

Bayo Canyon Aggregate Area, New Mexico, Site Long-Term Surveillance and Maintenance Plan

July 2023



U.S. DEPARTMENT OF
ENERGY

Legacy
Management

Contents

Abbreviations.....	iii
1.0 Site Conditions	1
1.1 Background.....	1
1.2 Regulatory Framework.....	1
1.2.1 DOE Order 458.1 Chg 3 (Admin Chg), <i>Radiation Protection of the Public and the Environment</i>	1
1.2.2 Hazardous Wastes: Resource Conservation and Recovery Act (RCRA).....	2
1.2.3 The 2016 RCRA Compliance Order on Consent.....	3
1.2.4 Mixed Waste: Federal Facility Compliance Act (FFCA).....	3
1.2.5 Specific Chemical Wastes: Toxic Substances Control Act	3
1.2.6 Solid Nonhazardous Wastes	3
1.2.7 Clean Air Act Title V Operating Permit.....	3
1.2.8 Airborne Radionuclide Emissions: Radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAPs).....	4
1.2.9 Clean Water Act.....	4
1.2.10 NPDES Industrial and Sanitary Point-Source Outfall Permit.....	4
1.2.11 NPDES General Permit for Discharges of Stormwater from Construction Sites	4
1.2.12 NPDES Individual Permit Authorization to Discharge (from SWMUs and AOCs)	4
1.2.13 Aboveground Storage Tank Program	5
1.2.14 Clean Water Act Section 404 and 401 Permits.....	5
1.2.15 Energy Independence and Security Act: Stormwater Management Practices	5
1.2.16 New Mexico Water Quality Act: Surface Water Protection.....	6
1.2.17 Safe Drinking Water Act	6
1.2.18 New Mexico Water Quality Act: Groundwater Discharge Regulations.....	6
1.2.19 Domestic Septic Tank Disposal Systems Discharge Permit DP-1589	6
1.2.20 DOE Order 232.2, <i>Occurrence Reporting and Processing of Operations Information</i>	6
1.2.21 National Environmental Policy Act.....	7
1.3 Operations.....	7
1.4 Contaminants.....	8
1.5 Site Conditions	9
2.0 Remedial Action.....	10
2.1 Contaminants of Potential Concern.....	10
2.2 Cleanup Criteria and Assessment of Risk	11
2.3 Remedial Action.....	11
2.4 Independent Verification	12
2.5 Use Restrictions.....	12
2.6 Certification and Regulator Concurrence.....	12
2.7 Agreements and Permits.....	12
3.0 Protective Measures	13
3.1 Institutional Controls.....	13
3.2 Annual Review and Data Verification	13
3.3 Site Visit Report	14

3.4	Site Fact Sheet	14
3.5	Beneficial Reuse Reviews	14
3.6	Site Inspections.....	14
3.7	Field Operations	14
3.8	Environmental Monitoring.....	15
4.0	References	15

Table

Table 1.	Summary of LTS&M Requirements at the BCAA, New Mexico, Site.....	15
----------	--	----

Abbreviations

AOC	area of concern
BCAA	Bayo Canyon Aggregate Area
CA	corrective action
CAA	Clean Air Act
COPC	contaminant of potential concern
COPEC	contaminant of potential ecological concern
CU	consolidated unit
DOE	U.S. Department of Energy
EISA	Energy Independence and Security Act of 2007
EM	Office of Environmental Management
EM-LA	EM Los Alamos Field Office
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ESL	ecological screening level
FFCA	Federal Facility Compliance Act
FIMS	Facilities Information Management System
FUSRAP	Formerly Utilized Sites Remedial Action Program
HI	Hazard Index
HQ	Hazard Quotient
IA	interim action
IC	institutional control
¹⁴⁰ La	lanthanum-140
LANL	Los Alamos National Laboratory
LM	Office of Legacy Management
LMS	Legacy Management Support
LTS&M	long-term surveillance and maintenance
mrem	millirem
mrem/yr	millirem per year
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl

RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
⁹⁰ Sr	strontium-90
SSL	soil screening level
SWMU	solid-waste management unit
TA-10	Technical Area 10

1.0 Site Conditions

1.1 Background

This document provides the regulatory framework under which remedial action was conducted and future land use controls will be implemented at the Bayo Canyon Aggregate Area (BCAA), New Mexico, Site. This document confirms compliance with environmental standards and requirements; highlights significant historical remedial activities; describes radiological controls in accordance with DOE Order 458.1 Chg 3 (Admin Chg), *Radiation Protection of the Public and the Environment*; and promotes environmental stewardship through an active environmental management system that provides environmental policy, planning, implementation, long-term stewardship, and management review.

The BCAA site is approximately 350 acres that lie within the much larger Los Alamos National Laboratory (LANL) site, which is managed by the U.S. Department of Energy (DOE) Office of Environmental Management (EM). More specifically, the entire LANL site (including the BCAA site) is managed by the EM Los Alamos Field Office (EM-LA). Stewardship responsibility for the BCAA site transferred to the DOE Office of Legacy Management (LM) in 2019. LM already has stewardship responsibility for the Bayo Canyon, New Mexico, Site, which is a separate 1.5-acre LM site entirely within the BCAA site and was remediated under the Formerly Utilized Sites Remedial Action Program (FUSRAP).

