leachate in concrete, earth-mounded bunkers
- Placement of a cap over the Restricted Area
- Stabilization of the site outside of the Restricted Area through improvement of the surface water drainage system
- Long-term monitoring and maintenance

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

Significant remediation progress has been achieved over the last 17 years at the Maxey Flats site. Specifically, the Commonwealth of Kentucky successfully accomplished the first three key components of the remedial action listed above. Then in September 2013, the Commonwealth and EPA entered into the final closure period, thereby initiating the placement of the final cap and stabilizing the site beyond the restricted area through surface water drainage system improvement. As of November 2016, substantial completion of the cap construction has been achieved, drainage system improvements have been installed, and the interim institutional control plan has been developed, covering the 12-month performance period following final cap placement. The Commonwealth is currently developing the long-term Institutional Control Plan (ICP) covering the next 100 years, and submission of the ICP to EPA is scheduled 6 months post the November 2016 substantial completion declaration (May 2017).

e. Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).

About 4.5 million cubic feet of waste was buried in the trenches during the facility's years of operation. The radiological waste at the site has been estimated to contain about 2.4 million curies of byproduct material (i.e., material that became radioactive by neutron activation in nuclear reactors), about 553,000 pounds of source material, about 950 pounds of special nuclear material (plutonium, uranium-233 [^{233}U], and uranium enriched in the isotopes ^{233}U or ^{235}U), and more than 140 pounds of plutonium.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

About 4.5 million cubic feet of waste was buried in the trenches during the facility's years of operation. The radiological waste at the site has been estimated to contain about 2.4 million curies of byproduct material (i.e., material that became radioactive by neutron activation in nuclear reactors), about 553,000 pounds of source material, about 950 pounds of special nuclear material (plutonium, uranium-233 [^{233}U], and uranium enriched in the isotopes ^{233}U or ^{235}U), and more than 140 pounds of plutonium.

i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

No additional material will be placed onsite during the 2016 successful completion of the final cell cap.

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*

No material will be shipped offsite, and no further waste streams are proposed or planned.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

With the placement of the final cap in 2016, no material will remain following the completion of the remediation action.

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

The MFDS is a Superfund site. The site was investigated and a remedy was evaluated under CERCLA. The MFDS Consent Decree defined the remedy, institutional controls, Responsible Parties (RPs), the obligations of the RPs to effect the remedy, and institutional controls for 200 years following placement of the remedy.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

There is no tribal involvement because there are no American Indian Tribes in the proximity of the Maxey Flats site. As a Superfund site owned by the Commonwealth of Kentucky, the state was directly involved in all interaction with EPA.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

The components of the physical remedy are described above. Clean closure was determined to be technically and financially impractical.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

The Maxey Flats Disposal Site will remain as an inactive low-level radioactive waste site in perpetuity. Portions of the site will have restricted access and restricted land use for at least 100 years to ensure protectiveness to the environmental and public health. No additional long-term land uses for the site have been defined by the Commonwealth.

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

In December 1977, the site ceased the receipt and burial of radioactive wastes. The radioactive waste was disposed of in 46 large, unlined trenches up to 680-feet long, 70-feet wide, and 30-feet deep that covered approximately 27 acres of land within a 45-acre fenced portion of the site. Hot wells were used for the burial of small volumes of waste with higher radioactivity. The hot wells were 10–15 feet deep and constructed of concrete-coated steel pipe or tile and capped with a large slab of concrete. The trench wastes were deposited in both solid and solidified-liquid form. Some wastes arrived at the site in containers such as drums, wooden crates, and concrete or cardboard boxes. Other wastes were disposed of loosely. The trenches were backfilled with 3–10 feet of soil to serve as a protective cover. After 1977, six additional trenches were excavated for the disposal of waste material generated onsite.

About 4.5 million cubic feet of waste was buried in the trenches during the facility's years of operation. The radiological waste has been estimated to contain about 2.4 million curies of byproduct material, about 553,000 pounds of source material, 950 pounds of special nuclear material (plutonium, uranium-233, or uranium enriched in the isotopes uranium-233, or uranium-235), and more than 140 pounds of plutonium.

As for stewardship and monitoring the disposal area, environmental monitoring beginning in the early 1970s confirmed that radionuclides were leaching from the buried materials and migrating through the shallow groundwater. Stabilization and maintenance activities included installing a temporary cover over approximately 27 acres of trench area, establishing surface water controls, and monitoring both subsidence and waste containment.

In 1991, EPA issued a Record of Decision for the Maxey Flats site and announced that the remedy selected was natural stabilization. This remedy would allow the materials in the trenches to subside naturally to a stable condition after which a permanent engineered cap would be placed over the entire area of buried contaminants.

The Commonwealth of Kentucky has been performing the monitoring and maintenance activities as required by the ROD, and EPA has conducted three Five-Year Reviews of the remedy. Since the placement of the interim cap, subsidence monitoring data demonstrate that minimal subsidence has occurred. When the ROD was written, the time required for the contents of the disposal area to naturally stabilize was estimated at 35–100 years. However, since that time, it has become evident that a number of factors may have contributed to substantially less time required to complete natural stabilization, including the 30–40 year age of the waste, the passive action of compacting the trenches during construction of the interim cap, and the weight of approximately 250,000 cubic yards of soil fill placed over the waste during construction of the interim cap.

The end of the interim maintenance period and the beginning of the final closure period is defined in the ROD as the time when subsidence of the trenches has nearly ceased and final cap installation can begin. EPA is required to determine the acceptable subsidence criteria, in consultation with the Commonwealth of Kentucky. The Commonwealth presented EPA with subsidence data verifying that the trench stabilization criteria have been achieved. After evaluating the data, EPA agreed with the criteria and approved the Commonwealth's request to proceed to the final closure period beginning September 2013.

Final closure period includes (1) design then placement of the permanent earthen cap consisting of layers of protective liners covered with soil and vegetation and (2) stabilization of the site outside the restricted area through improvement of the surface water drainage system. In November 2016, the Commonwealth provided EPA with the declaration of substantial completion of the final cap. Effective January 2017, which coincides with the next CERCLA five-year review period, the interim institutional control plan will be implemented for a 12-month period. The long-term institutional control plan covering 100 years is in development and on schedule for submission to EPA May 2017.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

At the Maxey Flat site several technologies were deployed: (1) removing leachate from the trenches, mixing it with cement, then transferring the mixture to earth-mounded concrete bunkers where it solidified, (2) demolishing site buildings and disposing of them onsite, (3) constructing an interim geomembrane cap, and (4) constructing engineered drainage features to direct runoff and minimize infiltration of rainwater.

d. What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?

The institutional controls and long term stewardship involve monitoring of the environment, monitoring of the performance of the remedy, and maintenance of the site including the components of the remedy.

e. What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.

The long-term institutional control plan covering a 100-year period is in development by the Commonwealth of Kentucky and on schedule for submission to EPA May 2017. Elements of the plan will include monitoring of the environment, monitoring of the performance of the remedy, and maintenance of the site including the components of the remedy.

f. Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.

The Commonwealth of Kentucky is responsible for the administration and execution of long-term stewardship and the institutional controls for the site.

Two five-year review cycles will occur to evaluate the remedy after EPA certifies completion. After the five-year cycles, the site will become the sole responsibility of the Commonwealth, and EPA and RPs will no longer be liable.

g. Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the State and/or Tribe.

The funding required for the long-term stewardship activities for the Maxey Flats site (e.g., implementation of the long-term institutional control plan covering 100 years and ongoing site maintenance) is provided by the Commonwealth of Kentucky. Up to $1 million annually will be required to administer, maintain, and monitor the site for the next 200 years. Funding will be provided through the Commonwealth's General Fund and the annual budgets of the Commonwealth’s Energy and Environment Cabinet.

As for the role of the DOE Office of Legacy Management, this Office will continue to manage the project record and respond to stakeholder inquiries for the site in perpetuity at an annual cost of less than $5000.

Mound Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Mound site, located in Miamisburg, Ohio, was named for a nearby Native American burial ground and is located approximately 10 miles southwest of Dayton, Ohio. The Great Miami River flows southwest through the city of Miamisburg and dominates the geography of the region surrounding the site. The region is a mix of farmland, residential areas, small communities, and light industry. Many residential developments and schools, the Miamisburg downtown area, and six city parks are located within a mile of the site.

Much of the site sits atop an elevated area overlooking the City of Miamisburg, the Great Miami River, and the river plain area to the west. Site elevations vary from 700 to 900 feet above sea level.

Construction of the plant was completed in 1948. The original mission for the site was to process polonium as part of the Manhattan Project. In January 1949, the Mound plant began research and operations involving other radionuclides. The site grew from the original 182 acres into 305 acres in 1983 when U.S. Department of Energy (DOE) purchased an undeveloped area south of the original property. The research and operations continued through the early 1990s. The general-purpose heat source - radioisotopic thermoelectric generator program remained until 2002 when the work was moved to INEL.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

According to the U.S. Department of the Interior Bureau of Indian Affairs, there are no federally recognized Indian tribes in the state of Ohio.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.
Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

DOE conducted comprehensive chemical and radionuclide characterizations before and during the cleanup to evaluate both the nature and extent of contamination and to identify potential exposure pathways and potential human and environmental receptors (i.e., develop a site conceptual model). These characterizations identified contamination in four media (soil, groundwater, surface water, and buildings/structures), with the majority of contamination present as low-level radioactivity or chemical contamination in the soil.

The organic chemicals detected in site soils included petroleum hydrocarbons, polynuclear aromatic hydrocarbons, and chlorinated solvents, such as trichloroethene. Radionuclides present above background levels included plutonium-238, thorium (total and the isotope thorium-230), cobalt-60, cesium-137, tritium, actinium-227, americium-241, bismuth-207, and bismuth-210m. Depleted uranium (uranium-238) was suspected to be present in the metallic form in some areas. Overall, 22 areas of potential radiological contamination were identified during initial characterizations. All of these areas were evaluated and remediated if necessary during the CERCLA cleanup.

Chemical contamination in groundwater consisted primarily of three chlorinated solvents with some associated breakdown products, such as vinyl chloride. In addition to chlorinated solvents, metals (e.g., chromium, nickel, and cadmium) were detected in groundwater at levels that exceeded drinking water standards. Tritium contamination in the groundwater of the buried valley aquifer (BVA) was present at levels slightly above background, but well below the drinking water standard. Tritium concentration in the main hill bedrock area was above drinking water standards. In surface water, tritium contamination was detected in seeps located around the main hill. A comprehensive sampling of sediments indicated that plutonium-238 was a common contaminant in the site drainage ditch, asphalt-lined pond, Miami-Erie Canal, overflow creek, and National Pollutant Discharge Elimination System outfall 002 sampling locations. With the exception of the two sampling locations in the Miami-Erie Canal, which indicated the highest levels of plutonium-238 in both sediment and subsurface soils, there was no distinguishable pattern of downstream trends indicating migration of plutonium-238. In addition, no other offsite locations had sample results for plutonium-238 greater than the established guideline values.

In 1998 there were 116 buildings onsite and chemicals, such as polychlorinated biphenyls, and some laboratory solvents, such as 2-butanone and toluene, were detected infrequently throughout various facilities. Other non-radiological environmental concerns pertaining to buildings and structures included lead, lead paint, and asbestos.

Through the use of removals as outlined in the Mound 2000 process, DOE removed buildings, slabs, soils, underground tanks, and lines to remediate the former DOE Mound site 1998 Property to U.S. Environmental Protection Agency's (EPA) risk-based standards for industrial/commercial use only. The offsite OU-4 Miami Erie Canal was remediated to unrestricted use. Remediation and waste disposal cost over $1B and took almost 20 years.

The remedies were used to evaluate the conditions post-removal, document that the remediation goals used for the prior cleanups were sufficient, and apply institutional controls (ICs) prohibiting groundwater use and the removal of soil from the Mound Site and limiting the use of the site to industrial/commercial uses. The remedies for Phase I (A, B, C) and Parcels 6, 7, and 8 include monitored natural attenuation for those contaminants that exceed maximum contaminant levels (MCLs). The Operable Unit 1 (OU-1) remedy contains a pump-and-treatment (P&T) system to control groundwater contamination and to minimize exposure to potential receptors by minimizing the migration of contaminated groundwater.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

DOE demolished 136 structures totaling 869,000 square feet plus 3 water towers and 7 stacks. DOE remediated and transferred 23 buildings for reuse and excavated 11.1 million cubic feet of soils from 190 potential release sites.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

There was no onsite disposal of radioactive or hazardous waste at the Mound site.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

There are no remaining waste streams onsite.

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*

There are no remaining materials to be shipped offsite.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

There are no remaining materials to be excavated onsite.

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

DOE established the Environmental Restoration Program at the site in 1984. The program collected and assessed environmental data to evaluate the nature and extent of contamination resulting from the site's operation, identified potential exposure pathways, and identified potential human and environmental receptors. Comprehensive chemical and radionuclide characterizations identified contamination in soil, groundwater, surface water, and buildings at the site. Most of the contamination was identified as low-level radioactivity in the soil and volatile organic compounds in the groundwater. The site was placed on the National Priorities List in 1989 because volatile organic compounds were discovered in groundwater that underlies the site and because of the site's proximity to a sole-source aquifer. DOE, EPA, and Ohio EPA signed a tripartite Federal Facilities Agreement in 1993 that provided a procedural framework among the agencies, which remains in effect.

In 1995, DOE and its regulators developed the MOUND 2000 process that expedited cleanup while satisfying CERCLA requirements. The core team of DOE, EPA, and Ohio EPA used the MOUND 2000 process to review historical and current assessment data for each building and 400 potential release sites and to determine a path forward for each. The core team oversaw all of the remediation activities and continues to oversee site post-closure activities.

In order to hasten the transfer to private use, DOE Office of Environmental Management (EM) divided the site into discrete land parcels, which were remediated to an industrial use end state in accordance with CERCLA regulations. Records of decision for these parcels defined the remedies.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

There has been no tribal involvement in the decision process at Mound as there are no federally recognized Indian tribes in the state of Ohio.

Ohio EPA has been involved early on with the decision process. Ohio EPA was added to the Federal Facilities Agreement in 1993, making it a tripartite agreement with EPA and DOE. Again, the Federal Facilities Agreement provided a procedural framework among the three agencies, which remains in effect.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

The primary remediation objective was to ensure that any residual risk associated with each parcel was acceptable based on the agreed-upon industrial/commercial end use as the only use. Remedies for each parcel were developed in accordance with that agreement. Evaluation of residual soil and groundwater contaminants within each land parcel determined that future users of the land will not be exposed to contaminant levels that would pose unacceptable risks as long as compliance with the deed restrictions is maintained.

The soil within each land parcel was not evaluated for any use other than onsite industrial/commercial use. Any offsite disposition of the soil from a land parcel without proper handling, sampling, and management could create an unacceptable risk to offsite receptors.

Additional groundwater monitoring was imposed for OU-1 (Parcel 9), Phase I, and Parcels 6, 7, and 8, where groundwater contamination had not reached acceptable levels.

The City of Miamisburg chartered the Mound Development Corporation (MDC), formerly the Miamisburg Mound Community Improvement Corporation, to transition the site for industrial/commercial reuse as the Mound Business Park.

