STATEMENT OF BASIS

September 7, 2023

SELECTION OF A REMEDY FOR CORRECTIVE ACTION AT MATERIAL DISPOSAL AREA C, SWMU 50-009 AT TECHNICAL AREA 50 LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NEW MEXICO EPA ID NO. NM08990010515

ACTION: New Mexico Environment Department (NMED) intends to select a remedy for corrective action at Material Disposal Area (MDA) C, Solid Waste Management Unit (SWMU) 50-009 at Technical Area (TA) 50. The United States Department of Energy (DOE) and Newport News Nuclear BWXT, LLC. (N3B) conducted a Corrective Measures Evaluation (CME) to evaluate different alternatives for remediation of MDA C and submitted a Revised CME Report on June 30, 2021 (CME 2021)[1]. NMED reviewed the CME 2021 and is issuing this Statement of Basis for the selected remedy.

FACILITY: Los Alamos National Laboratory (LANL), Los Alamos, New Mexico.

PERMITTEE: LANL is owned by the U.S. Department of Energy (DOE) Office of Environmental Management (EM) and National Nuclear Security Administration and is currently co-operated by Triad National Security, LLC (Triad), Environmental Management Los Alamos Field Office (EM-LA), and Newport News Nuclear BWXT (N3B).

The CME 2021 was submitted by DOE EM-LA in accordance with the requirements of 2016 Compliance Order on Consent. DOE EM-LA is located at the following address:

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[1] Los Alamos National Laboratory, June 2021. "Corrective Measures Evaluation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," Los Alamos National Laboratory Document EM2021-0177, Los Alamos, New Mexico (CME 2021)

Los Alamos, NM 87544

DOCUMENTS: The documents referenced throughout this Statement of Basis are listed below on page 22 and are available to view electronically at https://www.env.nm.gov/hazardous-waste/lanl/ and in person between the hours of 8:00 am and 5:00 pm at the Hazardous Waste Bureau located at 2905 Rodeo Park Dr. East, Bldg. #1, Santa Fe, NM 87505.

STATUTORY AND REGULATORY FRAMEWORK

The Resource Conservation and Recovery Act (RCRA), 42 U.S.C. §§ 6901 to 6992(k), provides for the regulation of hazardous waste. Congress waived the immunity of the United States for actions brought under state hazardous and solid waste laws as well as RCRA. Pursuant to Section 3006 of RCRA, 42 U.S.C. § 6926, the United States Environmental Protection Agency (EPA) delegated to NMED, on January 25, 1985, the authority to enforce the New Mexico Hazardous Waste Act (HWA) and its implementing regulations, the New Mexico Hazardous Waste Management Regulations (HWMR), in lieu of EPA enforcement through RCRA. NMED has maintained its delegation from EPA over hazardous waste management in New Mexico and has amended its state program to conform to statutory or regulatory changes in RCRA.

On November 8, 1989, the RCRA Hazardous Waste Permit (the Permit) was issued to the Permittees to operate a hazardous waste treatment and storage facility at LANL pursuant to the HWA, NMSA 1978, § 74-4-4.2. On March 8, 1990, EPA issued to the Permittees the Hazardous and Solid Waste Amendments (HSWA) portion of the Permit, effective on May 23, 1990, and revised it on May 19, 1994. Effective January 2, 1996, the NMED received from EPA the final authorization to implement its corrective action program under the HWA and its implementing HWMR. The HWMR required corrective action at sites where releases of hazardous waste have occurred. The renewed Permit became effective December 2010 and was set to expire in December 2020. The DOE submitted a Renewal Application in June 2020, and the Permit was administratively extended pursuant to 20.4.1.900 NMAC.

On March 1, 2005, NMED, DOE, and the University of California entered into a Consent Order (2005 CO) [2] pursuant to NMSA 1978, § 74-4-10 of the HWA, and 20.9.9.14 of NMAC. On June 22, 2016, NMED and the DOE entered into another Compliance Order on Consent (2016 CO) [3] which superseded the 2005 CO. The scope of the 2016 CO was to fulfill the requirements for: (1) corrective actions for releases of hazardous waste or hazardous waste constituents under Sections 3004(u) and (v) and 3008(h) of RCRA, 42 U.S.C. §§ 6924(u) and (v) and 6928(h), NMSA 1978, §§ 74-4-4(A)(5)(h) and (i), 74-4-4.2(B), and 74-4-10(E) of the HWA, and their implementing regulations at 40 C.F.R. Part 264, subpart F (incorporated by 20.4.1.500 NMAC); (2) corrective actions for releases of groundwater contaminants listed at 20.6.2.3103 NMAC, toxic pollutants listed at 20.6.2.7.WW NMAC, and explosive compounds as defined herein, pursuant to section 74-9-36(D) of the Solid Waste Act (SWA); (3) groundwater monitoring,