1.2 Regulatory Framework

1.2.1 DOE Order 458.1 Chg 3 (Admin Chg), *Radiation Protection of the Public and the Environment*

DOE Order 458.1 Chg 3 (Admin Chg) requires DOE facilities to protect the public and the environment from undue risk from radiological activities. The order requires DOE facilities to ensure that the radiological dose to the public from their activities does not exceed 100 millirem (mrem) in any given year. It also provides dose limits for wildlife and plants. DOE facilities are directed to keep radiological doses to the public and the environment as low as reasonably achievable and to monitor for routine and nonroutine releases of radioactive materials. Real estate that is transferred from DOE to other owners (for example, the land transfer tracts) cannot exceed dose limits of 25 mrem per year (mrem/yr) above background, and moveable items that are released from DOE National Laboratory sites (such as surplus equipment or waste sent for offsite disposal) cannot exceed 1 mrem/yr above background. Finally, DOE Order 458.1 Chg 3 (Admin Chg) also requires that the public be notified of any radiation doses resulting from DOE National Laboratory operations and of the release of property (either real estate or moveable items) that has potential to contain residual radioactivity. This pertains to the BCAA site because although the BCAA site is owned by Los Alamos County, DOE retains responsibility for any residual radioactivity remaining on the site.

During 2017, the estimated maximum radiological dose to a member of the public from LANL operations was less than 1 mrem. Radiation doses to wildlife and plants were also below DOE limits (LANL 2017). Screening action levels for radionuclides in soils on LANL property were updated in 2016 because of an update to the dose assessment computer code RESRAD (Yu et al. 2001) and to use “reference person” dosimetry (LANL 2016), which is consistent with

DOE technical guidance. The changes generally increased the screening action levels. LANL requested that DOE evaluate the updated levels for use as authorized limits for land conveyance and transfer in 2016.

All aspects of radioactive waste generation, storage, and disposal at LANL are regulated by DOE Order 435.1 Chg 1, *Radioactive Waste Management*, and DOE Manual 435.1-1 Chg 2, *Radioactive Waste Management Manual*.

1.2.2 Hazardous Wastes: Resource Conservation and Recovery Act (RCRA)

The RCRA regulates hazardous wastes from generation to disposal. Hazardous wastes include all solid wastes that are (1) listed as hazardous by the U.S. Environmental Protection Agency (EPA); (2) ignitable, corrosive, reactive, or toxic; (3) batteries, pesticides, lamp bulbs, or items that contain mercury; or (4) “mixed waste,” which is any hazardous waste listed above that has been mixed with a radiological waste. RCRA mandates a hazardous waste facility permit for facilities that treat, store, or dispose of hazardous wastes. LANL’s hazardous waste facility permit was initially granted in 1989 and was renewed in 2010. LANL does not dispose of hazardous waste onsite, but it does treat and store these wastes. LANL’s hazardous waste facility permit, which is issued by the New Mexico Environment Department (NMED), covers the two solid-waste management units (SWMUs), two areas of concern (AOCs), and two consolidated units (CUs) at the BCAA site. The permit’s operating requirements include reporting requirements to the NMED’s Hazardous Waste Bureau and to the public. Even though BCAA site stewardship transferred to LM in 2019, these permit requirements for the BCAA site will continue to be managed by EM-LA.

EM-LA has made major progress in addressing groundwater and surface water contaminants in recent years through the development of a watershed enhancement project. EM-LA designed and installed engineering structures in and around the Los Alamos facility to reduce stormwater velocity and decrease sediment load in surface runoff areas and to improve overall water quality. This project included a low-impact development master plan and standards documents, which were completed in September 2017. The main aspect of the project affecting the BCAA site is the surface water sampling project, which conducts increased sampling and monitoring for stormwater runoff at various locations within the Bayo Canyon area. The results of watershed sampling and monitoring are shared with the public and NMED. Six watersheds were defined in and around LANL to collect aquatic life species. To improve the capabilities of the four Accord Pueblos¹ in monitoring stormwater, nine sites were established for EM-LA to collect stormwater samples for the Pueblos. In addition, the Intellus NMED website was redesigned to improve public access to EM-LA monitoring data, including improving the Intellus query flow, enhancing visualization tools, and providing for multisite selection for data queries. LM and the Pueblos have access to the Intellus website to trend data, when necessary, at <https://www.intellusnm.com>.

¹ The “Accord Pueblos” refer to written accords between DOE and four Native American pueblo governments (Cochiti, San Ildefonso, Jemez, and Santa Clara) whose lands are adjacent to or near LANL. The accords set forth the specifications for maintaining a government-to-government relationship between DOE and each of the four pueblos. These accords have been in place since 1992, and are renewed periodically.

1.2.3 The 2016 RCRA Compliance Order on Consent

The 2016 RCRA Compliance Order on Consent is a settlement agreement between NMED and DOE addressing cleanup of legacy wastes. It supersedes the RCRA Compliance Order on Consent that was issued in 2005. The 2016 RCRA order guides and governs the ongoing cleanup of legacy waste at LANL through an annual work planning process. Campaigns are planned using risk-based criteria to group, prioritize, and implement corrective actions (CAs). The annual planning process allows for revisions to cleanup campaigns based on actual work progress, changed conditions, and funding. LANL has two types of legacy waste CA sites: SWMUs and AOCs. SWMUs are areas where solid wastes were spilled or disposed. The two SWMUs at the BCAA site include firing sites, outfalls, and landfills. AOCs are areas that may have received a hazardous waste or hazardous constituent through soil movement or effluent flow. The two AOCs within the BCAA site include canyon bottoms downstream of historical outfalls.

1.2.4 Mixed Waste: Federal Facility Compliance Act (FFCA)

The FFCA requires federal facilities that generate or store mixed waste to submit a site treatment plan that includes a schedule for developing treatment capacities and technologies to treat all the facility's mixed waste. In October 1995, the State of New Mexico issued a Federal Facility Compliance Order to LANL requiring a site treatment plan for mixed radioactive and hazardous wastes. There are no mixed wastes at the BCAA site.

1.2.5 Specific Chemical Wastes: Toxic Substances Control Act

The Toxic Substances Control Act addresses the production, import, use, and disposal of specific chemicals, including polychlorinated biphenyls (PCBs). LANL is responsible for recordkeeping and reporting related to disposal of PCB-containing substances. PCB-containing substances include dielectric fluids, solvents, oils, waste oils, heat-transfer fluids, hydraulic fluids, slurries, soil, and materials contaminated by spills. Because of the cleanup conducted by LANL, the BCAA site no longer contains regulated levels of PCB contaminants.