DOE established a sales contract with MDC to convey discrete parcels after completion of the CERCLA process. Land-use restrictions were conveyed with the property to ensure that it would always remain protective of human health and the environment. To date, approximately 60 percent of the site has been conveyed to MDC, and the remaining 40 percent is leased to them until 2017. The City of Miamisburg has accepted temporary ownership of some MDC-owned portions of the site until MDC leases or sells them.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

As indicated above, cleanup levels are based on industrial/commercial land use. The land use was selected through various meetings with DOE, City of Miamisburg, and regulators. Additional stakeholder outreach activities were also conducted to obtain input from the community. The Mound site ICs prohibit non-industrial use of the site, removal of soil, removal or use of groundwater, and removal or penetration of concrete flooring in a few of the rooms in the Technical Building without prior approval from the regulators. These ICs will remain in effect in perpetuity.

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

There are no disposal cells onsite.

c. *What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?*

The site was remediated to an industrial/commercial land use with only residual contamination to remain onsite.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

All landowners of former Mound site property are legally responsible for adhering to the ICs or activity and use limitations in the environmental covenant and lease agreement. DOE conducts an annual site institutional control assessment to determine that the ICs continue to function as designed, adequate oversight mechanisms are in place to identify possible violations of ICs, and adequate resources are available to correct or mitigate any problems if violations occur.

The following Mound site ICs run with the land in the form of restrictions and covenants in quitclaim deeds or activity and use limitations in the environmental covenant:

- Maintenance of industrial/commercial land use and prohibition against residential land use.
- Prohibition against groundwater use without prior written approval from EPA and Ohio EPA.
- Prohibition against the removal of soil from within the site boundary (as of 1998) to offsite locations without prior written approval from EPA, Ohio EPA, and Ohio Department of Health (ODH).
- Prohibition against the removal of concrete floor material in specified rooms of T Building to offsite locations without prior written approval from EPA, Ohio EPA, and ODH.
- Prohibition against the penetration of concrete floors in specified rooms of T Building locations without prior written approval from EPA, Ohio EPA, and ODH.
- Allow site access for federal and state agencies for the purpose of sampling and monitoring.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

There is only residual contamination at levels allowing for industrial/commercial reuse of the property. LM follows the *Operations and Maintenance Plan for the U.S. Department of Energy Mound, Ohio, Site* for groundwater monitoring and compliance with ICs, which are passed to landowners as use restrictions in deeds. This level of monitoring and surveillance will remain the same over the next 5 years and 75 years.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

The *Operations and Maintenance Plan for the U.S. Department of Energy Mound, Ohio, Site* contains the operation and maintenance and the institutional control requirements developed by DOE and approved by the regulators with input from the stakeholders. The activities described are required to maintain the remedies and controls for the site under CERCLA. DOE has worked with EPA, Ohio EPA, ODH, MDC, the City of Miamisburg, and other government entities to identify formal and informal processes for managing ICs, monitoring ICs, and providing information on compliance with ICs.

The landowners are legally responsible for adhering to the ICs, which run with the land in the form of restrictions and covenants in quitclaim deeds or activity and use limitations in the environmental covenant and lease agreement. Landowners shall also notify DOE of street name changes because the city permits, Ohio Department of Natural Resources well-drilling permits, and similar activities are filed by street addresses. Owner or transferee, if applicable, shall notify Ohio EPA within 10 days after each conveyance of an interest of the property or any portion thereof. Landowners will contact EPA and Ohio EPA to approve other land uses, soil removal, groundwater use, penetration or removal of concrete in T Building.

DOE, or its successors or assignees, is responsible for implementing, reporting on, monitoring, maintaining, and enforcing the ICs before and after the transfer of the site to MDC. DOE will consult with EPA should an enforcement action be required due to inconsistent land use as described in the deed restriction.

The DOE provides funding for monitoring the landowners' compliance to the present institutional controls at the Mound, Ohio, Site.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the State and/or Tribe.*

DOE provides the funding for the long-term surveillance and maintenance (which includes ICs), operations, and monitoring at the Mound site. The Mound site's annual budget is approximately $1 million per year.

Nevada National Security Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Nevada National Security Site (NNSS), formerly known as the Nevada Test Site, is a DOE, National Nuclear Security Administration (NNSA) site occupying approximately 1,360 square miles (870,400 acres) in southeastern Nye County, Nevada, and is larger than the State of Rhode Island. NNSS was established in 1950 as the nation's on-continent proving ground for testing and development of nuclear weapons. Between 1951 and 1992, the federal government conducted more than 900 nuclear tests at the site; 100 of these tests were conducted above ground (i.e., atmospheric tests). The NNSS occupies public lands that are administratively held by the Department of Interior, Bureau of Land Management (BLM). The only exception is the 740 acres of the Area 5 Radioactive Waste Management Complex (RWMC) that is titled to DOE. The lands have been withdrawn from public use via Public Land Orders and Public Laws for over a half-century. Public Law 106-65 under the National Defense Authorization Act (NDAA) for Fiscal Year 2000 is the latest to affect the NNSS. The changes were a slight increase of acreage to the NNSS and conform site boundaries to the Township, Section, and Range grid. The lands comprising the NNSS are under public use restrictions during management by the DOE/NNSA in accordance with Public Law 106-65. In addition to the NNSS, the 2000 NDAA and Public Law 106-65 re-established the withdrawal for the Nevada Test and Training Range (NTTR), formerly known as the Nellis Air Force Range, for use by the U.S. Air Force. The NTTR consists of more than 4,500 square miles that surround the 1,360-square-mile NNSS on the east, north, and most of the western boundary. BLM controls the lands adjacent to the southern boundary of the NNSS.

The Site is situated approximately 65 miles (105 kilometers) northwest of Las Vegas, Nevada, home to more than 2 million residents. With visitor counts now exceeding 40 million annually, Las Vegas is also one of the world's most active resort destinations. Two other population centers within relative proximity to the NNSS are Pahrump, Nevada with approximately 40,000 people about 20 miles south of the site, and Beatty, Nevada with approximately 1,000 people about 15 miles west of the site.

The Site is situated in the southern portion of the Great Basin, and northernmost sub-province of the Basin and Range Physiographic Province. The region is characterized by north–south-trending, linear mountain ranges that are separated by broad sediment-filled basins. The flat uplands of the northwest NNSS, including Pahute and Rainer Mesas, are composed of volcanic units of the southwestern Nevada volcanic field. Vertical relief at the NNSS varies from 3,280 feet above sea level at Frenchman Flat and Jackass Flat to 7,216 and 7,675 feet above sea level on Pahute and Rainer Mesas, respectively. The Great Basin Sub-Province is an internally draining basin with no outlet to the Pacific Ocean. Two deserts, the Mojave Desert and the Great Basin Desert, are connected by transitional valleys located within the Great Basin Sub-Province and characterized by their arid conditions and landforms formed by wind and water. Yucca Flat and Frenchman Flat are topographically closed valleys. Jackass Flats is topographically open and drains via Fortymile Wash to the south off the NNSS. Past actions by DOE, particularly underground nuclear testing, have significantly altered the topography at the NNSS. Yucca Flat (and, to a much lesser extent, Pahute and Rainier Mesas) is pockmarked with craters from surface explosions and collapsed test cavities. Buckboard Mesa, Shoshone Mountain, Dome Mountain, and Frenchman Flat also exhibit evidence of past tests. Other excavations on the NNSS include blasting for road construction, excavation of aggregate material (e.g., sand and gravel), flood and drainage control, and historical mining tunnels and shafts.

b. *Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?*

Sixteen Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone Tribes from Nevada, California, Utah, and Arizona have demonstrated cultural and historical ties to the NNSS, which is located within their aboriginal homelands. Tribes aligned together to form the Consolidated Group of Tribes and Organizations (CGTO) to serve as a mechanism for speaking through one voice on topics of mutual interest that occur on the NNSS.

Cultural Resources important to the CGTO and/or representative tribal communities are impacted by daily operations at the Area 5 RWMC, Underground Test Area (UGTA) activities, and Soils Remediation projects. The CGTO engages in ongoing NNSS projects including Revegetation, UGTA, Soils Remediation, Radioactive Waste Management Area, Waste Acceptance Criteria, Low-Level Waste Stakeholders Forum, intergovernmental interactions, and tabletop exercises.

CGTO Membership:

- Las Vegas Paiute Tribe
- Moapa Band of Paiutes
- Pahrump Paiute Tribe
- Paiute Tribe of Utah
- Kaibab Band of Paiutes
- Chemehuevi Indian Tribe
- Colorado River Indian Tribes
- Timbisha Shoshone Tribe
- Duckwater Shoshone Tribe
- Ely Shoshone Tribe
- Yomba Shoshone Tribe
- Lone Paiute and Shoshone Tribes
- Fort Independence Indian Reservation
- Big Pine Paiute Tribe
- Bishop Paiute Tribe
- Utu Utu Gwaitu Paiute Tribe

c. *Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site. Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.*

Contaminated soils and groundwater at NNSS resulted from years of nuclear testing associated with various research and development projects, and radioactive waste disposal programs. The types of activities that led to the existing contamination are as follows:

- Atmospheric Nuclear Testing/Soil Sites
- Underground Nuclear Testing/UGTA Sites
- Nuclear Rocket Development and Other R&D Programs
- Radioactive Waste Disposal
- Industrial Sites

<u>Atmospheric Testing/Soil Sites</u> - Prior to the 1963 Limited Test Ban Treaty, a total of 100 atmospheric nuclear tests were conducted at the NNSS. The atmospheric tests were detonated at or above ground level, on pads or short stands (13), towers (43), balloons (23), airdrops from bombers (19), airburst from a cannon (1), and air-to-air rocket (1). Residual surface contamination of the NNSS are derived from atmospheric and uncontained underground detonations. This contamination affects between 3 and 5 percent of land surface area. The majority of the fission products and other short-lived nuclides released from atmospheric testing were dispersed into the atmosphere and have since decayed away. The longer-lived radionuclides remain in the soil and on physical structures at the site. The primary radioactive isotopes that remain from atmospheric testing include plutonium, uranium, americium, cobalt, cesium, strontium, and europium.

DOE conducted numerous "safety" experiments at the NNSS and, while these experiments did not produce nuclear explosions, they did create significant surface contamination. These tests were conducted to determine the behavior of nuclear weapons in conventional explosive accident scenarios during handling, storage, and transport operations. They were conducted to ensure U.S. nuclear weapons would not produce a nuclear yield if detonated improperly (via accident or unauthorized attempt). Safety tests were also conducted to determine the size and distribution of plutonium particles that might result from fires and conventional explosive accidents involving nuclear weapons. Some experiments were also performed to determine the biological uptake of plutonium by various species of animals and plants. Safety experiments were conducted at five locations on the NTTR and at various locations on the NNSS. The depth of contamination at these soil sites may vary, but probably are 1 foot or less at any given site. DOE has estimated that these safety experiments contaminated approximately 2,885 acres with plutonium at levels in excess of 40 picocuries per gram.

A discussion on underground nuclear tests is included in this section of “Atmospheric Testing” because those tests encountered large areas of surface contamination, including nine underground cratering tests conducted by DOE. These tests used nuclear devices placed at shallow depths and resulted in the excavation of large volumes of earth. A portion of materials from these nuclear detonations were expelled to the surface.

In terms of cumulative effects, the contamination from atmospheric testing, along with the safety experiments and the underground cratering tests, resulted in an estimated 27,000 acres (42 square miles) of surface soils contaminated at levels in excess of 40 picocuries per gram. These contaminated surface soils have been, and continue to be, addressed under the Soils Corrective Action Units, described below.

Underground Testing/UGTA Sites - Beginning in November 1951 and ending in September 1992, DOE (and its predecessor agencies) conducted 828 underground nuclear tests at the NNSS. The tests had yields ranging from zero to over 1,000 kilotons. Underground testing originally left an estimated source term of over 132 million curies in the underground environmental media. Radioactive decay of the predominant radioactive isotope tritium (over 90 percent of the original total) has left an estimated one-third of the original curies underground. Approximately 30 percent of the tests were conducted under or within 100 meters (328 feet) of the water table. Due to these factors, it is estimated that the groundwater beneath the site now contains approximately 25 million curies of radioactivity.

NNSS conducted four basic types of underground tests: shallow, borehole, deep vertical, and tunnel tests. Collectively, these tests caused significant disruption to the geologic media, which resulted in hundreds of subsidence craters causing contamination of the subsurface geologic media, surface soils, and groundwater over an estimated 300 square mile area. The underground nuclear test areas have been, and continue to be, addressed under the UGTA Corrective Action Units, described below.

Nuclear Rocket Development and Other R&D Programs - In the mid-1950s, the federal government initiated a nuclear rocket testing and reactor development program at the NNSS. Test cells, roads, and assembly facilities were constructed at the NNSS in Area 25. Surface soils at these facilities were contaminated with radionuclides released during engine/reactor tests, and the buildings were contaminated during assembly and disassembly of the rocket motors and reactors. Some of the contaminated equipment and other materials were disposed in nearby landfills. Leach fields in the area were concurrently used for disposal of liquid wastes. Most of the residual radioactivity from nuclear rocket development has been removed and disposed under the Industrial Sites Corrective Action Units, described below, or decayed to levels that no longer present a significant hazard to human health or the environment.

Radioactive Waste Disposal - Covered below in Section 1.e.

Industrial Sites - In addition to contamination caused by the detonation of nuclear devices and waste disposal operations, a significant amount of contamination in the form of muck piles, ponds, sumps, injection wells, inactive tanks, leach fields, and waste sites was identified on the NNSS. These sites remained as by-products of nuclear testing, various research and development programs, and related support activities. These chemical and radioactive contaminated areas, which included ~1,126 individual sites, are referred to as Industrial Sites. Approximately 8 Industrial Sites remain to be closed under the Federal Facility Agreement and Consent Order (FFACO) and are localized to the Engine Maintenance Assembly and Disassembly (EMAD) and Test Cell C facilities in Area 25 on the NNSS.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

Soils Corrective Action Units - The DOE/NNSA recently completed clean-up activities for the Double-Tracks and Clean Slate I Projects located on the NTTR. In anticipation of cleanup activities, the CGTO has requested an opportunity receive updates on cleanup activities with the potential for examining the disturbed area and integrating the CTGO in conducting traditional blessings or other activities to restore balance to the area.

For the majority of contaminated soils located within the NNSS boundary, DOE is planning a characterization and long-term monitoring program. DOE has and will perform limited removal of contamination; establishment of engineered barriers when necessary; and use control restrictions, along with post-closure inspections when required, at all locations with residual contamination following closure. The DOE originally identified over 140 EM surface contaminated sites on the NNSS and NTTR. As of the end of 2016, the State of Nevada through the FFACO has approved the closure of ~123 EM Soils sites.

UGTA Corrective Action Units - The shallow, borehole, deep vertical and tunnel underground nuclear tests were conducted in Frenchman Flat (11 tests), Yucca Flat (662), Rainier Mesa/Shoshone Mountain (67), and Central and Western Pahute Mesa (82). Each of these areas is known as a Corrective Action Unit. Closure of one of the five Corrective Action Units (Frenchman Flat) has been reached with ongoing monitoring of the groundwater to ensure the hydrogeologic transport models for potential migration conform with conditions as they are currently understood. There are a total of 879 UGTA Corrective Action Sites within the five corrective action units on the NNSS, of which 11 Corrective Action Sites are now closed under the FFACO.