[2] State of New Mexico Environment Department, March 2005. "Compliance Order on Consent, The United States Department of Energy and The Regents of the University of California, Los Alamos National Laboratory." (2005 CO).
[3] State of New Mexico Environment Department, June 2016. "Compliance Order on Consent, U.S. Department of Energy, Los Alamos National Laboratory". (2016 CO).

groundwater characterization and groundwater corrective action activities, including requirements, for regulated units under Subpart F and for miscellaneous units under Subpart X of 40 C.F.R. Part 264 and 20.4.1.500 NMAC (incorporating 40 C.F.R. Part 264); and (4) additional groundwater information required in Part B permit applications under 40 C.F.R. § 270.14(c) and (d)(3) and 40 C.F.R. § 270.23(b) (incorporated by 20.4.1.900 NMAC).

A campaign for remediation of MDA-C is included in Appendix C of the 2016 CO. MDA C consists of 115 subsurface waste disposal units (7 pits and 108 shafts). The pits and shafts are listed as a solid waste management unit (SWMU) 50-009 in the Appendix A of the 2016 CO and Attachment K-1, *SWMUs and Areas of Concern (AOCs) Requiring Corrective Action* in the current RCRA Permit. Pursuant to Section XVIII of the 2016 CO, after the selection of a remedy by NMED, the DOE must submit a Corrective Measures Implementation (CMI) Plan to NMED. The CMI Plan will have to include the specific design of the remedy(s) selected by NMED including construction specifications, operation and maintenance plans, performance monitoring of the selected remedy, and an implementation schedule. After NMED's approval of the CMI plan, DOE would implement the CMI plan, and then DOE would submit a CMI Report for NMED's review and possible approval in accordance with Section XVIII.C of the 2016 CO.

MDA C contains both radioactive materials and hazardous waste or constituents. Although the management of radioactive waste is not regulated under the HWA, the contamination at MDA C consists of both hazardous waste constituents and radionuclides and is considered mixed waste and was evaluated under the CME.

FACILITY OPERATIONS

LANL is an approximately 36-square-mile federal facility located adjacent to the town of Los Alamos, New Mexico. LANL is surrounded by the Pueblo de San Ildefonso, Los Alamos County, Bandelier National Monument, Santa Fe National Forest, Santa Fe County, and Bureau of Land Management lands. The Facility is located on a mesa and canyon landscape with relief up to approximately 300 feet from the tops of the mesas to canyons bottoms. The majority of buildings and technical areas (TAs) are located on the mesa tops. LANL has been in operation since the 1940s. LANL was established by the United States Army Manhattan Engineer District for the development and assembly of an atomic bomb. It is owned by the U.S. Department of Energy and currently co-operated by Triad National Security, LLC (Triad) and Newport News Nuclear-BWXT, LLC. (N3B). Current and historic operations include nuclear weapons design and testing; high explosives research, development, fabrication, and testing; chemical and material science research; electrical research and development; laser design and development; and photographic processing. Disposal activities started in the early 1940s and continues through the present day.

BACKGROUND

MDA C is an 11.8-acre landfill consisting of 115 subsurface waste disposal units (7 pits and 108 shafts) located at TA-50. TA-50 is bounded on the north and east by Effluent and Mortandad

Canyons, and on the south and west by Pajarito Canyon. TA-50 is adjacent to several technical areas including TA-55, TA-63, TA-35, TA-66, and TA-40. Facilities at TA-50 include a radioactive liquid waste treatment facility (RLWTF); a waste characterization, reduction, and repackaging facility; offices and several storage areas; SWMUs and AOCs; and MDA C (also known as SWMU 50-009).

MDA C is an inactive landfill consisting of 6 disposal pits, 1 chemical disposal pit, and 108 shafts. Solid waste containing hazardous constituents as well as radioactive waste was disposed of in the landfill between 1948 and 1974. The depths of the 7 pits at MDA C range from 12 to 25 feet below the original ground surface, and the depths of the 108 shafts range from 4 to 25 feet below the original ground surface.

MDA C is located atop Mesita del Buey, a finger-shaped mesa that trends southeast and ranges from 7210 to 7280 feet above sea level. The topography of MDA C slopes gently from west to northeast, gradually becoming steeper across the northeastern portion of MDA C towards Ten Site Canyon.