1.2.6 Solid Nonhazardous Wastes

LANL sends sanitary solid waste, construction debris, and demolition debris to the Los Alamos County Eco Station for transfer to municipal landfills such as the municipal waste landfill in Rio Rancho, New Mexico. The Legacy Management Support (LMS) contractor may use this process to remove solid waste and debris from the BCAA site as needed.

1.2.7 Clean Air Act Title V Operating Permit

Under the Clean Air Act (CAA), LANL is regulated as a major source of air pollutants based on its potential to emit nitrous oxides, carbon monoxide, and volatile organic compounds. LANL has a CAA Title V Operating Permit and is required to keep air emissions of regulated pollutants below permit limits. LANL submitted a Title V permit modification application in July 2016 for five small spray evaporators to replace a larger unit that was taken out of service, and LANL received the new permit, P100-R2M1, on February 3, 2017. LANL is required to annually certify compliance with the Title V Operating Permit. The BCAA site is not included in this air permit.

1.2.8 Airborne Radionuclide Emissions: Radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAPs)

Emissions of airborne radionuclides are regulated under the radionuclide NESHAPs, which sets a dose limit of 10 mrem/yr to any member of the public from air emissions. The estimated maximum dose to a member of the public in 2017 via air emissions was 0.47 mrem, less than 5% of the radionuclide NESHAPs limit. LANL conducted a BCAA site-specific RESRAD dose assessment using past data and the most current version of the program to crosscheck the estimated maximum dose to the public from the BCAA site. This follow-up RESRAD verifications by LANL, determined that the BCAA site is safe for recreational use.

1.2.9 Clean Water Act

The primary goal of the Clean Water Act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. The act requires National Pollutant Discharge Elimination System (NPDES) permits for several types of effluent and stormwater discharges. The NPDES permits described below establish specific chemical, physical, and biological criteria and management practices that LANL must meet when discharging water. EPA Region 6 enforces LANL's Clean Water Act permits. NMED certifies the permits as being protective of waters of the state and performs some compliance inspections and monitoring on behalf of EPA.

1.2.10 NPDES Industrial and Sanitary Point-Source Outfall Permit

As of 2017, there were 11 outfalls regulated by LANL's NPDES Industrial and Sanitary Point-Source Outfall Permit. Six of the outfalls discharge cooling water from conventional cooling towers and one discharges treated sanitary waste. LANL's Outfall Permit requires weekly, monthly, quarterly, yearly, and term sampling to demonstrate compliance with different effluent quality limits. LANL reports analytical results to EPA and NMED. The BCAA site does not contain any industrial or sanitary point-source outfalls.

1.2.11 NPDES General Permit for Discharges of Stormwater from Construction Sites

The NPDES General Permit for Discharges of Stormwater from Construction Sites, referred to as the Construction General Permit in this document, regulates stormwater discharges from construction sites covering 1 or more acres. LANL compliance with the Construction General Permit includes developing Stormwater Pollution Prevention Plans and conducting site inspections during construction. LANL inspects the location and condition of controls at the entire LANL site and identifies CAs if needed. During 2017, LANL had 25 Stormwater Pollution Prevention Plans for construction sites, and LANL performed 554 stormwater inspections. CA reports are prepared for stormwater management issues observed during inspections. The BCAA site is not managed under this Construction General Permit.

1.2.12 NPDES Individual Permit Authorization to Discharge (from SWMUs and AOCs)

LANL's NPDES Individual Permit Authorization to Discharge, referred to as the Individual Permit in this document, authorizes discharges of stormwater from 405 SWMU and AOC discharge sites at LANL. Controls that reflect best industry practices are applied at each of the 405 discharge sites to minimize or eliminate movement of pollutants off the entire LANL site.

To sample the stormwater runoff, the 405 discharge sites are grouped into 250 discharge monitoring locations that discharge to a common drainage point. Stormwater samples collected from these locations are analyzed to determine the effectiveness of the controls. An Individual Permit field team uses ultra-high frequency telemetry to monitor the condition of automated samplers and to notify them when a sampler collects stormwater discharge. When target action levels for pollutants, based on New Mexico surface water quality standards, are exceeded in the samples, the Individual Permit requires additional CAs at that discharge site. A discharge site is removed from the Individual Permit when the CAs for that discharge site are certified as completed by EPA. All CAs within the BCAA site have been confirmed as completed in the EPA letter received September 2017, and stormwater inspections within the BCAA site have ceased. BCAA site removal from Individual Permit No. NM0030759 is underway.

1.2.13 Aboveground Storage Tank Program

LANL's aboveground storage tank program manages compliance with the EPA requirements under the Clean Water Act and with *New Mexico Administrative Code* regulations administered by NMED's Petroleum Storage Tank Bureau. The BCAA site does not contain any aboveground storage tanks.

1.2.14 Clean Water Act Section 404 and 401 Permits

The Clean Water Act requires that LANL receive U.S. Army Corps of Engineers verification that proposed work within perennial, intermittent, or ephemeral watercourses complies with nationwide Section 404 permit conditions. Section 401 of the Clean Water Act requires states to certify that Section 404 permits issued by U.S. Army Corps of Engineers comply with state water quality standards. NMED reviews Section 404 and 401 permit applications and issues separate Section 401 certification letters, which may include additional permit requirements to meet state stream standards for individual LANL projects. Section 404 and 401 verifications and certifications that were issued or active at LANL in 2017 are listed in the 2017 Annual Site Environmental Report (DOE LANL 2018). No Section 401 or 404 reports are active for the BCAA site.