Industrial Sites Corrective Action Units - The remediation/closure process for contaminated Industrial Sites was based on a prioritization process that was largely dependent on a site's future use potential. In NNSS Area 25, for example, the land is being developed in part to support certain current national security activities. In other parts of NNSS, like Yucca Flat, Industrial Sites were remediated to support ongoing stockpile stewardship activities and the readiness program for nuclear testing. In general, Industrial Sites that showed a potential for health risks as a result of direct exposure, inhalation, and/or re-suspension of contaminants were remediated to support negotiated facility/land-use scenarios. While in some cases sites were/are clean-closed, given expected restricted access and limited land-uses, Industrial Sites on the NNSS were/are remediated to negotiated levels that are acceptable for reducing risks to human health and the environment.

Off-Site Corrective Action Units - The CNTA is located 70 miles east of Tonopah, Nevada and consists of three parcels totaling 2,560 acres. The CNTA is in Northern Nye County and falls within the ancestral homelands and region of influence of the CGTO. A proposed LM expansion of 360 acres was announced in the Federal Register in 2016 for this specific DOE undertaking in order to have identical surface and subsurface areas withdrawn. The expansion is expected to include tribal involvement through the CGTO who remains interested in restoring the cultural integrity and balance of the area.

The Project Shoal area is in Southern Churchill County and falls within the ancestral homelands and region of influence of the CGTO. The Project Shoal area was withdrawn from public use under Public Land Order 2771, and the surrounding land is withdrawn under Public Law 106-65 as the Naval Air Station Fallon Ranges for use by the U.S. Navy. The DOE is responsible for the subsurface estate. The Navy is responsible for management and use of the surface estate. No change to the current land use or withdrawals is planned. All surface contamination at the Project Shoal site was removed.

For these Nevada Off-Site Corrective Action Sites (Project Shoal and Central Nevada Test Area [CNTA]), DOE committed to characterizing and remediating surface contamination to levels that would be acceptable for multiple use activities. The underground test cavities would be restricted, however, and DOE and/or the BLM would retain in perpetuity institutional control of the subsurface contamination. It is important to note that remaining surface contamination at the CNTA is limited to nonradioactive constituents such as heavy metals and fuel oils. Accordingly, closure in place of certain limited nonradioactive contaminated areas was approved under the FFACO. Responsibility for all of the Off-Site nuclear test locations in the United States was transferred to the DOE Office of Legacy Management in 2006, including the two Nevada sites.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

NNSS currently functions as a national low-level waste disposal facility for both on-site and off-site generated defense low-level waste, mixed low-level waste and classified waste. Two waste management sites are located on the NNSS in Area 5 and Area 3. The Area 5 RWMC occupies 740 acres (more than 1 square mile) and is located in Frenchman Flat, about 12 miles north of Mercury, Nevada, which serves as the base camp for the NNSS. The Area 3 Radioactive Waste Management Site (RWMS) is in cold stand-by, occupies 125 acres, and is located 23 miles north of Mercury in Yucca Flat. Yucca Flat was used extensively for both atmospheric (84 tests) and underground (662 tests) nuclear testing.

Established in 1961, the Area 5 RWMC is a classically "engineered" shallow landfill disposal facility primarily used for disposal of on-site and off-site generated low-level waste, low-level mixed waste, and classified waste. Since the late 1980s, NNSS ceased accepting TRU waste and mixed waste for storage from off-site locations. The majority of legacy TRU waste previously stored at the Area 5 RWMC was sent to WIPP for disposal.

The Area 3 RWMS was used for bulk and packaged low-level waste. The site is composed of seven subsidence craters from underground nuclear tests. The locations between four of the craters were excavated to make two oval-shaped landfill units. Conventional landfill methods were used to dispose of waste in the craters. The majority of the waste disposed at the Area 3 RWMS is atmospheric testing debris from cleanup activities of surface contamination and underground tunnel tests on NNSS. The Area 3 RWMS was also used for disposal of low-level waste generated from soil cleanup activities on NTTR.

The waste disposal facilities at Area 3 and Area 5 have safely disposed nearly 1.75 million cubic yards of waste through calendar year 2015. The estimated cumulative radioactivity of all wastes at the time of disposal is 16.3 million curies.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

   i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

Described above in 1.e.

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*

A minor amount of Transuranic waste from ongoing experiments at the NNSS will be shipped off-site for disposal at the Waste Isolation Pilot Plant near Carlsbad, New Mexico.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

The contaminated soils in Yucca Flat, for example, will not be remediated because Yucca Flat has been set aside to support the readiness program for nuclear testing. Maintaining a defense readiness posture for nuclear testing is still a mission at the NNSS. Accordingly, institutional control for most of the contaminated soils on NNSS proper is assumed by DOE to be "in perpetuity" at the existing boundaries. Appropriately, "clean closure" of most of the contaminated soils on NNSS would be cost prohibitive and generally impractical given both current and expected land uses.

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

The regulatory process established for DOE's EM program at the NNSS is detailed in the State of Nevada/DOE/U.S. Department of Defense (DoD) Federal Facility Agreement and Consent Order (FFACO). The agreement permits DOE to assert it authority for conducting EM program activities under the Resource Conservation and Recovery Act (RCRA), and the Atomic Energy Act. In addition, both DOE and the State acknowledge the FFACO is subject to other authorities including the Solid Waste Disposal Act, which includes both the RCRA and the Hazardous and Solid Waste Act in tandem with Nevada Revised Statutes, and the Nevada Administrative Code. The FFACO reaffirms the State of Nevada has stipulated that it retains all of its hazardous waste and clean water authorities and legal rights delegated by the U.S. Environmental Protection Agency. Concurrently, the FFACO stipulates DOE retains jurisdiction over matters relegated in related laws, including the Atomic Energy Act.

For DOE Nevada activities that fall outside those described in the scope of the FFACO (e.g., waste disposal), an Agreement in Principle (AIP) is in place for the Nevada Division of Environmental Protection (NDEP) to provide oversight for those activities. The AIP reflects and provides a further understanding and commitment between the Parties regarding the DOE Nevada's provision of technical and financial support to Nevada for environmental, safety, and health oversight and associated monitoring activities for DOE operations located in Nevada.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

The CGTO engages in monitoring, evaluating, and restoring the cultural integrity of resources impacted by NNSS activities. The Nevada Field Office (NFO) works closely with the CGTO and its member Tribes reinforcing its Trust Responsibility through government-to-government interactions as identified in DOE Order 144.1, American Indian Policy. The CGTO has a designated Spokesperson who assists in facilitating discussions and serving as a conduit for sharing information in-between regularly scheduled meetings or interacting with the NFO, Nevada Department of Environmental Protection and participating in DOE's State Tribal Government Working Group.

DOE Nevada provides periodic updates and hosts Tribal Update Meetings with the CGTO to elicit comments and recommendations relating to NNSS activities.

- The CGTO Spokesperson serves as a DOE Nevada-appointed Liaison representing tribal and CGTO perspectives to the Nevada Site Specific Advisory Board.
- DOE Nevada interacts on a regular basis with the CGTO Spokesperson promoting transparency and open communication.
- CGTO representation on the State Tribal Government Working Group remains a priority of culturally affiliated tribes and the DOE Nevada.
- CGTO engages in routine interactions with the Nevada State Historic Preservation Office to receive project updates occurring on the NNSS.
- NDEP provides guidance to the CGTO upon request relating to NNSS activities.

Tribal Remedial Actions are considered an integral part of NNSS activities. The CGTO in collaboration with DOE Nevada is engaged in activities of importance identified by the Tribes and supported by the DOE including the following:

- Facilitate Archaeological and Tribal Evaluations of UGTA Sites
- Interaction and Traditional Blessings conducted in the Radioactive Waste Management Complex for Storage Cell 18
- Initiate Tribal interactions and Traditional Blessings for Underground Test Area locations
- Soils Remediation
- Tribal reviews of NEPA Documents, and Waste Acceptance Criteria
- Implementation of a Tribal Revegetation Project in response to a tribal request integrating Traditional Ecological Knowledge in revegetation activities in response to FFACO stipulations

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

Achieving closure(s) of contaminated sites on the NNSS is accomplished through a regulatory process defined under the above referenced FFACO. This agreement contains a detailed process or "Corrective Action Strategy" for planning, implementing, and completing environmental corrective actions. The process is designed to produce decision(s) for closure of contaminated sites. In general, site closure activities under the FFACO are being pursued to address the following areas:

- Soils Corrective Action Units
- Underground Test Area (UGTA) Corrective Action Units (underground nuclear tests at the NNSS)
- Industrial Sites Corrective Action Units (includes decontamination and decommissioning activities)
- Off-Site Corrective Action Units (Project Shoal and the Central Nevada Test Area underground nuclear test sites)

The closure process for contaminated surface soils varies for sites on and off the NNSS. For example, DOE has committed to characterize and remediate radioactive contaminated surface soil outside the NNSS boundaries that may have been impacted by DOE activities, such as sites on the NTTR. These sites may be remediated to a dose receptor limit of 25 millirem per year under a land use scenario agreed to by the DoD. State of Nevada officials recognize that "clean closure" of these sites would be cost prohibitive and generally impractical given both current and expected land uses. Other remediation scenarios could include capping the contaminated area with an engineered barrier, posting warning signs, and establishing a use restriction. Once remediation is complete, sites would be available for alternative "controlled" uses as appropriate. Cleanup levels would generally respond to future military missions and DOE related research and development activities. If the land use scenario were to change, for example, if the DoD decides to relinquish the land withdrawal back to the BLM, then DOE would have to reconsider the adequacy of the approved closure with the State, which could potentially lead to a requirement for additional remediation.

For the underground test areas, DOE has stated that the subsurface contamination around the nuclear test cavities will not be remediated since cost-effective groundwater technologies have not been developed to remove or stabilize radioactive contaminants. Rather, closure in place with long-term monitoring and institutional controls will follow data collection to characterize the hydrogeological setting and computer modeling of the setting, the radiological source term, and flow and contaminant transport to forecast areas of current and future contamination for 1,000 years. The uncertainty in model forecasts will be managed through institutional control of areas of potential groundwater contamination. DOE has committed to a subsurface monitoring program of UGTA sites. In addition, to restrict access to contaminated groundwater, DOE is planning to institute institutional control of the contaminated subsurface in perpetuity.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

The only land currently part of the NNSS that is actually owned by DOE is the 740 acres of the Area 5 RWMC. The withdrawal for this land was relinquished, and the title was granted to DOE in 2010. This ownership ensures DOE will have institutional control of the 740 acres in perpetuity. DOE anticipates retaining restricted access to the entire NNSS for the foreseeable future.

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

There are approximately 40 landfill cells, 13 Greater Confinement Disposal (GCD) boreholes, and a storage building for transuranic (TRU) waste destined for disposal at the DOE Waste Isolation Project Plant (WIPP) near Carlsbad, New Mexico.

c. *What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?*

Most treatment technologies have been investigated for use at the NNSS. Following many trials and preliminary applications, the current technologies used are based on cost-effective and reasonable measures employing risk-based corrective actions.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

The NNSS withdrawal of lands currently under management by DOE is planned for the foreseeable future. Controls over contaminated areas have been established in accordance with compliance agreements, post-closure requirements, and ongoing use restrictions. These agreements, requirements, and restrictions have been developed using cost-effective and reasonable measures employing risk-based corrective actions for localized projected land-use scenarios.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

DOE anticipates retaining restricted access to the entire NNSS for the foreseeable future.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

Long-term stewardship at the NNSS remains a long-term commitment and joint effort of the Consolidated Group of Tribes, State of Nevada and the Department of Energy. The nature of the radioactive waste and other materials stored or impacting the NNSS supports DOE's proposal to place permanent use restrictions on selected areas within its boundary, given the soil and groundwater contamination at the site. DOE plans on fulfilling stewardship responsibilities for the NNSS in perpetuity. The CGTO believes their ongoing involvement with DOE in co-managing those cultural resources located on the NNSS is essential to sustaining the cultural balance and integrity of their traditional homelands. Clearly, controlling access to the site, monitoring surface and groundwater contamination, and implementing methods for preserving institutional knowledge about the location and contents of residual contaminated areas remains a priority for the foreseeable future.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*

Long-term stewardship funding will be the responsibility of the landlord (possibly NNSA or Legacy Management if it transfers) when the EM program completes its activities. Currently, no direct DOE EM funding is provided to support the DOE Nevada American Indian Consultation Program or tribal interactions involving these activities. Limited American Indian Consultation Program funding is derived from fees collected from NNSS contractors responsible for fulfilling activities for DOE Nevada relating to EM, low-level waste storage, Radioactive Waste Management Complex activities, the UGTA Activity, and Soil Activity remediation. Tribal interactions currently include site monitoring, tribal revegetation activities, archaeological surveys with tribal participation, document reviews, text preparation, and cultural restoration and land preparation.

Oak Ridge Reservation

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Oak Ridge Reservation (ORR) comprises approximately 33,500 acres owned by the U.S. Department of Energy (DOE). Most of the ORR lies within the city limits of Oak Ridge, Tennessee. Three major installations are located within the ORR: the Oak Ridge National Laboratory (ORNL), the Y-12 National Security Complex, and the East Tennessee Technology Park (ETTP). These installations were constructed in the early 1940s by the Atomic Energy Commission as research, development, and process facilities in support of the Manhattan Project.

The ORR lies within Anderson and Roane Counties (combined population of 130,000), about 20 miles west of Knoxville, Tennessee. The ORR is bounded on the north and east by the city of Oak Ridge and on the south and west by the Clinch River. The Reservation lies within the Valley and Ridge Province, a major subdivision of the Appalachians. The parallel valleys and ridges trend in a northeast-southwest pattern.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

There are no American Indian tribes in proximity to the site. However, we do consult with the Cherokee tribe regarding any cultural artifacts discovered on federal land.

c. Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site. Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

Former operations at DOE's installations on the reservation generated solid, hazardous and mixed waste (hazardous waste mixed with radionuclides). DOE's Environmental Management (EM) program constructed hazardous waste, storage and disposal facilities to dispose of the lower contaminated waste streams onsite, while waste with higher radioactivity is shipped offsite. Past operations impacted soils, sediment, surface and ground water on the reservation which DOE's EM program is working to identify, access, and remediate. Extensive remedial action projects have been completed at the site and many remain underway. Excavation and/or in place closure has occurred for most of the burial grounds, and multiple ground water control/remediation systems have been put in place.

DOE's EM program in Oak Ridge defined a strategy for remedial actions and cleaning the three major campuses onsite (ETTP, ORNL, and Y-12) based on a watershed approach. This approach reflects an understanding of each site's specific geologic setting and potential contaminant migration pathways. It provides a logical grouping of work and a meaningful and measureable method for managing areas of contamination, tracking contaminants of concern, analyzing environmental effects, making decisions, and defining projects within each site. Based on available resources and further analysis, the cleanup scope for all three campuses is then integrated and prioritized.

d. *Describe any additional cleanup accomplishments undertaken or completed since 1999.*

The EM program has made significant progress cleaning the reservation. Off-site environmental legacy waste sites affected by past DOE operations have been remediated. Several reservation-wide initiatives have been accomplished, such as the Legacy Material Disposition Program that dispositioned more than 100 million pounds of mixed waste.