1.2.15 Energy Independence and Security Act: Stormwater Management Practices

Section 438 of the Energy Independence and Security Act of 2007 (EISA) establishes stormwater runoff requirements for federal development and redevelopment projects. Any federal project more than 5000 square feet that alters the flow of water over the surface of the ground must implement low-impact development controls to maintain predevelopment water temperatures, flow rates, flow volumes, and duration. Examples of appropriate controls include vegetated swales, infiltration basins, permeable pavement, vegetated strips, rain barrels and cisterns. The goal is to control runoff through infiltration, evapotranspiration, or harvest and reuse. The EISA is not directly applicable to the BCAA site based on its current natural condition. Proposed future-use improvements may require that these statutes be revisited.

1.2.16 New Mexico Water Quality Act: Surface Water Protection

Under the New Mexico Water Quality Act, the New Mexico Water Quality Control Commission adopts standards for surface waters of the state. *New Mexico Administrative Code 20.6.4* (NMAC 20.6.4), “Standards for Interstate and Intrastate Surface Waters,” establishes surface water quality standards that define designated uses of surface waters of the state, the water quality criteria necessary to protect those uses, and an antidegradation policy. The discharge limits and monitoring requirements in LANL’s NPDES permits are determined, in part, by the impairment status of affected water courses. During 2017, most assessment units at LANL were evaluated as impaired to some extent, but no information in the LANL 2017 Site Environmental Report indicated that the BCAA site drainage area was impaired (DOE LANL 2018).

1.2.17 Safe Drinking Water Act

The Los Alamos County Department of Public Utilities supplies water for Los Alamos, White Rock, LANL, and Bandelier National Monument. The Department of Public Utilities issues an annual drinking water quality report, as required by the Safe Drinking Water Act. For the latest year of publication (2017), the drinking water quality for Los Alamos met all EPA regulations. The BCAA site is included in the Department of Public Utilities groundwater sampling regime.

1.2.18 New Mexico Water Quality Act: Groundwater Discharge Regulations

Under the New Mexico Water Quality Act, the New Mexico Water Quality Control Commission sets regulations for liquid discharges onto or below ground surfaces to protect groundwater. NMED enforces the groundwater discharge regulations and may require a facility that discharges effluents to submit a discharge plan and obtain a permit. In 2017, LANL had four discharge permits and one discharge permit application pending. These regulations do not pertain to the BCAA site.

1.2.19 Domestic Septic Tank Disposal Systems Discharge Permit DP-1589

On July 22, 2016, NMED issued discharge permit DP-1589 to LANL for discharges from eight septic tank disposal systems. These septic systems (a combined septic tank and leach field) are located in remote areas of the entire LANL site where access to the sanitary wastewater system plant’s collection system is not practicable. Four of the eight septic tank disposal systems are active; the remaining four systems are inactive because water service to the buildings using the systems is disconnected. A septic tank system or parts of a system might remain within the BCAA site, but if so, it has been disconnected and all building structures have been removed.

1.2.20 DOE Order 232.2, *Occurrence Reporting and Processing of Operations Information*

DOE Order 232.2, *Occurrence Reporting and Processing of Operations Information*, requires that abnormal events or conditions that occur during facility operations must be reported. An “occurrence” is one or more events or conditions that may adversely affect workers, the public, property, the environment, or the DOE mission. No occurrences were reported at the BCAA site in 2017 (DOE LANL 2018).

1.2.21 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impacts of proposed activities, operations, and projects in decision-making. The act requires the preparation of Environmental Assessments or Environmental Impact Statements for any projects or activities having the potential for significant environmental impacts, and that requirement includes a public participation component. LANL operates under a site-specific Site-Wide Environmental Impact Statement (DOE 2008) and associated Record of Decision (Volume 73 Federal Register page 55833 [FR 55833]) and Supplement Analyses. For transition of the BCAA site, a NEPA Categorical Exclusion was developed and approved by LM (CXE LM 27-01).

1.3 Operations

During its operational history, the BCAA site was known as Technical Area 10 (TA-10) and included roughly 350 acres of land and facilities that supported the development of nuclear weapons. From 1943 to 1961, TA-10 was used primarily as a firing site to test assemblies containing conventional high explosives, including components made from depleted or natural uranium. Radiochemistry and liquid waste processing facilities at the site were used in the production of lanthanum-140 (¹⁴⁰La). The TA-10 site also included various ancillary facilities associated with waste disposal, including (1) sewage lines, manholes, septic tanks, and seepage pits for sanitary and radioactive liquid waste and (2) disposal pits for solid radioactive waste (Mayfield et al. 1979). The site was remediated in 1957 and again from 1960 to 1963. Most of the buildings were burned in place and the ash and debris was removed and disposed of at the main disposal area for the Los Alamos complex. More than 550 dump-truck loads of contaminated waste were excavated and removed. The excavations were backfilled and the site was regraded (Mayfield et al. 1979). After those remediation efforts, the site was transferred via a quitclaim deed to Los Alamos County in 1967.

A Comprehensive Environmental Assessment and Response Program field survey was conducted around the firing sites, in an area now known as CU 10-001(a)-99, that identified the presence of metal cable and small pieces of shrapnel. The shrapnel consisted of aluminum and steel with small amounts of lead, wood, and other shot residue (DOE 1986). During the survey, six survey monuments and associated guard posts were installed in an area that roughly encompasses the old liquid waste disposal complex, the radiochemistry laboratory, and the area of the waste disposal pit. The monuments are marked “Buried radioactive material. No excavation prior to 2142 AD. See county records” (DOE 1986).

In 1993, geomorphic mapping identified various types of radioactively contaminated shrapnel in the TA-10 site (Drake and Inoué 1993). These results prompted an interim action (IA) to remove shrapnel from Bayo Canyon (LANL 1997). Shrapnel removal began in September 1994 and was completed by January 1995. More than 19,000 pieces of shrapnel were collected during the surface shrapnel removal operation. A total of 458 pieces (2.4%) were found to emit radioactivity levels that exceeded local background levels.

In 1994, surface and subsurface sampling was conducted in accordance with a Phase I RCRA Facility Investigation (RFI). The sampling was designed (1) to determine whether residual RCRA chemicals—particularly barium, beryllium, or lead—existed in surficial deposits near

the firing pads (i.e., at SWMUs 10-001(a)–(d)) and (2) to confirm that no human health or ecological risks were associated with the radiological constituents identified in previous investigations (LANL 1995). The objective of the RFI was “to characterize the nature, concentration, and lateral and vertical extent of potential subsurface contamination related to historic activities at the site” (LANL 1996a). Radionuclides were retained as contaminants of potential concern (COPCs) at SWMUs 10-003(a)–(o), 10-007, and 10-002(b), and an IA was recommended to remove chamisa plants containing elevated levels of strontium-90 (⁹⁰Sr) (LANL 1996b). To control access to the area, a fenced exclusion zone was constructed and the area was posted as a radiation control area. Stormwater control measures, including silt fences and straw wattles, were put in place along the northern and eastern parts of the site to capture runoff. Straw bales were placed along the edge of a channel that emerges from a culvert along the western part of the site to prevent run-on (LANL 1997). After a final inspection on July 5, 2001, LANL’s Water Quality and Hydrology group determined the area was stabilized and no further inspections were necessary (Veenis 2005).

On March 1, 2005, LANL, EM, and NMED entered into an Order on Consent to remediate LANL (25,600 acres), which included the BCAA site. In 2007, an RFI was conducted (1) to address specific requirements for the Bayo Canyon contained in Section IV.C.5.c, “Technical Area 10 Investigation,” in the Order on Consent and (2) to complete the characterization of the site as specified in the approved Bayo Canyon Aggregate Area Investigation Work Plan (LANL 2005).

Three AOCs and 26 SWMUs were recommended for certification that CAs were completed in the *Investigation Report for Bayo Canyon Aggregate Area* (Request), dated June 15, 2015. On January 31, 2017, NMED issued Certificates of Completion for all AOCs and SWMUs requested at the BCAA site (NMED 2017). These areas were determined to meet applicable RCRA standards and so could be released for recreational or residential use. However, DOE determined that, based on human and environmental radiological health risk, these sites could only be released for recreational use. Today, the BCAA site includes two CUs (10-001(a)-99 and 10-002(a)-99), two SWMUs (10-004(a) and 10-006), and two AOCs (C-10-001 and 10-009), which are all monitored by EM.

The BCAA site property is owned by Los Alamos County and it is open to the public for recreational activities such as hiking, mountain biking, and horseback riding. A trail exists at the base of the cliff north of CU 10-002(a)-99, and runs through most of the canyon. Access to the trail is the same public road, and the maintenance road access is used to enter the BCAA site.

1.4 Contaminants

The types of contamination at the BCAA site that were remediated varied, depending on the particular CU, SWMU or AOC and what activities were undertaken in those areas over the history of the site. The contaminants of concern that remained following remedial activities, and that resulted in a “recreational use only” determination for the BCAA site, are radiological constituents, including uranium, ¹⁴⁰La, and ⁹⁰Sr.

1.5 Site Conditions

In November 2018, LM and LMS contractor personnel visited the BCAA site and issued a trip report that evaluated existing site conditions and any future plans expressed by EM-LA and Los Alamos County. That trip report describes the condition of the site, including the presence of chamisa (a subspecies of rabbitbrush) flourishing along the roadsides and generally at the bottom of the entire length of the canyon.

The BCAA site contains approximately 350 acres of a park-like forest setting that is open to the public for recreational use, including hiking, biking, and horseback riding. The following observations were made during the site visit:

- There are numerous signs posted to delineate DOE property throughout the canyon, including along the maintenance road and at the entrance.
- Los Alamos County, as the property owner, has done a good job of maintaining the hundreds of acres for public use.
- It was observed that utility poles with electric service remain in the field from previous EM remediation activities. In field discussions, Los Alamos County personnel said they have no need for the poles to remain. In 2019, DOE coordinated the removal of this infrastructure.
- Trailhead signs are weathered at some locations and are difficult to read.
- The FUSRAP Bayo Canyon site is in the central portion of the BCAA site and was one of the focus areas of the site visit.
- Around the landfill there was damaged radiological control fencing that apparently was constructed as a temporary measure. In 2020, Los Alamos County conveyed to DOE that the fence was no longer needed. As such, in 2020 the fence was removed by an LM contractor.
- There are erosion controls in the area of the landfill, including wattles placed inside the fenced area at the downgradient edge of the site, which are managed by DOE's EM-LA. Those controls are designed to divert runoff around the fenced area and to slow water moving over the landfill area. Some of the controls required maintenance and field observation were shared with DOE's EM-LA.

The BCAA site has transferred to LM stewardship and has been placed under the long-term care of LM as a Category 2 site, similar to the Bayo Canyon FUSRAP site. Category 2 activities typically include routine inspection and monitoring/maintenance, records-related activities, and stakeholder support. LM will inspect the physical condition of the BCAA site and report any significant disturbances to EM to reinforce the premise that residual contamination continues to present no unacceptable risk to the public or the environment. LM's responsibilities at the site will consist of managing site records for transition and beyond, responding to stakeholder inquiries, managing protective measures, performing an annual verification on the accuracy of site information, and performing a site inspection annually for 3 years (2019, 2020, and 2021), followed by site visits on a rolling 5-year schedule thereafter.

From recent follow-up RESRAD verifications by LANL, which included the potential ⁹⁰Sr uptake by the chamisa plants within the area, it has been determined that the BCAA site is safe for recreational use, but the area continues to require an institutional control (IC) prohibiting excavation until 2142.