At the ETTP, the EM program has removed more than 400 old, excess and contaminated facilities, including all of the former uranium enrichment processing buildings. Employees also dispositioned 7,000 depleted uranium hexafluoride cylinders from the site. At ORNL, the cleanup program has removed dozens of old, excess and contaminated facilities. It has also processed all of its original contact-handled transuranic waste and 90 percent of the remote-handled transuranic waste. The program also completed the cleanup at burial grounds adjacent to ORNL and constructed 145 acres of protective soil caps over the area. At Y-12, the EM program constructed two treatment systems that annually remove mercury from 100 million gallons of water. Additionally, employees removed and dispositioned large mercury tanks and thousands of pounds of mercury-contaminated sludge from 14,000 feet of piping in Y-12's West End Mercury Area storm sewer system.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

Waste streams disposed of on the Oak Ridge Reservation date back to the early 1940's and include "legacy" wastes associated with original Manhattan Project and Cold War production activities and other missions, particularly isotope production activity at Oak Ridge National Laboratory. In addition, the ongoing Oak Ridge Reservation cleanup program continues to generate volumes of waste (predominantly building demolition debris and contaminated soils) that are transported and disposed of in a modern compliant disposal facility. It is estimated that the total volume of buried legacy waste was on the reservation is well below 1 million cubic yards, and that the volume of material generated to date by cleanup and disposed of in the onsite CERCLA cell is in the range of 1.5 to 1.7 million cubic yards. The estimated number of curies present in these disposed wastes is approximately 2 to 2.5 million curies.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

    i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

It is estimated that an additional 2.5 million cubic yards of waste material (approximate) will be generated during completion of Oak Ridge Reservation cleanup. These wastes will be predominantly building and equipment demolition debris and contaminated soils from cleanup operations at Oak Ridge National Laboratory and the Y-12 facility. Curie calculations associated with these projected waste streams are currently not available though the total curie inventory associated with these facilities is less than 30 million curies the vast majority of which is targeted for off-site disposal.

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*
Approximately 10% of the total volume generated (characterized in response above) is anticipated to be shipped for off-site disposal or treatment.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

It is anticipated that select burial grounds located proximate to each of the three major facilities in Oak Ridge will remain in place. The total land area associated with these burial grounds is in the range of 500-600 acres including the interstitial spaces located between burial trenches.

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

Two federal laws, the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are the dominant regulatory drivers for environmental management activities on the ORR.

In December 1989, the ORR was placed on the National Priorities List as a high priority hazardous waste site requiring remediation. In May 1991 the Tennessee Oversight Agreement (TOA) was signed. This document pledged financial and technical support from DOE, including participation in a tri-party agreement. In January 1992, DOE, the Environmental Protection Agency and the Tennessee Department of Environment and Conservation negotiated the Federal Facility Agreement (FFA) for environmental restoration activities on the ORR. The FFA integrates the corrective action processes of RCRA and CERCLA.

b. *How are the tribe(s) and/or the state(s) involved in the decision process?*

No American Indian tribes are located in proximity to the Oak Ridge Reservation however the Cherokee Nation is consulted with on all cultural resource issues. The State of Tennessee is a direct participant in decision processes via the Oak Ridge Reservation Federal Facility Agreement.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

Final Decisions have not been made for the burial grounds in Oak Ridge, all of the decisions directing in-place closure are Interim Records of Decision. Current program plans are based on expectation that these areas will remain as burial grounds based upon the protectiveness of selected remedies, and the cost and implementation hazards that would be associated with excavation and transportation of burial ground contents.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?

A community involvement process referred to as the "End Use Working Group" was utilized to build consensus amongst community members, the DOE and its regulators on land use end-states for the legacy waste areas. These land areas will be restricted to a waste management function in perpetuity.

b. Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.

DOE has multiple burial grounds located across the ORR. To date, the EM program has addressed most of them to prevent contact with groundwater and subsequent contamination migration offsite. Oak Ridge also has an onsite 2.2 million cubic yard CERCLA disposal facility for mixed, low-level waste resulting from cleanup. None of these locations are open to the public.

Each year DOE operates the disposal facility, the EM program provides funds into an account for the State of Tennessee to use for oversight and stewardship when it is closed and capped. While it is still operational, DOE regularly monitors groundwater near the disposal facility to ensure all of the contamination remains in place. As required by EPA/DOE and TDEC agreements, as codified in CERCLA documentation, when it is closed, the disposal facility area will be monitored as long as waste remains in place that could pose any risk to human health or the environment. Long-term stewardship requirements for the disposal cell will include maintaining the vegetative cover, monitoring for any evidence of cap erosion or subsidence, repair of all containment systems, and continuation of al monitoring systems needed to determine if any environmental releases are occurring form the site. Additionally, if any release is detected, actions will be triggered to ensure these releases are addressed and removed immediately.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

DOE utilized numerous designs and features to ensure the safe long term disposal of materials in its onsite disposal facility. First, the EM program selected a site with geological features that prevent contamination from moving toward residential areas due to a natural groundwater divide. Additionally, there is 15 feet of protective liners and other material that provides a barrier beneath the dispositioned material.

When the disposal facility is completely filled, it will be covered by a multi-layer cap composed of low-permeability clays and synthetic sheeting. The engineering design will isolate the waste and prevent storm water from passing into it. The top of the cap will be a four-foot thick erosion control layer of soil and grasses that provide further protection. These synthetic sheeting materials used in the liner and cap have been thoroughly tested and can be expected to last for several centuries. During operations, and for many years after it is closed, water that contacts the waste will be captured and treated, if needed, to remove contaminants. Water will not be discharged to the environment prior to meeting all applicable regulatory standards.

Finally, drainage layers are composed of appropriate diameter rock, selected for its resistance to weathering to ensure the rocks do not crumble or dissolve over time. The underdrains and surface water drains are layered with graded diameter material (sand, gravel-sized rock, larger rock) that reduces the chance of clogging. Appropriately built drainage layers will last indefinitely.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

Oak Ridge's disposal facility will be regularly monitored as long as waste remains in place that could pose any risk to human health or the environment. Additionally, if any release is detected, actions will be triggered to ensure these releases are addressed and removed immediately. Specific activities associated with long term stewardship plans for disposal cells and burial areas are discussed in response to question III b above.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

Though not yet finalized, LTS plans are being developed for each watershed on the Oak Ridge Reservation. These plans identify necessary monitoring programs for all environmental media, along with any necessary institutional controls necessary to ensure long-term protectiveness.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

Broadly speaking, allocation of responsibilities for long term stewardship in Oak Ridge are defined by watershed level CERCLA Records of Decision and follow on implementation documentation. Generally speaking, ultimate responsibility for enforcing these conditions rests with the Parties to the Oak Ridge Federal Facility Agreement.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*

DOE currently provides grants to the State of Tennessee to provide monitoring and oversight of the Oak Ridge cleanup program, including oversight of stewardship activities. These funding mechanisms are reviewed and renewed on an annual basis. DOE has also established a Perpetual Care fund for the existing onsite CERCLA disposal facility to ensure the availability of funds for monitoring of the onsite disposal facility post closure. Current and anticipated practice calls for provision of funding for these activities via the Congressional Appropriations process.

Rocky Flats Site

I. Site Background and Remediation Description

a. *Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.*

The Rocky Flats Plant was part of the nationwide nuclear weapons complex that manufactured nuclear weapons components under the jurisdiction and control of the U.S. Department of Energy (DOE) and its predecessor agencies, the U.S. Atomic Energy Commission and the Energy Research and Development Administration.

To accommodate construction of the plant, a parcel of land 16 miles northwest of Denver, Colorado, in northern Jefferson County was acquired by the U.S. government in 1951. Additional parcels acquired in 1974 and 1975 increased the size of the plant property to approximately 6500 acres.

The Rocky Flats Federal property is on a plateau at the eastern edge of the Front Range of the Rocky Mountains, at an elevation close to 6000 feet. Most of the property was used as a security buffer surrounding the site's 385-acre industrial area.

The DOE Office of Legacy Management (LM) is responsible for long-term surveillance and maintenance of approximately 1300 acres (the Central Operable Unit, or COU) of the more than 6,500-acre Rocky Flats federal property. LM is also responsible for approximately 200 acres of former buffer zone land, which is now associated with an active gravel mine and will be transferred to the refuge as mining permits expire and reclamation required by Colorado law is completed. The U.S. Fish and Wildlife Service (FWS) is responsible for the almost 4,700 acres forming the Rocky Flats Refuge which surrounds the COU. The Peripheral Operable Unit (POU) or refuge was determined by the CERCLA process in 2006 to be acceptable for unlimited use/unlimited exposure.

b. *Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?*

There are no tribes in current proximity to the site that are impacted by past or current operations.

c. *Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.*

   Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

After nuclear weapons components production ended, the facility's mission changed to cleanup and closure, and it was renamed the Rocky Flats Environmental Technology Site. Operational problems during the plant's history, its abrupt shutdown in 1989 for environmental and safety concerns, and standard practices used at the time caused substantial contamination consisting of plutonium, beryllium, and other hazardous substances. Unknown quantities and chemical configurations of plutonium liquids remained in process piping, and tanks and classified materials were left where they were being used or processed.

In October 2005, DOE completed an accelerated 10-year, $7 billion cleanup of chemical and radiological contamination in production buildings and limited areas across the site after nearly 50 years of production activities. Cleanup required decommissioning, decontaminating, demolishing, and removing more than 800 structures, including six plutonium-processing and fabrication building complexes. DOE removed more than 500,000 cubic meters of low-level radioactive waste, primarily generated by decontaminating and demolishing contaminated buildings, and evaluated 421 potentially contaminated environmental sites, 88 of which required remediation.
Low level residual soil contamination exists in the COU. Within the COU, the primary contaminants of concern in soil are plutonium-239/240, benzo(a)pyrene, dioxins, arsenic, and vanadium. Low levels of wind-blown plutonium were also detected in the refuge and in a small area east of the refuge, however, these areas were determined to be suitable for unlimited use/unlimited exposure and did not require cleanup.

While the remedial actions removed a substantial amount of contaminant sources, groundwater plumes and some areas of contaminated soil remain within the COU. All contaminated groundwater discharges to surface water within the COU, so surface water and stream sediments contain low levels of chemical compounds such as volatile organic compounds nitrate, and uranium. Overland flow from areas of residual surface soil contamination also contributes to radiological contamination (i.e., plutonium and americium) in surface water.

COU areas and their primary contaminants, contaminated media, and waste include:

- Present Landfill (PLF) waste with asbestos and hazardous waste constituents and the Original Landfill (OLF) with trash, construction debris, and some depleted uranium contamination. Landfill covers are designed and engineered with precipitation run-on and runoff controls and groundwater monitoring wells.
- PLF leachate containing volatile organic compounds (VOCs). A passive, seep-treatment system uses passive aeration to treat the collected leachate.
- Limited subsurface soil areas with VOCs, metals, and radionuclide contamination.
- Buried former building and infrastructure components containing low levels of plutonium, and americium contamination (generally fixed within the building concrete matrix after concrete surface removal by mechanical decontamination was performed to the extent practical).
- Buried incinerator ash containing low levels of uranium.
- Disposal trenches containing VOCs and plutonium and americium.
- Limited areas where surface soil is contaminated with low levels of plutonium-239/240 and americium-241 (below levels of human health or ecological concerns), which could affect surface water quality if the soils were disturbed to the extent that erosion could mobilize the contaminants.
- Limited subsurface soil areas contaminated with nitrates, uranium, and VOCs that contribute contaminants to groundwater, which may affect surface water quality.
- Limited subsurface areas where VOC contamination levels preclude occupied buildings because volatilization could lead to unacceptable VOC levels.

- Groundwater contaminant plume areas that may affect surface water quality because of nitrates, uranium, and VOCs at levels above surface water standards and, in some cases, above maximum drinking water contaminant levels. Four groundwater collection and three treatment systems remove these constituents to reduce groundwater contaminant loading to surface water and meet regulatory requirements.

Sections 3.0 through 6.0 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) Report present the nature and extent of soil, groundwater, surface water and sediment, and air contamination, respectively.

RI/FS (http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx#RIFS)

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

The cleanup was completed in October 2005; no additional cleanup has been undertaken.

e. Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).

There is no onsite disposal of radioactive or hazardous waste.

f. To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.

No additional cleanup is planned for the site.

i. Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).

Not applicable

ii. Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?

Not applicable.

iii. Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).

Contaminated materials remain in the COU in the form of:

1) Two landfills (described above;
2) Buried features, such as former building slabs, walls, foundations and a tunnel;

3) Burial trenches and pits;
4) Process waste lines and valve vaults (removed to the extent practical and the remaining lines were flushed and grouted in place);

II. Decision Processes

a. State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.

Rocky Flats was added to U.S. Environmental Protection Agency's (EPA's) National Priorities List (NPL) in 1989 because environmental investigations indicated that site operations released materials defined as hazardous substances, contaminants, and pollutants by CERCLA. Also released were materials considered hazardous wastes and waste constituents, as defined by the Resource Conservation and Recovery Act (RCRA) and the Colorado Hazardous Waste Act (CHWA).

Under CERCLA and in accordance with Executive Order 12580, *Superfund Implementation*, DOE is delegated as the lead agency responsible for the response action for hazardous substance releases at Rocky Flats. EPA and the Colorado Department of Public Health and Environment (CDPHE) are the support agencies. DOE is also responsible for corrective action for releases of hazardous waste and hazardous waste constituents at Rocky Flats under RCRA and CHWA. In Colorado, CDPHE regulates RCRA/CHWA corrective action.

Three successive federal facility agreements and compliance orders, beginning in 1986 and culminating with the Rocky Flats Cleanup Agreement (RFCA)—signed by DOE, EPA, and CDPHE in July 1996—covered investigation and cleanup activities. The RFCA incorporated a consultative, accelerated action approach that was eventually recommended by the Government Accountability Office for other DOE Complex sites. Cleanup, closure, and final remedy selection met all RFCA requirements.
The final remedy was selected in the September 29, 2006 Corrective Action Decision/Record of Decision (CAD/ROD) after completion of cleanup and closure by DOE under RFCA. The CAD/ROD was based on the results of the July 2006 RI/FS, Comprehensive (Human Health and Ecological) Risk Assessment (CRA; Appendix A to the RI/FS), and the Proposed Plan.

CAD/ROD (http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx#CAD)
RI/FS (http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx#RIFS)

b. How are the tribe(s) and/or the state(s) involved in the decision process?

On March 14, 2007, DOE, EPA, and CDPHE entered into the *Rocky Flats Legacy Management Agreement* (RFLMA). The agreement establishes the regulatory framework for implementing the final remedy for the Rocky Flats COU and ensuring that it protects human health and the environment. RFLMA provides site-specific regulatory standards for contaminants and governs continued site monitoring and possible response actions.

RFLMA (http://www.lm.doe.gov/Rocky_Flats/RFLMA.pdf)

No tribes were involved in the process. Colorado's two federally-recognized tribes (Ute Mountain Ute and Southern Ute) are located in the southwest corner of Colorado near Durango, hundreds of miles from Site.

c. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

The RI/FS determined that the POU (the current Refuge) was already in a state protective of human health and the environment and therefore met conditions that allowed unlimited use and unrestricted exposure. The selected remedy/corrective action for the POU was no action.

Contamination remaining in the Central OU prohibits unlimited use and unrestricted exposure. One factor that prevented achieving clean closure was risk to worker health and safety. For example, during cleanup DOE determined it would be too dangerous for workers to remove deep, underground structures from the Site. Instead, the contaminated structures were treated with a sealant and buried. The selected remedial alternative complied with ARARs and met the remedial action objectives. Concerns about cost, implementability, negligible benefits associated with additional removal actions combined with pressure to close the Site were also factors justifying a CERCLA remedy for the COU. See *Rocky Flats Closure Legacy Report* (http://www.lm.doe.gov/Rocky_Flats_Closure.pdf) and CAD/ROD (http://www.lm.doe.gov/Rocky_Flats/Regulations.aspx#CAD).