2.0 Remedial Action

After the remediation efforts of 1957 and 1960–1963 (see Section 1.3), the BCAA site property was transferred via a quitclaim deed to the Los Alamos County in 1967. Several subsequent investigations and smaller cleanup efforts occurred through 2012. In January 2017, NMED issued a Certificate of Completion for the remediation of RCRA-regulated hazardous contaminants of concern, acknowledging that residual radioactivity, regulated by DOE, is safe for recreational use but remains at levels exceeding residential use scenarios.

2.1 Contaminants of Potential Concern

The principal COPC for the BCAA site is ⁹⁰Sr. However, a total of 24 inorganic, 42 organic, and 6 radionuclide COPCs have been identified in solid media at the site. The distributions of most inorganic, organic, and radionuclide COPCs had been defined during previous investigations. The specific concerns about contaminant distribution identified in the investigation work plan have been addressed by the 2007 investigation, and the nature and extent of site COPCs are defined. In general, the concentrations of inorganic and organic COPCs at all former TA-10 sites are low and do not exhibit marked concentration trends or strong correlation that would indicate a release. The 2007 data confirm the extent of the ⁹⁰Sr contamination associated with historical operations (DOE LANL 2008).

The estimated total excess lifetime cancer risk from hazardous chemical exposures is below the NMED target level of 1×10^{-5} for recreational, construction worker, and residential scenarios for all former TA-10 sites.

The Hazard Indexes (HIs) for the recreational and residential scenarios were less than the NMED target HI of 1.0 for all of the TA-10 site. CUs 10-001(a)-99 and 10-002(a)-99 and SWMU 10-004(a) had HIs greater than the NMED target HI of 1.0 for the construction worker scenario. The three HIs for the construction worker scenario are approximately 2.0, primarily from the detection of manganese. However, the exposure point concentrations (EPCs) for manganese are similar to soil background concentrations, indicating that exposures would be similar to background levels. The HIs without manganese are below 1.0, indicating no potential for unacceptable risk to the construction worker at any portion of the former TA-10 site.

The radiological doses for the recreational and construction worker scenarios were below the DOE target of 15 mrem/yr for all areas. The dose for the residential scenario was below 15 mrem/yr at CU 10-001(a)-99, SWMU 10-004(a), and AOCs 10-009 and C-10-001. The estimated residential dose was greater than 15 mrem/yr at CU 10-002(a)-99.

Potential ecological risk was evaluated for several receptors using minimum ecological screening level (ESL) comparisons, HI analyses, comparisons to background, potential effects to populations (individuals for threatened and endangered species), the relative toxicity of related compounds, and the infrequency of detection. The lines of evidence for each receptor support the conclusion that no potential ecological risk exists within the BCAA site.

2.2 Cleanup Criteria and Assessment of Risk

The EPCs for carcinogenic COPCs were divided by the appropriate soil screening level (SSL) and multiplied by 1×10^{-5} to estimate the excess lifetime cancer risk. The total excess cancer risk was compared to the NMED target risk level of 1×10^{-5} (NMED 2006). A Hazard Quotient (HQ) was generated for each noncarcinogenic COPC by dividing the EPC by the appropriate SSL. The HQs were summed to generate an HI, which was compared with the NMED target HI of 1.0 (NMED 2006).

The total excess cancer risk for the recreational scenario is 8×10^{-13} , which is less than the NMED target risk of 1×10^{-5} (NMED 2006). Individual EPCs for the noncarcinogenic COPCs also did not exceed their respective recreational SSLs. The recreational HI is 0.03, which is less than the NMED target HI of 1.0 (NMED 2006).

One radionuclide, ^{90}Sr , was identified as a COPC. The ^{90}Sr doses for the recreational, construction worker, and residential scenarios are 0.02 mrem/yr, 0.001 mrem/yr, and 13 mrem/yr, respectively. The doses for all scenarios are below the target dose of 15 mrem/yr. The total excess cancer risk from radionuclides for the recreational and construction worker scenarios is below 1×10^{-5} . The excess cancer risk from radionuclides for the residential scenario is 2×10^{-5} .

An ecological screening assessment was conducted to determine whether contaminants of potential ecological concern (COPECs) at CU 10-001(a)-99 result in a potential unacceptable risk to ecological receptors. Based on the ecological screening assessment, several COPECs (including COPECs without ESL) were identified at the BCAA site. Receptors were evaluated for potential risk using the following lines of evidence: minimum ESL comparisons, HI analyses, comparison to background, potential effects to populations (individuals for threatened and endangered species), the relative toxicity of related compounds, and the infrequency of detection. The results of the ecological risk screening assessment indicate no potential risk to ecological receptors at the site, and further investigation or CAs are not warranted based on ecological risk.

2.3 Remedial Action

With the exception of SWMU 10-007, all other discharge sites were proposed and then certified by NMED as having CAs complete without further controls for hazardous constituents.

Preliminary CA alternatives were evaluated for SWMU 10-007. Based on the low radiological dose to humans and the absence of contaminant migration from the site, long-term ICs were determined to be an appropriate final action for the subsurface ^{90}Sr contamination beneath the buried debris. Other actions might also be identified, as determined by DOE and the current property owner (Los Alamos County). Lastly, removal of two isolated areas of elevated ^{90}Sr activity identified south of the former radiochemistry laboratory was proposed as a good stewardship practice. DOE and Los Alamos County performed the two ^{90}Sr removal actions before issuing the Certificate of Completion in January 2017.

Currently the BCAA is managed as a recreational use site and will likely remain a recreational use site into the foreseeable future.

2.4 Independent Verification

It is currently unknown whether independent verification was conducted on any RCRA remedial actions conducted at the BCAA site.