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

After cleanup, two operable units (OUs) defined the Rocky Flats Federal property within the boundaries of the property.

The largest portion of the property,now designated as the POU or refuge, which served as the security buffer zone, transferred to the U.S. Department of the Interior in July 2007, to be managed by the U.S. Fish and Wildlife Service (USFWS) as the Rocky Flats National Wildlife Refuge. Additional DOE-administered lands (745 acres) associated with private mineral rights on the property's west side transferred to the refuge in 2014.

- Peripheral OU
    - 4883 acres
    - Generally unaffected portions of Rocky Flats surrounding the Central OU

LM is responsible for long-term surveillance and maintenance of approximately 1300 acres (Central OU) of the 6500-acre Rocky Flats Federal property.

- Central OU
    - 1309 acres
    - All site areas required additional remedial/response actions (with consideration to future land management)

Final CAD/ROD response actions:

- Central OU
    - Institutional controls
    - Physical controls
    - Continued monitoring and maintenance

- Peripheral OU
    - No action; Unrestricted Use and Unlimited Exposure

Restrictions for the Central OU will be maintained in perpetuity.
Unlike the COU, the CAD/ROD classified the Peripheral OU as suitable for unrestricted use. In 2001, the U.S. Congress passed an Act requiring that portion of the Rocky Flats property not requiring a CERCLA remedy, the POU be used as a wildlife refuge. U.S. Fish & Wildlife Service anticipates fully opening the refuge (POU) to the public in 2018.

b. Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.

No wastes generated during cleanup were disposed of on-site, but rather were taken to various off-site disposal locations. Two landfills that operated in the COU prior to cleanup were capped in place. The Present Landfill has a "RCRA" cap and the leachate that flows out of the bottom is collected and treated with a passive aeration system. The Original Landfill has a constructed soil cover.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

Treatment technologies were evaluated in decision documents for each accelerated action based on types and levels of contamination and the existing technologies at the time. Low-temperature thermal desorption was applied twice for the contents of Ryan's Pit and trenches T-3 and T-4.
Electron donor material in the form of Hydrogen Release Compound (HRC) or HRC-X was used to promote biodegradation at several source areas for groundwater contaminated with chlorinated solvents. In most locations, the HRC or HRC-X was added either via injection or by addition to backfill placed after the most highly-contaminated subsurface soils were excavated and removed.

d. What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?

DOE LM is responsible for the long-term care of legacy liabilities at former nuclear weapons production sites, such as Rocky Flats, following cleanup, disposal, or stabilization at a site or portion of a site and in perpetuity to ensure protection of human health and the environment. These activities include maintaining all engineered and institutional controls designed to contain or prevent exposure to residual contamination and waste, recordkeeping activities, inspections to evaluate surface features, groundwater and surface water monitoring, maintaining other barriers and contained structures, access control, and emergency response.

At Rocky Flats, LM is responsible for managing land retained by DOE (i.e. the COU) and for compliance with the long-term requirements outlined in RFLMA. Monitoring and maintenance responsibilities at Rocky Flats include 2 closed landfills, 3 groundwater treatment systems, and more than 100 water monitoring locations and stations. In addition to complying with RFLMA requirements, LM manages and maintains 3 surface water retention ponds, erosion controls, and revegetation.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

The RFLMA is the LTS plan for the COU. RFLMA Attachment 2 defines the Central OU remedy surveillance and maintenance requirements. The RFLMA may be amended and RFLMA attachments may be modified from time to time, as approved by CDPHE and EPA in accordance with RFLMA Part 10, "Amendment of Agreement and Modification of Attachments." The requirements include environmental monitoring; maintenance of the erosion controls, signage designating the COU, landfill covers, and groundwater treatment systems; and operation of the groundwater treatment systems.

RFLMA Attachment 2 stipulates that DOE use administrative procedures to control activities in accordance with the institutional controls and to meet quality assurance and control program requirements. The RFLMA also recognizes that other procedures are established to guide work and implement best management practices (BMPs).

The Rocky Flats Site Operations Guide (RFSOG) is maintained by LM as the primary document to guide work, satisfy the requirements of the RFLMA, and implement BMPs at the Central OU. The RFSOG explains how LM will fulfill its long-term surveillance and maintenance obligations at the Central OU. Unlike RFLMA, RFSOG is not a regulatory document; it is not legally enforceable and is subject to changes in policy and DOE guidance. The RFSOG is periodically reviewed, and changes are made as part of a continuous improvement process. Also, RFLMA requirements may be modified upon approval of CDPHE and EPA. If there is any conflict between the RFSOG and the modifications to the RFLMA, the RFLMA takes precedence. The RFSOG incorporates applicable LM policy and guidance and is consistent with the planning requirements of DOE Orders 430.1B and 413.3B.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

As discussed previously, DOE, EPA, and CDPHE are parties to the RFLMA. The agreement establishes the regulatory framework for implementing the final remedy for the Rocky Flats COU and ensuring that it protects human health and the environment.
DOE is lead agency for site maintenance, monitoring, and remediation.

Under RFLMA, CDPHE is the lead regulatory agency. DOE also entered into an Environmental Covenant (an institutional control) with the State of Colorado, pursuant to state statute. DOE is responsible for implementing the Environmental Covenant, but CDPHE may enforce the Covenant.

EPA is the lead regulatory agency for certain CERCLA actions such as concurrence with 5-Year Reviews.

The Rocky Flats Stewardship Council (Stewardship Council) formed in February 2006 to provide ongoing local government and community involvement in the post-closure management of Rocky Flats. The

Stewardship Council serves as a forum only and does not have decision-making authority with respect to Site management.

The Stewardship Council's mandate is found in federal law. In late 2004, the U.S. Congress, working with DOE and the Stewardship Council's predecessor organization, the Rocky Flats Coalition of Local Governments, approved legislation creating a new organization to focus on the post-closure care and management of Rocky Flats. The Stewardship Council includes elected officials from 10 municipal governments neighboring Rocky Flats, three community organizations, and one individual.

The Stewardship Council is funded by DOE and may not use its DOE grant funding in its interactions with USFWS. In addition to working with DOE, EPA and CDPHE, the Stewardship Council may use its dues funding to also work with USFWS on issues related to the management of the Rocky Flats National Wildlife Refuge.

RFLMA (http://www.lm.doe.gov/Rocky_Flats/RFLMA.pdf)
RFSC (http://www.rockyflatssc.org/)

> g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the State and/or Tribe.*

Funding is provided through the Legacy Management Support Services subcontract as determined by DOE LM.

RFLMA states that DOE will reimburse the State of Colorado's oversight of Rocky Flats.

Savannah River Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

Located in the southwestern portion of South Carolina, the Savannah River Site (SRS) was originally purchased for the Atomic Energy Commission and is now owned by the U.S. Department of Energy (DOE). Situated in rural Aiken, Barnwell, and Allendale counties, SRS is about 15 miles south of the city of Aiken, South Carolina and 25 miles southeast of the city of Augusta, Georgia.

The SRS was established in the 1950's to produce materials (primarily tritium and plutonium-239) needed for the nation's nuclear deterrent. SRS facilities included five nuclear reactors, two chemical separations plants, a heavy water extraction plant, a nuclear fuel and fabrication facility, a tritium extraction facility, a nuclear laboratory, waste management facilities, and requisite utilities infrastructure. Some of these facilities are still operating. But, many others have been closed or demolished. Today, waste processing and treatment, environmental remediation and cleanup, tritium processing, and safeguarding nuclear materials are key SRS missions.

The SRS occupies nearly 310-square miles (198, 344 acres) within the Southeastern Mixed Forest Ecoregion. Habitats include upland terrestrial areas, wetlands, streams, reservoirs, and the adjacent Savannah River. These diverse habitats support a wide variety of plants and animals, including a number of threatened, endangered, and sensitive species. The entire SRS was designated as the first National Environmental Research Park (NERP) over four decades ago to provide research opportunities to study the impacts of energy and defense-related technologies on the environment.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

The closest federally-recognized tribe to SRS is the Catawba Indian Nation. They have a reservation in Rock Hill, South Carolina, about 150 miles north of the SRS. The only other federally-recognized tribe in the region is the Eastern Band of Cherokee, who are located about 230 miles from the Savannah River site in Qualla, North Carolina. Neither tribe has cultural connections to the SRS nor are they directly impacted by the SRS activities.

There also are several federally-recognized Native American groups whose traditional territories were on or near the SRS. These include the Creek descendant communities of the Muscogee Nation, Kialegee Tribal Town, Thlopthlocco Tribal Town, Alabama-Quassarte Tribal Town, the Chickasaw Nation, and the Poarch Band of Creek Indians. All except the last group are located in eastern Oklahoma, while the Poarch Band is located in Atmore, Alabama. The cultural heritage of these groups and their connection to the landscape of the state may be impacted by SRS activities.

There are 14 Native American tribes and entities recognized in South Carolina, and three of these have traditional territories near the SRS. Those include the Edisto Natchez Kusso Tribe of South Carolina, the Beaver Creek Indians, and the Chaloklowa Chickasaw Indian People. While their known territories do not overlap SRS boundaries, their cultural heritage and connection to the landscape of the state may be impacted by SRS activities.

c. *Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site. Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.*

Nuclear material production at SRS produced unusable by-products, such as radioactive waste. About 36 million gallons of radioactive liquid waste are stored in 49 underground tanks. The Defense Waste Processing Facility (DWPF) is processing the high-activity waste, encapsulating radioactive elements in borosilicate glass, a stable storage form. Since DWPF began operations in March 1996, more than 10 million pounds of radioactive glass has been produced. In 2015, 93 DWPF canisters were produced that immobilized 1.8 million curries of radioactivity. Since the beginning of operations at DWPF, 57.4 million curies have been immobilized.

Much of the liquid waste in the underground tanks is being separated as relatively low-level radioactive salt solution through a new, innovative approach to waste removal, called the Actinide Removal Process and Modular Caustic Side Solvent Exaction Unit. These facilities treat, decontaminate and disposition radioactive salt waste removed from SRS storage tanks, sending the higher activity waste to DWPF. The facilities use the same unit processes as those in the SRS Salt Waste Processing Facility (SWPF), Construction of the SWPF is now complete and operational testing is underway. The SWPF will provide high volume, highly efficient treatment capacity for longer term salt processing at SRS.

Low-level salt waste from salt treatment processing is sent to the Saltstone Production Facility, where it is mixed with cement, ash and furnace slag and poured into permanent concrete vaults for safe disposal at the Saltstone Disposal Facility. SRS is the first site in the DOE Complex to disposition salt waste. Through 2015, over 750,000 gallons of waste was processed and disposed through the Saltstone facilities.

SRS waste tanks have provided nearly 50 years of safe storage for nuclear waste. Removing waste from the tanks will allow for permanent closure of the Site's high-level waste tanks. This is a high priority for DOE. During 2015, Tank 16 H was operationally closed and Tank 12 H was undergoing preparation for tank closure.

In addition to radioactive liquid waste, other radioactive wastes at the Site include low-level solid waste (includes items such as protective clothing, tools and equipment that have become contaminated with small amounts of radioactive material) and transuranic (TRU) waste (contains alpha-emitting isotopes with an atomic number greater than uranium). Other wastes include hazardous waste, which is any toxic, corrosive, reactive or ignitable material that could affect human health or the environment; mixed waste, which contains both hazardous and radioactive components; and sanitary waste, which, like ordinary municipal waste, is neither radioactive nor hazardous.

SRS disposes of low-level radioactive waste on site in specially engineered facilities. However, some types of low-level waste are technically unsuitable for disposal at SRS waste management facilities. In July 2001, SRS began shipping some of these wastes to off-site treatment and disposal facilities.

TRU waste had been stored temporarily at SRS. The opening of the Waste Isolation Pilot Plant (WIPP) in New Mexico, a DOE deep geological disposal facility specifically designed for TRU waste has provided a disposal site. In 2001, SRS began shipping its TRU waste, about 30,000 legacy drums or about 6,000 cubic meters to WIPP. At the end of 2011, over 29,500 55-gallon drums, of the original TRU waste inventory was shipped. Over the past eight years SRS has disposed of another 4,965 cubic meters of Tru waste. The SRS will resume TRU waste shipments when WIPP repairs and renovations are completed.

Hazardous waste is routinely shipped off site to commercial facilities for treatment and disposal. In 2001, SRS made its first-ever shipments of mixed waste for treatment off site, and continues to decrease the inventory of mixed waste using available Resource Conservation and Recovery Act (RCRA)-regulated treatment and disposal vendors. Over the past eight years SRS has disposed of 904 cubic meters of hazardous waste and 1,316 cubic meters of mixed waste.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

Since approximately 2003, extensive cleanup and closure work has been completed at SRS under a concept known as Area Completion, which streamlines and accelerates the cleanup process. The SRS Area Completion Project (ACP) has removed excess facilities and remediated soil and groundwater in an integrated fashion, with the full support of DOE, the United States Environmental Protection Agency (EPA) and the South Carolina Department of Health and Environmental Control (SCDHEC).

ACP focuses on cleaning up contamination in the environment by treating or immobilizing the source of the contamination to mitigate transport through soil and groundwater and clean up or slow the movement of contamination that has already migrated from the source. From capping waste sites to installing efficient groundwater treatment units, field work is a top priority. Field work includes closure of inactive seepage basins, rubble pits, rubble piles and disposal facilities. Major groundwater cleanup systems operate extensively in nearly every Site area.

To date, 405 of SRS's 515 waste units have been completed, with more than 3,600 regulatory milestones safely met. Deployment of numerous cost-effective technologies expedites the cleanup process. Remediation is being executed in a fashion that completes environmental cleanup and facility decommissioning area by area until all areas at SRS are completed. The target date is 2065. Units at which waste is left in place will be under institutional controls that feature access restrictions, inspection, maintenance and long-term stewardship monitoring. Typically, soils will be remediated to an acceptable residual risk for industrial workers.

Groundwater is addressed in a manner such that required cleanup levels, approved by regulators, will be achieved over time. Much ACP work was accelerated through a significant investment of $1.6 billion at SRS in 2009 from the American Recovery and Reinvestment Act, including a 85 percent reduction in footprint and final decommissioning of numerous facilities, notably three production reactors which are expected to remain in their present state for over 1,400 years.

e. Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).

Please see the above discussion.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

Please see the above discussion.

i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

II. Decision Processes

a. *State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.*

The management of waste at SRS is complex and includes many facilities that are regulated under DOE Orders, as well as federal and state regulations. These include: 1) DOE Order 435.1, "Radioactive Waste Management" for the management, treatment, and storage of low-level, high level, and TRU waste; 2) SCDHEC industrial wastewater regulations through provisions of Section IX, "High-Level Radioactive Waste Tank Systems of the Federal Facility Agreement (FAA)" for the F-Area and H-Area tank farms; 3) SCDHEC industrial wastewater regulations for the interim Actinide Removal Process and Modular Caustic Side Solvent Extraction Unit; 4) SCDHEC solid waste landfill regulations for low activity salt solution sent to the Saltstone Production Facility for disposition in the Saltstone Disposal Facility; 5) SCDHEC industrial waste water regulations for operation of the Defense Waste Processing Facility; and 6) SCDHEC NPDES permit and industrial wastewater permit for the Effluent Treatment Project.

Since 1993, the FFA integrates the CERCLA and RCRA requirements to achieve a comprehensive remediation strategy for SRS environmental restoration and cleanup. It also coordinates administrative and public participation requirements. The FFA governs the remedial action process, sets annual work priorities, and establishes milestones for SRS cleanup actions. All 515 SRS waste units are listed in in FFA Appendices C ("RCRA/CERCLA Units List"), G ("Site Evaluation List"), and H ("Solid Waste Management Units Evaluation"). The CERCLA requires that reviews be conducted every five years for sites where hazardous substances remain at levels that do not allow for unrestricted use after remedy completion. The remedies are evaluated to determine if they are functioning as designed, and are still protective of human health and the environment. The EPA, SCDHEC, and DOE signed the "Fifth Five-Year Remedy Review Report for SRS Operable Units with Native Soil Covers and/or Land Use Controls in 2015. After regulatory review and comment on this report, it is scheduled for public review in 2017.

Involvement of tribes in decisions affecting SRS natural and cultural resources is encouraged in a variety of ways. The Catawba Nation and the state recognized tribes are engaged through National Environmental Policy Act (NEPA) compliance, while the state recognized tribes also are involved through the SRS Citizen's Advisory Board (CAB). When cultural resources projects require consultations, all affected federally-recognized tribes are consulted.

Recently, the SRS has initiated an effort to revise its Cultural Resources Management Plan. As part of that, an attempt has been made to re-engage tribes that are not involved through the CAB and NEPA compliance. Staff have attended Department of Defense consultation meetings at Fort Jackson and the South Carolina National Guard and held meetings with the Muscogee Nation, Thlopthlocco Tribal Town, and Kialegee Tribal Town. They also have meetings with tribes planned during the upcoming Southeastern Archaeological Conference.

b. *Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.*

Please see Section III below.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

DOE's Office of Environmental Management (EM) is currently responsible for managing SRS. Long Term Stewardship (LTS) is a post EM remediation operating program. The cost and schedule associated with the LTS program is contingent upon the length of time, performance and productivity of the preceding EM remediation work scope, and any significant regulatory changes and determinations made during the EM remediation phase that would continue into the LTS performance period.

Based on current plans, the LTS program for SRS will not begin until 2066 In the interim EM management at SRS will be consistent with the Land Use Controls Assurance and Implementation Plans (LUCAP/LUCIP), the CERCLA Record of Decision, or RCRA Permit Modification for each waste unit/facility.

a. *What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?*

b. *Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.*

c. *What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?*

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*

Weldon Spring Site

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The Weldon Spring Site is located in St. Charles County, Missouri, about 30 miles west of St. Louis.

In 1941, the U.S. Department of the Army (Army) acquired about 17,000 acres of land in St. Charles County to construct and operate the Weldon Spring Ordnance Works to manufacture trinitrotoluene (TNT) and dinitrotoluene (DNT) explosives. The Army closed the ordnance works and declared it surplus in 1946. By 1949, all but about 2000 acres of the property had been transferred to the State of Missouri. The property would eventually become the Weldon Spring Wildlife Area and the August A. Busch Memorial Wildlife Area. Except for several small parcels transferred to St. Charles County, the remaining property became the Weldon Spring Uranium Feed Materials Plant and the U.S. Army Reserve and National Guard Training Area (the Weldon Spring Training Area [WSTA]).

The land for the feed materials plant, now referred to as the Chemical Plant, was the result of a transfer of 205 acres of the former ordnance works from the Army to the U.S. Atomic Energy Commission (AEC). Additional land was later acquired to construct a fourth raffinate pit to increase waste storage capacity. From 1957 to 1966, AEC produced uranium trioxide, uranium tetrafluoride, and uranium metal from uranium and thorium ore concentrates. Plant operations generated several chemical and radioactive waste streams, including raffinates from the refinery operation and magnesium fluoride slurry (washed slag) from the uranium recovery process. Raffinates and waste slurries were piped to the raffinate pits from which supernatant liquids were decanted to the plant process sewer. This sewer drained offsite to the Missouri River via a 1.5-mile natural drainage channel termed the Southeast Drainage.

As result of past activities, the Weldon Spring Site became contaminated. The U.S. Environmental Protection Agency (EPA) placed the Quarry and former Chemical Plant areas of the site on the CERCLA National Priorities List (NPL) in 1987 and 1989, respectively. The U.S. Department of Energy (DOE) is responsible for cleanup activities at the site through the Weldon Spring Site Remedial Action Project. The WSTA is listed on the NPL separate from the Weldon Spring Site. The Army is responsible for cleanup activities at the WSTA.

The Weldon Spring Site consists of two noncontiguous areas: the 217-acre chemical plant area and a 9-acre limestone quarry. The Weldon Spring site is located in the southwest uplands of St. Charles County, which is bordered by the Mississippi River to the north and the Missouri River to the south. The county land is about half uplands and half floodplain. Site elevations range from approximately 610 feet mean sea level (MSL) near the northern edge to about 670 feet MSL near the southern edge. A small portion of land in the northern area of the site is within the 100-year floodplain of nearby Schote Creek. Gently rolling topography characterizes the area to the north and west, whereas wooded ravines characterize the terrain to the south and east.

The site straddles the surface water drainage divide that separates the Mississippi River and the Missouri River watersheds. Runoff south of the divide flows to the Missouri River through the Southeast Drainage, a natural channel with intermittent flow.

More than 64 feet of alluvial deposits blanket the bedrock in the Missouri River valley. Silt loam is the predominant soil type in the area surrounding the site, both in gently rolling terrain to the north and in more hilly terrain to the south. Approaching the Missouri River, the soil types in the floodplain include silt, silty clay, silty loam, and clay loam.

Overlying the bedrock at the site are unconsolidated sedimentary units that range in thickness from 16 to 59 feet. Beneath this unconsolidated material lies the Mississippian Burlington-Keokuk Limestone, which is about 140–160 feet thick at the site and comprised of an upper weathered zone and a lower unweathered zone. The contact between these zones is often difficult to distinguish. Karst features are present in the vicinity of the site, although the site itself is not considered to be situated in an area of collapse potential.

Groundwater at the site consists of perched groundwater in the unconsolidated deposits (e.g., near the raffinate pits), a shallow unconfined aquifer in the Burlington Keokuk Limestone, and a deep confined aquifer in the St. Peter Sandstone. The shallow limestone aquifer has been contaminated as a result of past processing and disposal activities by the Army and the AEC.

Groundwater in the shallow aquifer appears to flow by diffuse flow, along horizontal bedding planes, and to a lesser extent through fractures. Groundwater offsite flows by diffuse flow and also via certain free-flow conduits on both sides of the groundwater divide. Discharge points for the conduits are perennial springs such as Burgermeister Spring to the north and springs in the Southeast Drainage to the south.

b. *Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?*

There are no federally recognized American Indian tribes in Missouri today.

c. *Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site.*
Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.

Radioactive contaminants at the site included radionuclides of uranium-238, thorium-232, and the uranium-235 decay series; chemical contaminants included metals and inorganic anions, as well as organic compounds such as polychlorinated biphenyls (PCBs), and nitroaromatic compounds.

As a result of past discharge and disposal activities, the four raffinate pits and two ponds contained sludge and sediment contaminated with radionuclides such as uranium, thorium, and radium; metals such as lead and molybdenum; and inorganic anions such as fluoride, sulfate, and nitrate. Also, additional areas contained soil contaminated with radionuclides such as uranium, thorium, and radium and some metals such as lead and arsenic.

Material from site buildings and other structures included asbestos-containing material used in construction, concrete and lighting components contaminated with PCBs, and metal and concrete contaminated with radionuclides such as uranium, thorium, and radium as a result of past processing activities. Containerized process wastes included a variety of liquids and solids contaminated with both chemicals and radionuclides.

Bulk (solid) waste was removed from the Weldon Spring Quarry as an interim remedial action to mitigate the potential threat associated with this source of contaminants migrating into the air and the underlying groundwater at the Quarry. Public drinking water supply wells are located approximately one-half mile downgradient from the Quarry in the Missouri River alluvium. The remedial action was to excavate the bulk waste from the Quarry and transport to the Chemical Plant area for temporary storage and eventual placement in an engineered disposal facility. Quarry bulk waste removal was completed in 1995. Residual contamination in the Quarry proper and in the groundwater underlying the Quarry was the subject of a separate remedial action. Restoration of the Quarry was completed in 2002.

Onsite soil contained generally low levels of radionuclides (primarily uranium) as a result of airborne releases during plant operations; soil at scattered locations contains radionuclides such as uranium, thorium, and radium and contamination with heavy metals, PCBs, polycyclic aromatic hydrocarbons, and inorganic anions such as sulfate and nitrate. Offsite soil and sediment at the Southeast Drainage, 10 vicinity properties, and three lakes in the adjacent Busch Wildlife Area contained low levels of radionuclides (primarily uranium) that exceed background concentrations as a result of past spills and discharges and ongoing surface runoff.

Contamination is also present in groundwater beneath the site due to leaching from the raffinate pits and other contaminant sources. The groundwater contains elevated levels of uranium, nitrate, sulfate, TCE, and nitroaromatic compounds. Some metals have also been detected at levels above background in isolated wells onsite.

Contaminated raffinate pit sludge totaled approximately 220,000 cubic yards. Contaminated sediment totaled approximately 120,000 cubic yards. Contaminated structural material from chemical plant building demotion and bulk waste from the Quarry totaled approximately 170,000 cubic yards. Contaminated soil totaled approximately 340,000 cubic yards.

Construction of an engineered disposal cell on the Chemical Plant property began in 1997. Approximately 1.48 million cubic yards of waste materials, including building debris, asbestos-containing materials, treated raffinate sludge, contaminated soils, equipment used to process drums, and the Quarry bulk wastes were disposed in the cell (see volumes in preceding paragraph). To form a structurally stable material, raffinate sludge was mixed with Portland cement and fly ash in the engineered and constructed onsite chemical stabilization and solidification plant to create grout that was pumped to the disposal cell. Disposal activities were completed in 2001.

d. Describe any additional cleanup accomplishments undertaken or completed since 1999.

See response to 1c.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

The disposal cell contains 1.48 million cubic yards of contaminated materials including building debris, asbestos-containing materials, treated raffinate sludge, contaminated soils, drums, process equipment, and the Quarry bulk wastes. Hazardous wastes were not placed in the disposal cell. The total activity of the contaminated wastes in the disposal cell is estimated at 6.57×10^3 curies.

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

No waste is estimated for future onsite disposal.

ii. *Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?*

The leachate collected by the Disposal Cell Leachate Collection and Removal System (LCRS) is currently pretreated for uranium onsite and then disposed of by hauling to a nearby Publicly Owned Treatment Works for final treatment and discharge. The LCRS is monitored remotely by the System Operation and Analysis at Remote Sites (SOARS) system. The volume of leachate generated is declining with approximately 25 to 30 thousand gallons collected and treated in 2016.

In addition, it is estimated that one or two drums of debris that are found during excavations onsite will be shipped offsite in the future.

iii. *Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).*

A Removal Action was conducted in the Southeast Drainage Area to excavate accessible soil and sediment and place them in the onsite Disposal Cell. Residual soil and sediment contamination remains in the Southeast Drainage Area and will be managed in place with institutional controls for decades or longer.

The Quarry Bulk Waste and Quarry Residuals remedial actions removed the majority of contaminated material, soil, and sediment from the Quarry Area. Residual soil contamination remains at inaccessible locations within the Quarry and will be managed in place with institutional controls for the long-term.

II. Decision Processes

a. State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.

The U.S. Environmental Protection Agency placed the Quarry and former Chemical Plant areas on the CERCLA NPL in 1987 and 1989, respectively. Initial remedial activities at the former Chemical Plant (a series of Interim Response Actions authorized through the use of the Engineering Evaluation/Cost Analysis [EE/CA]) process) included:

- Removal of electrical transformers, electrical poles and lines, and overhead piping and asbestos that presented an immediate threat to workers and the environment.
- Construction of an isolation dike to divert runoff around the Ash Pond area to reduce the concentration of contaminants going offsite in surface water.
- A detailed characterization of onsite debris, the separation of radiological and nonradiological debris, and the transport of materials to designated staging areas for interim storage.
- Dismantling of 44 Chemical Plant buildings under four separate Interim Response Actions.
- Treatment of contaminated water at the former Chemical Plant and the Quarry.

Remediation of the Weldon Spring site was administratively divided into four operable units (OUs): the Chemical Plant OU, the Quarry Bulk Waste OU, the Quarry Residuals OU (QROU), and the Groundwater OU (GWOU). The Southeast Drainage was remediated under a CERCLA removal action and documented through an EE/CA report and the Decision Document for the Southeast Drainage. The following sections describe the selected remedies.

In the Record of Decision (ROD) for remedial action at the Chemical Plant Area of the Weldon Spring Site, DOE established the remedy for controlling contaminant sources at the former Chemical Plant (except groundwater) and disposing of contaminated materials in an onsite disposal cell. The remedy included the remediation of 17 offsite vicinity properties affected by former Chemical Plant operations. The vicinity properties were remediated in accordance with Chemical Plant ROD cleanup criteria.

The selected remedy included:

- Removal of contaminated soils, sludge, and sediment.
- Treatment of wastes by chemical stabilization or solidification, as appropriate.
- Disposal of wastes removed from the former Chemical Plant and stored Quarry bulk wastes in an engineered onsite disposal facility.
- DOE implemented remedial activities for the Quarry Bulk Waste OU as set forth in the ROD for this operable unit.

The selected remedy included:

- Excavation and removal of bulk waste (i.e., structural debris, drummed and unconfined waste, process equipment, sludge, soil).
- Transportation of waste along a dedicated haul road to a temporary storage area located at the former Chemical Plant.

- Staging of bulk wastes at the temporary storage area.

The QROU ROD addressed residual soil contamination in the Quarry proper, surface water and sediments in the Femme Osage Slough and nearby creeks, and contaminated groundwater.

The selected remedy included:

- Long-term monitoring and institutional controls (ICs) to prevent exposure to contaminated groundwater north of the Femme Osage Slough.
- Long-term monitoring and ICs to protect the quality of the public water supply in the Missouri River alluvium and the implementation of a well-field contingency plan.
- Confirming the model assumptions regarding the extraction of contaminated groundwater and establishing controls to protect naturally occurring attenuation processes.

DOE implemented the Interim ROD Remedial Action for the GWOU, which was approved on September 29, 2000, to investigate the practicability of remediating trichloroethene (TCE) contamination in Chemical Plant groundwater using in situ chemical oxidation. It was determined, based on extensive monitoring, that in situ oxidation did not perform adequately under field conditions; therefore, the remediation of TCE was reevaluated with the remaining contaminants of concern.

In the ROD for the final remedial action for the GWOU, DOE established the remedy of monitored natural attenuation (MNA) to address contaminated groundwater and springs.

The selected remedy included:

- Sampling of groundwater and surface water, including springs, to verify the effectiveness of naturally occurring processes to reduce contaminant concentrations over time.
- ICs to prevent exposure to contaminated groundwater at the former Chemical Plant and to the north toward Burgermeister Spring.

Remedial action for the Southeast Drainage was addressed as a separate action under CERCLA. The EE/CA for the removal action at the Southeast Drainage was prepared in August 1996 to evaluate the human and ecological health risks within the drainage. The EE/CA recommended that selected sediment in accessible areas of the drainage should be removed with track-mounted equipment and transported by off-road haul trucks to the Chemical Plant. Soil removal occurred in two phases: 1997 to 1998, and in 1999.