2.5 Use Restrictions

Residential use is restricted in all areas of the BCAA site. The BCAA site's current and future use is recreational. Biking, hiking, and horseback riding trails continue to be developed throughout the 352-acre site, and site trailheads contain kiosks with maps and other information.

2.6 Certification and Regulator Concurrence

NMED and DOE have determined that the recreational site is adequately protective of human health now and into the foreseeable future. This is documented in a letter from NMED to EM (NMED 2017).

2.7 Agreements and Permits

- LANL's hazardous waste facility permit, which is issued by NMED, covers two SWMUs, two AOCs, and two CUs at the BCAA site. (For more information see Section 1.2.2.)
- The 2016 Compliance Order on Consent is a settlement agreement between NMED and DOE addressing cleanup of legacy wastes. (See Section 1.2.3 for more details.)
- EM-LA maintains Individual Permit Authorization to Discharge (No. NM0030759) under NPDES for various SWMUs and AOCs. A site is removed from the Individual Permit when the CAs for the site are certified complete by NMED. The CAs at the BCAA site were certified as complete in a EPA letter received September 2017, and stormwater inspections have ceased. BCAA site removal from the Individual Permit is underway. (See Section 1.2.12 for more details.)
- DOE and Pueblo de San Ildefonso Memorandum of Agreement, amended in 2015 (DOE and Pueblo 2014) is an agreement to access the Pueblo's land as needed to conduct CAs and other cleanups as needed and to keep the Pueblo informed of the status EM-LA of activities.
- DOE plans to work with Los Alamos County to obtain an access agreement (draft DE-RO01-19LM70224) that will allow DOE to perform ongoing minor maintenance to meet its stewardship responsibilities at the BCAA site.

3.0 Protective Measures

Long-term surveillance and maintenance (LTS&M) requirements for the BCAA site, an LM Category 2 site, are summarized at the end of this section in Table 1, and include the following:

- Managing site records
- Responding to stakeholder inquiries
- Managing ICs as defined by DOE
- Performing an annual site inspection and follow-up report
- Providing site condition information to Los Alamos County and EM-LA
- Developing a draft emergency contingency communication plan

3.1 Institutional Controls

DOE Policy 454.1 Chg 1 (Admin Chg), *Use of Institutional Controls*, applies the term “institutional controls” to include legal instruments (e.g., land use restrictions), physical or engineering controls (e.g., fences and signs), and methods of providing information to people (interpretive displays) that help minimize the risk of human exposure to contaminants and maintain the remedies at a site. The DOE policy utilizes this broader application of the term to encompass the diverse nature of ICs and other measures used throughout DOE in a consistent, yet flexible policy framework integrated into an overall sitewide program.

The following engineering and physical controls (planned or in place) are associated with the BCAA site under the DOE’s broad application of ICs:

- Plans to update information in the kiosks at the trailheads
- Signage to provide information and a contact number in the event of an emergency
- Site inspections to check whether the aforementioned controls are adequate, intact, and operating as intended
- Maintain the formal access agreement between LM and the county to ensure DOE has unencumbered access to the site to conduct inspections and maintenance as necessary

3.2 Annual Review and Data Verification

Historical records for the BCAA site are maintained and managed by EM-LA. Site records generated by LM and the county and correspondence for the site are managed by an LMS records coordinator and reviewed as necessary to keep the records current. The accuracy of site information will be verified on an annual basis. This verification includes but is not limited to site ownership, site conditions, current use, adjacent land use, and developmental property goals of the owner (both near-term and long-term).

3.3 Site Visit Report

A site visit to assess any changed conditions and to conduct a Facilities Information Management System (FIMS) inspection is performed on a 5-year rolling schedule. The verified information and results of each 5-year site inspection is reflected in the FIMS inspection report and in the site's LTS&M plan update.

3.4 Site Fact Sheet

Protective measures for sites transitioning to LM can be identified to fulfill DOE's postclosure responsibilities and to ensure the future protection of human health and the environment. LM's protective measures identified in this plan include:

- Maintenance of an LM public site fact sheet.
- Maintenance of an LM webpage.

The public fact sheet and the LM website are reviewed annually and updated as necessary.

3.5 Beneficial Reuse Reviews

Beneficial reuse has been established by Los Alamos County in designating the BCAA site as a recreational area and trail system for use by the public. LM will meet with Los Alamos County periodically to review the county's future plans for this area and ensure that the recreational designation remains in place until 2142, which is when the area is expected meet residential risk criteria.

3.6 Site Inspections

Site inspections will be conducted annually for the first 3 years following successful transfer; those 3 years are expected to be fiscal year 2020 through fiscal year 2022. After this time, inspections will occur on a 5-year rolling schedule. These inspections will assess any changed conditions that might adversely affect the protectiveness of human health or the environment. Specifically, the inspections will ensure that the following conditions are maintained:

- The area has not degraded or become overgrown with unwanted vegetation
- The signs are in good condition, legible, and are secured to the fence in a level manner
- The information in the kiosks is current, secured, and legible and the kiosk structures are in sound condition
- The erosion controls appear to be controlling the speed and course of the water and there are no signs of significant damage

3.7 Field Operations

LM does not require field operations at the BCAA site.

3.8 Environmental Monitoring

LM is not responsible for any environmental monitoring requirements at the site.

Table 1. Summary of LTS&M Requirements at the BCAA, New Mexico, Site

DOE LTS&M Requirements	Comments
Managing site records	The LM/LMS site records are maintained and managed by LM. Updates to the site records are conducted as necessary to keep the records current.
Responding to stakeholder inquiries	All stakeholder inquiries are posed to LM. The LMS contractor assists LM in responding to stakeholders, as requested.
Managing protective measures	The public fact sheet and the LM website is reviewed annually and updated as necessary.
Performing an annual verification on the accuracy of the site information	The site information (e.g., site ownership, site conditions, current and adjacent property use, and near-term and long-term developmental property goals of the site and the surrounding area) is reviewed annually to ensure that future use of the property is understood.
Performing a site inspection annually to evaluate any changed conditions	Every 5 years, a FIMS inspection will be included in the site inspection.
Performing necessary site maintenance during annual site inspections, such removing unused electrical utilities, telephone poles, barbed wire, old signs, and miscellaneous material	The site shall be inspected annually in fiscal years 2020, 2021, and 2022, and then every 5 years to ensure that ICs are functioning properly. Signs are in good condition and trails are safe. Any needed maintenance will be planned around site inspections to reduce travel and to minimize the number of site visits.