In 2005 an Explanation of Significant Differences (ESD) was completed to specify use restrictions needed to ensure that remedies in place for the CPOU (including Southeast Drainage), QROU, and the GWOU remain protective for the long term and to restrict land and natural resource uses that are inconsistent with anticipated land uses.

The site areas for which use restrictions were specified include the Chemical Plant disposal cell and buffer area, Southeast Drainage soil and sediment, the Chemical Plant area (including Southeast Drainage) groundwater and springs, the Quarry itself, Quarry area groundwater, and a small reduction zone north of the Femme Osage Slough and south of the Quarry where soil restrictions have been identified. The use restrictions were used as performance objectives for identifying appropriate Institutional Control (IC) mechanisms for implementation.

These remedial actions are protective of the anticipated future land use; however, they do not allow for unlimited use and unrestricted exposure (UU/UE) in all areas. Because of this, a Long-Term Surveillance and Maintenance (LTS&M) Plan was developed to explain how the DOE will fulfill its obligation to manage residual hazards at this site over the long term. Because some of the wastes disposed of at the site will remain hazardous for several thousand years, the LTS&M Plan essentially requires management of hazards in perpetuity. As defined by the DOE guidance document, Long-Term Stewardship Planning Guidance for Closure Sites, long-term stewardship refers to all activities necessary to ensure protection of human health and the environment.

EPA and DOE signed a Federal Facility Agreement (FFA) in 1986 and amended it in 1992. The main purpose of the agreement was to establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at the site in accordance with CERCLA. Subsequently, EPA, DOE, and the Missouri Department of Natural Resources (MDNR) signed an updated Federal Facility Agreement; EPA provided the final signature on March 31, 2006.

This updated FFA was created to provide for proper and effective long-term protection of public health, welfare, and the environment. It also established a procedural framework and schedule for conducting appropriate actions at the site over the long term and facilitates cooperation and exchange of information among the parties of the agreement. The FFA includes the LTS&M Plan as an attachment and procedures for modifying the LTS&M Plan.

b. How are the tribe(s) and/or the state(s) involved in the decision process?

There are no federally recognized American Indian tribes in Missouri today.

The State agency, the MDNR, is a party to a Federal Facility Agreement that is between MDNR, EPA and DOE. MDNR provides reviews of documents and has participated in the CERCLA decision process with review of CERCLA documents. They are also provided a grant from DOE for oversight activities.

c. Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.

The different areas of the site were cleaned up to separate risk-based cleanup standards as described in Section II. a. above. The selected remedial actions are protective of the anticipated future land use; however, they do not allow for unlimited use and unrestricted exposure (UU/UE) in all areas. Because of this, long term stewardship is required essentially in perpetuity.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

a. What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?

The Explanation of Significant Difference (ESD) prepared for the Weldon Spring site finalized in February 2005 presents use restrictions for specific areas. The areas are on either federal or state-owned properties. No privately owned property is affected by the use restrictions. These use restrictions or IC objectives as listed below are implemented through the Long-Term Surveillance and Maintenance (LTS&M) Plan for the site.

Chemical Plant OU

Disposal Cell and Buffer Area: The use restrictions listed below must be met throughout the disposal cell area, including its surrounding 300-foot (ft) buffer zone. This area is under federal DOE jurisdictional control. The use restrictions listed below shall be maintained until the remaining hazardous substances are at levels allowing for UU/UE. Due to the extremely long-lived nature of the radioactive constituents in the disposal cell, these restrictions are expected to be necessary for essentially as long as the disposal cell remains in place. The objectives of the controls or restrictions are as follows:

1. Prevent activities on the disposal cell, such as the use of recreational vehicles that could compromise the integrity of the cell cover (e.g., result in the removal or disturbance of the riprap).
2. Prevent activities in the buffer zone such as drilling, boring, or digging that could disturb the vegetation, disrupt the grading pattern, or cause erosion.
3. Retain access to the buffer area for continued maintenance, monitoring, and routine inspections of the cell and buffer area.
4. Prevent construction of any type of residential dwelling or facility for human occupancy on the disposal cell and buffer area, other than facilities to be occupied for activities associated with performing environmental investigation or restoration and expansion of the existing Interpretive Center.
5. Maintain the integrity of any current or future remedies or monitoring systems. Southeast Drainage Soil or Sediment: The use restrictions listed below must be met at the approximately 37-acre area covering the 200 ft corridor along the length of the Southeast Drainage. The restricted area is located on property that is owned by state entities. These restrictions will need to be maintained until the remaining hazardous substances are at levels allowing for UU/UE, which is anticipated to be a period of decades or longer.
6. Prevent the development and use of the Southeast Drainage property for residential housing, schools, child care facilities, and playgrounds.

Groundwater OU

Chemical Plant Area Groundwater and Springs: The use restrictions listed below must be met in the entire area of approximately 1140 acres where groundwater use needs to be restricted until concentrations of the contaminants of concern meet drinking water or risk-based standards that allow for UU/UE. The period of time necessary for contaminants to attenuate to these levels has been estimated at approximately 100 years. The size of the restricted area includes a 1000 ft buffer area that accounts for the groundwater gradient and flow conditions at the site. The restricted area includes properties under federal jurisdictional control (DOE and the Army) as well as properties owned by state entities. The objectives of the controls or restrictions are as follows:

1. Prevent the use of the contaminated shallow groundwater and spring water for drinking water purposes. The contaminated shallow groundwater occurs in the weathered and unweathered portions of the upper limestone unit (Burlington-Keokuk). The contaminated groundwater and spring water system occurs within the limits of the hydraulic buffer zone. This restriction will need to be maintained over a period of decades or longer.
2. Limit the use of all groundwater within the outlined restricted area to investigative monitoring only. The boundary of the restricted area extends beyond the area of contamination and is intended to provide a buffer against potential hydraulic influences on the area of contamination by preventing such things as pumping wells from being located in the proximity of the contaminated area. This restriction includes the shallow groundwater system and also extends vertically to all groundwater systems that underlie the contaminated groundwater. This restriction will need to be maintained over a period of decades or longer.
3. Retain access to the area for continued monitoring and maintenance of groundwater wells and springs.
4. Maintain the integrity of any current or future remedies or monitoring systems.

Quarry Area

The use restrictions listed below must be met at the specific areas at the Quarry area. The use restrictions must be maintained until the remaining hazardous substances are at levels allowing for UU/UE.

1. Prevent the development and use of the Quarry for residential housing, schools, child-care facilities and playgrounds. Prevent drilling, boring, digging, or other activities in the Quarry proper that disturb the vegetation, disrupt the grade, expose the Quarry walls, or cause erosion of the clean fill that was used to restore the Quarry. This restriction should be maintained for the long-term. The 9-acre Quarry is under DOE jurisdictional control.
2. Prevent the use of the contaminated shallow groundwater for drinking water purposes. The contaminated shallow groundwater underlies the Quarry and extends to the marginal alluvium north of the slough. This restriction will need to be maintained over a period of decades or longer.
3. Limit the use of all groundwater within the outlined restricted area to investigative monitoring only. The boundary of the restricted area extends beyond the area of contamination and is intended to provide a buffer against potential hydraulic influences on the area of contamination by preventing such things as pumping wells from being located in the proximity of the contaminated area. This restriction includes the shallow groundwater system and also extends vertically to all groundwater systems that underlie the contaminated groundwater. This restriction will need to be maintained over a period of decades or longer, until uranium concentrations in Quarry groundwater north of the slough are at 300 picocuries per liter (pCi/L) or lower. With the exception of the 9-acre Quarry, this restricted area is owned by state entities. This area covers approximately 202 acres.
4. Prevent drilling, boring, digging, construction, earth moving, or other activities in the location identified as the Quarry natural reduction zone area that could result in disturbing the soils at this location or exposing subsurface soils (i.e., soils deeper than about 5 ft below the surface). The soil at a depth of 5 ft or greater in this area contains geochemical properties that allow reduction processes to naturally occur, resulting in the precipitation of uranium from Quarry

groundwater north of the Femme Osage Slough and thereby minimizing uranium migration to the well field. The restrictions must be maintained over a period of decades or longer, until uranium concentrations in Quarry groundwater north of the slough are 300 pCi/L or lower. This area is located on property owned by a state entity and is approximately 4.7 acres in size.

5. Retain access to the area for continued monitoring and maintenance of groundwater wells.
6. Maintain the integrity of any current or future remedies or monitoring systems.

The institutional controls that were attained to meet the above requirements of the ESD are as follows:

- Special Use Area designation under the State Well Drillers' Act: The "Special Use Area" under the Missouri well code was finalized in the Missouri regulations and became effective August 2007 as Title 10 *Code of State Regulations* 23-3.100(8) (10 CSR 23-3.100[8]). This is a special regulation that DOE and the Army pursued with MDNR that requires additional drilling protocols and construction procedures to be implemented by regulations on any well construction within the restriction boundaries.
- Memorandum of Understanding with the Army: The Army and DOE signed the memorandum in September and October 2009, respectively. This IC is complete.
- Easements with surrounding affected state agency landowners (Missouri Department of Conservation [MDC], Missouri Department of Natural Resources, Division of State Parks [MDNR Parks], Missouri Department of Transportation [MoDOT]) for implementing the use restrictions required on state properties: DOE established easements to restrict use of the contaminated groundwater in the area of the hydraulic buffer zone, to restrict land use in the Southeast Drainage, and to restrict land use at the Quarry reduction zone. DOE and MDNR Parks finalized and signed the easement regarding the MDNR Parks property in September 2009. The easement with MDC was finalized in July 2011, and the easement with MoDOT was finalized in June 2012. The MoDOT property was transferred to St. Charles County, and the restrictive easement was conveyed with the land transfer and is still in effect.

Additional ICs that were in effect prior to the ESD include the following:

- DOE is committed to perpetual care of the disposal cell and buffer zone as specified in the Chemical Plant Record of Decision, which is enforceable under the Federal Facility Agreement.
- A notation of land ownership has been entered on the ownership record filed at the St. Charles County Recorder's Office (deed notice). The notation explains the restrictions on groundwater use and residential development of the Chemical Plant and Quarry areas. The notice acts as an informational device in the event ownership is transferred at some point in the future.
- The Interpretive Center serves as a community information resource. It depicts the history of the area and details the progression of the cleanup process, and it offers information on the construction of the engineered disposal cell and the residual groundwater contamination. The Interpretive Center hosts field trips almost every day of the week. This informational IC is very useful in informing the community on what occurred and what is left in place at the Weldon Spring Site. The Center hosts over 20,000 visitors per year.
- Historical markers have been placed along the Hamburg Trail, and information plaques are accessible at the top of the engineered disposal cell.

- Missouri regulates the construction of wells pursuant to Title 10 *Code of State Regulations* Division 23, Chapter 3 (10 CSR 23.3), "Well Construction Code."
- DOE has real estate licenses with the MDC and MDNR Parks that allow access for monitoring and maintaining groundwater wells, drilling and plugging wells, usage of the land for effluent water pipeline, etc.

The site reached construction completion under CERCLA on August 22, 2005. The site also received the EPA Superfund Sitewide Ready for Anticipated Use designation from EPA in a letter dated March 20, 2013.

b. Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.

The disposal cell and institutional control areas are inspected annually per the LTS&M Plan. The disposal cell is also monitored by LiDAR aerial surveys. Other LTS activities include frequent groundwater monitoring and leachate monitoring that is performed by a remote monitoring system (SOARS), treatment, and disposal.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

For the Quarry Bulk Waste Operable Unit, response technologies considered included surface containment, surface and subsurface containment, in situ treatment, expedited excavation with temporary storage at the Chemical Plant area, and delayed action pending the Record of Decision for the site.

For the Quarry Residuals Operable Unit, remedial alternatives considered included monitoring with no active remediation and groundwater removal at selected areas with on-site treatment. A field test was performed to verify predictive models relating to groundwater remediation. The test included installation of a groundwater interceptor trench and operating it for two years. Quarry proper restoration included backfilling the quarry with soil to reduce fall hazards, stabilize the north and south highwalls, and eliminate ponding of surface water. The design also effectively prevented any potential residual contaminants in the cracks and fissures from mobilizing.

For the Chemical Plant Operable Unit (CPOU), treatment technologies considered included chemical stabilization/solidification, and vitrification.

For the Southeast Drainage, no treatment technologies were evaluated, however response action technologies considered included access restrictions, concrete encapsulation, hydraulic removal, and conventional excavation. A screening process was performed based on available routes and access, engineering methodology, degree of environmental damage that would be caused by removing trees and vegetation in the drainage to access the contaminated sediment locations, cost and potential risk reduction.

For the Groundwater Operable Unit (GWOU), treatment technologies considered included pump and treat and insitu chemical oxidation. Pilot scale systems of these technologies were operated at the site.

d. *What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?*

The specific requirements associated with the LTS components at the Weldon Spring Site are included in the *Long-Term Surveillance and Maintenance Plan for the U.S. Department of Energy Weldon Spring, Missouri, Site* and include annual inspections, groundwater sampling and monitoring, annual reporting of environmental monitoring data, maintenance of institutional controls, monitoring of the remedies, and CERCLA five-year review reporting. The LTS&M Plan is enforceable under the FFA.

e. *What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.*

See response to 6d.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

DOE is responsible for monitoring and maintaining the Disposal Cell, groundwater remedies, and ICs for the site in accordance with the LTS&M Plan. This includes annual inspections of the areas and contacting property owners annually. The property owners and parties to the ICs are responsible for complying with the restrictions and requirements as defined in the ICs.

Annual funding is provided through the Department of Energy Office of Legacy Management long-term surveillance and maintenance budget.

The MDNR and EPA are responsible for reviewing documents, providing comments to DOE, approving certain documents, and providing overall oversight of DOE's work.

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*

Funding for long-term surveillance and maintenance is provided through the U.S. Department of Energy, Office of Legacy Management through an annual budget request process. A grant with the State of Missouri is also in place to provide funding for oversight. There are no Native American tribes involved at the site.

West Valley Demonstration Project

I. Site Background and Remediation Description

a. Provide a brief description of the site. Include the site's name, location, owners (both current and future), approximate size, proximity to populated areas, and general topography features.

The West Valley Demonstration Project (WVDP) is located in western New York State (NYS), about 30 miles (mi) (50 kilometers [km]) south of Buffalo, New York. The WVDP facilities currently occupy a security-fenced area of about 152 acres (61 hectares [ha]) within the 3,338-acre (1,351 ha) Western New York Nuclear Service Center (WNYNSC or Center) located primarily in the town of Ashford in northern Cattaraugus County. The entire Center is owned by the New York State Energy Research and Development Authority (NYSERDA).

The Project lies on NYS's Allegheny Plateau at an elevation of approximately 1,300 to 1,450 feet (ft) (400 to 440 meters [m]) above mean sea level. The underlying geology includes a sequence of glacial sediments above shale bedrock. The Project is drained by three small streams (Franks Creek, Quarry Creek, and Erdman Brook) and is divided by a stream valley (Erdman Brook) into two general areas: the north plateau and the south plateau. Franks Creek, which receives drainage from Erdman Brook and Quarry Creek, flows into Buttermilk Creek, which enters Cattaraugus Creek and flows westward away from the WNYNSC. Cattaraugus Creek ultimately drains into Lake Erie, to the northwest.

Although several roads and a railway approach or pass through the WNYNSC, the public is prohibited from accessing the WNYNSC, except on the highways. A limited public deer hunting program managed by New York State Energy Research and Development Authority (NYSERDA) is conducted on a year-to-year basis in designated areas on the WNYNSC. No unescorted public access is allowed on the WVDP premises.

Land near the WNYNSC is used primarily for agriculture and arboriculture. Downgradient of the WNYNSC, Cattaraugus Creek is used locally for swimming, canoeing, and fishing. Although some water is taken from the creek to irrigate nearby golf course greens and tree farms, no public drinking water is drawn from the creek before it flows into Lake Erie. Water from Lake Erie is used as a public drinking water supply.

The communities of West Valley, Riceville, Ashford Hollow, and the village of Springville are located within approximately 5 mi (8 km) of the Project. Population around the site is sparse with the average population density of Cattaraugus County about 61 persons/mi^2 (24 persons/km^2). No major industries are located within this area.

b. Provide a list of the American Indian Tribe(s) in current proximity to the site. How are the tribes impacted by past and current site operations?

There is one Tribal government with WVDP site interests and treaty rights, the Seneca Nation. The Center is located approximately 20 miles upstream of Cattaraugus Territory (which is located on Cattaraugus Creek), and approximately 20 miles northeast of the Allegany Territory.

The Seneca Nation of Indians Cooperative Agreement was signed in 1996 to foster government-to-government relationships between the Seneca Nation of Indians and the DOE. Activities conducted in accordance with the Cooperative Agreement continue to promote an understanding of environmental and human health issues and sustains the cultural resources of the Seneca Nation of Indians.

The Seneca Nation of Indians primary concerns as they relate to the WVDP include Cattaraugus Creek water and sediment sampling and analysis, results of an aerial radiation survey conducted in 2014 at and downstream of the Center (including the Cattaraugus Territory of the Seneca Nation), soil sampling and dose assessments conducted by NYSERDA as a follow up to the aerial radiation survey, the North Plateau Groundwater Plume, transportation of hazardous materials through the Seneca territories and decommissioning of the Center.

c. *Describe the general contamination associated with the site. Include the types of contamination present, types of media that have been impacted, and the types and quantity of waste both before and after remedial actions were taken. Also, describe any ongoing remedial actions (i.e., groundwater pump and treat, etc.) associated with the site. Please be concise and specific in your description including which remedial actions were taken since 1999 to the present and those planned for the future if any.*

The primary source of waste was 600,000 gallons of liquid high-level radioactive waste (HLW), which was stored in underground tanks at the site. The WVDP was created by the 1980 WVDP Act (Public Law 96-368; October 1, 1980) to solidify the HLW. Vitrification was identified as the best method to solidify the liquid waste and scientists and engineers subsequently developed the methodology and demonstrated the WVDP's ability to produce high-quality glass on a production schedule. Between 1996 and 2002, 24 million curies of liquid HLW were immobilized in glass in 275 stainless steel canisters. The canisters were placed in a shielded cell in the Main Plant Process Building (MPPB) for storage and were relocated to a dry cask storage system on the south plateau in 2016. A tank and vault drying system was subsequently installed at the waste tank farm to reduce the potential for corrosion of the underground tanks.

As a result of nuclear fuel reprocessing operations and HLW vitrification, the MPPB was contaminated with uranium and plutonium isotopes and fission products, and the Vitrification Facility (VF) was contaminated with fission products. Deactivation of both facilities have been underway since 2002. Deactivation of the MPPB is underway, with demolition scheduled to begin in 2018. Deactivation of the VF is complete, and demolition began in September 2017.

The primary subsurface contamination is a plume of strontium-90 (Sr-90) contaminated groundwater migrating to the north-northeast of the MPPB. The source was traced to at least one leak in piping during reprocessing operations in the 1960s. In 1995, a pump and treat groundwater recovery system was established to control the western lobe of the plume. In 1999, a pilot-scale permeable treatment wall (PTW) was installed within the leading edge of the eastern lobe of the plume to evaluate the effectiveness of this type of system in treating Sr-90 contaminated groundwater. An evaluation of monitoring data indicated that the PTW is effective in removing Sr-90 through ion-exchange. Thus, in 2010, a full scale, 860-foot-long, zeolite-filled PTW was installed in order to limit expansion of the Sr-90 contaminated groundwater plume and to maintain a passive mitigation system with minimum maintenance and waste generation. Following completion of the PTW construction, monitoring wells were installed to augment the existing wells to evaluate its performance as a radiological groundwater contaminant mitigative measure.

Another area where groundwater contamination has been detected on the north plateau is the Construction and Demolition Debris Landfill (CDDL). Continued monitoring has identified volatile organic compounds at decreasing levels slightly above detection limits down-gradient of the CDDL. Mitigative measures have not been deemed necessary thus far.

On the south plateau, the main sources of potential contamination are associated with the Nuclear Regulatory Commission-Licensed Disposal Area (NDA) and the State-Licensed Disposal Area (SDA). The NDA is an in-ground radioactive waste disposal unit that was used to dispose of radioactive waste from the MPPB. It was licensed by the Nuclear Regulatory Commission as part of the reprocessing plant's Part 50 license. The buried wastes include spent fuel and radioactive wastes from reprocessing operations and decontamination activities. The NDA was also used by DOE for the disposal of WVDP waste in the first four years of the WVDP, but no waste has been buried at the NDA since 1986. Leachate is known to exist in some NDA disposal holes and trenches. The leachate consists of water contaminated with radiological and chemical constituents leached from the buried wastes. After groundwater chemical and radioactive contamination was detected in a well downgradient of the NDA, an interceptor trench and liquid pretreatment system were installed. In 2008, infiltration measures consisting of an up gradient barrier wall and a geomembrane cover over the NDA were installed as an interim measure under the RCRA 3008(h) Consent Order. Water level data indicate the cap and slurry wall have caused the weathered till to become dry in some areas. Reduced water volume extracted from the interceptor trench also shows that groundwater flow through the NDA is effectively being reduced.

The SDA is an in-ground radioactive waste disposal unit that is owned and managed by NYSERDA. It operated from 1963 to 1975 and accepted low-level radioactive waste from commercial nuclear power plants, universities, hospitals, and industrial facilities, including the NFS West Valley reprocessing plant. The SDA is approximately 15 acres in size and is covered with an impermeable geomembrane to prevent infiltration of precipitation. The SDA is regulated by the New York State Department of Environmental Conservation and New York State Department of Health.

d. *Describe any additional cleanup accomplishments undertaken or completed since 1999.*

WVDP Accomplishments 1996-2002. Processed liquid high-level waste into 275 stainless steel canisters of vitrified (glass) waste. Processing and primary tank cleaning and flushing removed approximately 99 percent of the radioactivity.

WVDP Accomplishments 2003-2007. Dismantled the Vitrification Cell. Completed construction and startup of the Remote Handled Waste Facility. Shipped approximately 1,000,000 ft^3 of low-level radioactive waste. Demolished a significant number of buildings/facilities, reducing the overall footprint of the WVDP. Shipped the remaining 125 spent nuclear fuel assemblies to the Idaho National Laboratory.

WVDP Accomplishments 2008-2011. Installed a cap and slurry wall to reduce groundwater flow through the NDA. Installed a Tank and Vault Drying System in the Waste Tank Farm, with an ultimate goal of preventing the underground steel tanks from corroding under ambient tank and vault conditions. Installed the permeable treatment wall to capture Sr-90 in the groundwater. Published the record of decision for the decommissioning and/or long-term management of the WVDP. Received U. S. NRC concurrence with the Phase 1 Decommissioning Plan. DOE awarded the Phase 1 Decommissioning and Facility Disposition Contract to CH2M HILL • BWXT, West Valley, LLC.

WVDP Accomplishments 2012-2016. Demolished the 60-foot-tall radiologically contaminated 01-14 building and demonstrated the proof-of-concept for safe open air demolition of contaminated structures at the WVDP. Deactivated 95% of the Vitrification Facility and 56% of the Main Plant Process Building. Processed and shipped 50% of the legacy LLW and all the legacy mixed, hazardous, and industrial waste off site for disposal. Completed preparations for the shipment of three large packages of contaminated vitrification vessels, which were shipped off site for disposal in November 2016. Completed the relocation of 75% of the canisters of HLW from the MPPB to a dry cask storage system on a new on-site storage pad. Canister relocation was completed by the end of 2016.

Studies 2014-Present. DOE and NYSERDA jointly conducted an aerial survey that measured radiation on the WNYNSC and along Cattaraugus Creek from the boundary of the Center to Lake Erie. Some areas outside the Center have radiation levels slightly above background, including two areas on the Cattaraugus Territory of the Seneca Nation of Indians. NYSERDA has conducted additional surveys and soil sampling in those areas. Dose assessments were prepared using land use information provided by the Seneca Nation that considers the hunting and gathering practices of the Seneca Nation people. All doses were well below the U.S. Nuclear Regulatory commission's 25 millirem/year standard for unrestricted use. Results have been presented to the public and the Seneca Nation of Indians.

To support the Phase 2 Decommissioning decision, DOE and NYSERDA are conducting scientific studies (Phase 1 Studies) to facilitate interagency consensus on specific technical issues and to identify and reduce uncertainty in decommissioning decisions for the remaining facilities.

e. *Describe the amount of onsite disposal of radioactive and hazardous waste already in place (in volume, curies and types of waste streams).*

The Construction and Demolition Debris Landfill (CDDL) is located in the northeastern corner of the North Plateau. The CDDL covers about 1.5 acres of the site approximately 1000 feet northeast of the MPPB. It averages between 10 to 15 feet in depth. The CDDL was used from 1963 to 1985 for disposal of nonradioactive construction and demolition debris such as office and plant waste, lumber, concrete, and structural steel. Some volatile organic compounds have been detected in groundwater downgradient of the CDDL. In addition, it is located in the flow path of the Sr-90 groundwater plume. The CDDL is estimated to contain a total volume of 425,000 cubic feet of waste material and soil.

The NDA is an in-ground radioactive waste disposal unit, which is described in the response to I.c. The inventory of radionuclides includes fission products and isotopes of uranium and plutonium. The inventory of hazardous chemicals includes solvents and heavy metals.

The SDA is an in-ground radioactive waste disposal unit, which is described in the response to I.c. The inventory of radionuclides includes fission products and isotopes of uranium and plutonium. The inventory of hazardous chemicals includes solvents and heavy metals

f. *To the extent possible, describe the projected amount of cleanup (in volume, curies and types of waste streams) remaining at the site.*

   i. *Describe the possible amount and types of materials estimated for future disposal of hazardous and radioactive waste onsite (i.e., contaminated materials such as waste from* *burial grounds or building demolition debris reburied for onsite disposal after demolition, treatment, etc.).*

There will be no disposal of radioactive or hazardous waste onsite.

ii. Describe the amount and types of materials estimated to be shipped off-site. What is the proposed or planned pathway(s) for treatment and disposal of the waste stream(s)?

Several million cubic feet of waste will be generated for offsite disposal during the Phase 1 decommissioning work. All wastes generated at the WVDP are disposed offsite at licensed facilities appropriate for the types of wastes being disposed.

iii. Describe the amount and types of materials estimated to remain onsite that will not be excavated and disposed of, once remediation efforts are complete (i.e., historic burial grounds left in place that may or may not be capped; contaminated pipelines left in place).

The decisions for the disposition of remaining facilities (NDA, CDDL, waste tank farm, and SDA) have yet to be made. Alternatives will be evaluated through the National Environmental Policy Act (NEPA) and New York State Environmental Quality Review Act (SEQRA) processes with plans for decisions in 2020.

II. Decision Processes

a. State the regulatory process(es) (i.e., CERCLA, RCRA, Orders, etc.) used at the site.

The West Valley Demonstration Project Act requires DOE to demonstrate that the liquid HLW from reprocessing can be safely managed by solidifying it at the Center and transporting it to a geologic repository for permanent disposal. Specifically, Section 2(a) of the Act requires DOE to:

- Solidify HLW by vitrification or by such other technology that DOE deems effective,
- Develop containers suitable for the permanent disposal of the solidified HLW,
- Transport the solidified HLW to an appropriate federal repository for permanent disposal,
- Dispose of the LLW and TRU waste produced by the HLW solidification program, and
- Decontaminate and decommission the waste storage tanks and facilities used to store HLW, the facilities used for HLW solidification of the waste, and any material and hardware used in connection with the project in accordance with such requirements as the NRC may prescribe.

Activities at the WVDP are regulated by various federal and state, public, worker, and environmental protection laws. These laws are administered primarily by the EPA, DOE, the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers (USACE), NYSDEC, and NYSDOH through programs and regulatory requirements for permitting, reporting, inspecting, self-monitoring, and auditing.

Some of the facilities are permitted under the Resource Conservation and Recovery Act (RCRA) or have Interim Status (IS) under RCRA as Hazardous Waste Management Units. Many are Solid Waste Management Units (SWMUs). In 1984, DOE notified EPA of hazardous waste activities at the WVDP and identified DOE as a hazardous waste generator. In 1990, to comply with 6 NYCRR Part 373-3, a RCRA Part A (i.e., Interim Status or Part A) Permit Application for the WVDP was filed with NYSDEC for storage and treatment of hazardous waste. The WVDP has operated under interim status ever since. Additionally, DOE and NYSERDA entered into the RCRA 3008(h) Consent Order with NYSDEC and EPA in March 1992.

b. How are the tribe(s) and/or the state(s) involved in the decision process?

The Seneca Nation of Indians Environmental Protection Department participates in the development of oversight strategies, taking into consideration tribal and stakeholder input into decommissioning decisions. The Seneca Nation of Indians are active participants in the West Valley Citizens Task Force meetings, review of environmental documents, and the National Environmental Policy Act (NEPA) process.

c. Describe the final decision(s) for closure and the justification for not obtaining clean closure including unrestricted use and unlimited exposure.

The final decisions are yet to be determined. DOE and NYSERDA intend to make an integrated decommissioning decision for the final phase of the WVDP, the State-licensed Disposal Area (NYSERDA-owned and operated), and the remainder of the Center by 2022. DOE and NYSERDA will use the NEPA and the SEQRA processes.

III. Legacy Waste and Onsite Disposal

Please answer the questions below for legacy waste areas at the site even if the site is operational or in active cleanup status.

The answers to all of the following questions have yet to be determined. DOE and NYSERDA intend to make an integrated decommissioning decision for the final phase of the WVDP, the State-licensed Disposal Area, and the remainder of the Center by 2022. DOE and NYSERDA will use the NEPA and SEQRA processes.

a. What was the final land use chosen? Are there restrictions on other uses? How long are these restrictions necessary? What process was used to select the land use?

b. Describe the disposal cells and LTS activities and elements in place for the stewardship and monitoring of disposal areas.

c. What treatment technologies were considered or used prior to deciding to leave the contamination for LTS?

d. What are the specific requirements/actions associated with the LTS components? What mechanism is used to ensure that long-term operation, monitoring, and institutional controls are maintained?

e. What is the LTS plan for the site? For legacy waste to remain onsite, describe the monitoring and surveillance plans and procedures for LTS implementation over the next five and 75 years.

f. *Briefly describe the responsibilities of all the parties involved and any agreements (i.e., MOU, consent decree, FFA, etc.) that pertain to LTS. Please specify the organization(s) responsible for enforcing the LTS components including institutional controls and, if applicable, discuss the role of the parties (local governments, future owners, etc.) not involved in the LTS agreement.*

g. *Provide a summary of proposed or known funding provisions (i.e., who provides funds, how much funding is needed, how often is funding obtained, legal funding drivers, etc.) associated with the long-term stewardship, operations, monitoring, and institutional controls. Describe any additional funding for oversight activities provided to the state and/or tribe.*