4.0 References

73 FR 55833. U.S. Department of Energy, National Nuclear Security Administration, “Record of Decision: Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico,” *Federal Register*, September 26, 2008.

DOE (U.S. Department of Energy), 1986. Excerpted pages and notes from *Phase I: Installation Assessment, Los Alamos National Laboratory*, final, Volume 1 of 2, Comprehensive Environmental Assessment and Response Program, Environment and Health Division, Environmental Programs Branch, Albuquerque Operations Office, Albuquerque, New Mexico, October.

DOE (U.S. Department of Energy), 2008. “Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico,” U.S. Department of Energy report DOE/EIS-0380, May.

DOE and Pueblo (U.S. Department of Energy and Pueblo de San Ildefonso), 2014. Memorandum of Agreement, amended in 2015.

DOE LANL (U.S. Department of Energy and Los Alamos National Laboratory), 2008. *Investigation Report for Bayo Canyon Aggregate Area*, Revision 1, LA-UR-08-3202, EP2008-0226, May.

DOE LANL (U.S. Department of Energy and Los Alamos National Laboratory), 2018. *2017 Annual Site Environmental Report*, Revision 2, LA-UR-18-28565, December 4.

DOE Manual 435.1-1 Chg 2, *Radioactive Waste Management Manual*, U.S. Department of Energy, June 8, 2011.

DOE Order 232.2, *Occurrence Reporting and Processing of Operations Information*, U.S. Department of Energy, January 17, 2017.

DOE Order 435.1 Chg 1 (Pg Chg), *Radioactive Waste Management*, U.S. Department of Energy, August 28, 2001.

DOE Order 458.1 Chg 3 (Admin Chg), *Radiation Protection of the Public and the Environment*, U.S. Department of Energy, January 15, 2013.

DOE Policy 454.1 Chg 1 (Admin Chg), *Use of Institutional Controls*, U.S. Department of Energy, December 7, 2015.

Drake, P., and C. Inoué, 1993. *Geomorphic Characterization of Operable Unit 1079 (OU-1079), Formerly Technical Area 10, Los Alamos National Laboratory, New Mexico*, report prepared for Los Alamos National Laboratory by Glorieta Geoscience Inc., Santa Fe, New Mexico, September.

LANL (Los Alamos National Laboratory), 1995. *RFI Report for Solid Waste Management Units 10-001(a-d)*, Los Alamos National Laboratory, Los Alamos, New Mexico, September 5.

LANL (Los Alamos National Laboratory), 1996a. *RFI Report for Potential Release Sites 10-002(a-b), 10-003(a-o), 10-004(a-b), 10-005, 10-007*, Los Alamos National Laboratory document LA-UR-96-1284, Los Alamos, New Mexico, April.

LANL (Los Alamos National Laboratory), 1996b. *Radiological Addendum to the RFI Report for Potential Release Sites 10-002(a,b), 10-003(a-o), 10-004(a,b), 10-005, 10-007, TA-10 Subsurface*, Los Alamos National Laboratory document LA-UR-96-1748, Los Alamos, New Mexico, June.

LANL (Los Alamos National Laboratory), 1997. *Interim Action Report for Potential Release Sites 10-002(a,b), 10-003(a-o), 10-004(a,b), and 10-007*, Los Alamos National Laboratory, Los Alamos, New Mexico, April.

LANL (Los Alamos National Laboratory), 2005. "Investigation Work Plan for Bayo Canyon Aggregate Area," Los Alamos National Laboratory document LA-UR-05-4761, Los Alamos, New Mexico, July.

LANL (Los Alamos National Laboratory), 2016. *Derivation of Authorized Limits for Land Transfer at Los Alamos National Laboratory*, LA-UR-16-27038, September.

LANL (Los Alamos National Laboratory), 2017. "Updated Dose Assessment of Los Alamos National Laboratory-Derived Residual Radionuclides in Soils within Tract A-16-a for Land Transfer Decisions," Los Alamos National Laboratory report LA-UR-17-21162, February.

Mayfield, D.L., A.K. Stoker, and A.J. Ahlquist, 1979. *Formerly Utilized MED/AEC Sites, Remedial Action Program: Radiological Survey of the Bayo Canyon, Los Alamos, New Mexico*, U.S. Department of Energy Report No. DOE/EV-0005/15, Los Alamos, New Mexico, June.

NMAC 20.6.4. “Standards for Interstate and Intrastate Surface Waters,” *New Mexico Administrative Code*.

NMED (New Mexico Environment Department), 2006. “Technical Background Document for Development of Soil Screening Levels, Revision 4.0, Volume 1, Tier 1: Soil Screening Guidance Technical Background Document,” New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico, June.

NMED (New Mexico Environment Department), 2017. “Certificate of Completion for the Order on Consent for the Bayo Canyon Aggregate Area,” January 31.

Veenis, S., 2005. Bayo Canyon BMPs and an attachment, included in an email message sent to D. Stevens (Terranear PMC) from S. Veenis (LANL), Los Alamos, New Mexico, June 24.

Yu, C.A., A.J. Zielen, J.J. Cheng, D.J. LePoire, E. Gnanapragasam, S. Kamboj, J. Arnish, A. Wallo III, W.A. Williams, and H. Peterson, 2001. *User’s Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, Illinois.