MDA C is comprised of pits and shafts that were dug into the Tshirege Member unit 3 (Qbt 3) of the Bandelier Tuff. This unit overlays the remainder of the Tshirege Member (Qbt 2, Qbt 1vu, Qbt 1vc, Qbt 1g, and Qbtt), the Cerro Toledo Interval (Qct), the Otowi Member of the Bandelier Tuff (Qbof and Qbog). These units are all ash-flow tuff deposits with various degrees of welding from eruptions originating from the present-day Valles Caldera. The units are all in the unsaturated vadose zone, with no evidence of perched intermediate water.

The ash-flow tuffs overlay the Tschicoma Formation (Tvt 2), a thick, massive dacite formation. Observations from nearby wells (R-60 Completion 2011)[4] show dacite chips to be strongly fractured. The fractures/joints are filled with iron-oxide precipitates.

The Tschicoma Formation overlays the Puye Formation (Tpf), an unconsolidated unit containing volcaniclastic sediment and ancestral river deposits. The regional aquifer water table is in this formation. The regional water table is approximately 1320 feet below ground (bgs) surface at MDA C.

The waste disposal records of MDA C are contained in a series of Los Alamos Scientific Laboratory (LASL) disposal logbooks. Few data exist on the volume of nonradioactive waste disposed of at MDA C.

The pits at MDA C were reported to dispose of solid wastes containing hazardous waste, uncontaminated classified materials, and low-level waste (LLW).

Pit 1 was operated from November 1948 – September 1951. Based on documentation in the LASL logbooks 2587 and 3478, Pit 1 was used to dispose of the following materials: trichloroethene (TCE), boron, sulfuric acid, graphite, medical laboratory solutions, contaminated

[4] Los Alamos National Laboratory, March 11, 2011. "Completion Report for Regional Aquifer Well R-60," Los Alamos National Laboratory Document LA-UR-11-0189, Los Alamos, New Mexico, (R-60 Completion 2011).

materials and trash, tritium, americium-241, uranium, classified materials, plutonium, cyanide, mercury, radium-226, acids, lead, and waste oil.

Pit 2 was operated from April 1950 – September 1951. Based on documentation in LASL logbooks 2587 and 3478, Pit 2 was used to dispose of the following materials: TCE, contaminated materials and trash, boron, tritium, americium-241, uranium, sulfuric acid, biological waste, graphite, classified materials, plutonium, cyanide, mercury, radium-226, acids, lead, and waste oil.

Pit 3 was operated from October 1951 – April 1953. Based on documentation in the LASL logbook 4644, Pit 3 was used to dispose of the following materials: mercury teplers, tritium-contaminated glassware, cyanide solutions, contaminated materials and trash, TCE, boron, americium-241, uranium, sulfuric acid, biological waste, graphite, classified materials, plutonium, radium-226, acids, lead, waste oil, and beryllium.

Pit 4 was operated from October 1951 – February 1955. Based on documentation in LASL logbooks 4644 and 6030, and was used to dispose of the following materials: tritium-contaminated glassware, boxes and urine samples, mercury teplers, actinium-227, vials of radium-226, cyanide and cyanide solutions, a 5-gallon can of actinium waste, empty bottles, contaminated materials and trash, TCE, boron, americium-241, uranium, sulfuric acid, biological waste, graphite, classified materials, plutonium, acids, lead, waste oil, and beryllium.

Pit 5 was operated from April 1953 – September 1959. Base on documentation in the LASL logbooks 6030, 7277, and 9593, Pit 5 was used to dispose of the following materials: lead and acid batteries, a 5-gallon can of actinium-227 waste, lead bricks, vials of radium-226, zirconium shavings, cyanide and cyanide solutions, radionuclide-contaminated waste oil, empty bottles, silver nitrate, beryllium chips, tritium-contaminated boxes and urine samples, contaminated materials and trash, TCE, boron, americium-241, uranium, sulfuric acid, biological waste, graphite, classified materials, and plutonium. Pit 5 is approximately 125 ft. from the mesa edge and may be vulnerable to cliff retreat due to seismic events over long timeframes (e.g., thousands to tens of thousands of years).

Pit 6 was operated from October 1956 – September 1959. Based on documentation in the LASL logbooks 9293, 9593, and 11363; Pit 6 was used to dispose of the following materials: radionuclide-contaminated oil, tritium-contaminated oil, copper sheets, cobalt chips, bottles of cadmium-boron tungstate, tritium-contaminated boxes and cans, a can of oil, approximately 100 Curies (Ci) of source-strength cobalt-60, a lanthanum source, 10 bottles of platinum chloride, beryllium chips, carbon-14-contaminated graphite, a plutonium slug, contaminated materials and trash, TCE, boron, americium-241, uranium, sulfuric acid, biological waste, classified materials, mercury, actinium-227, radium-226, acids, and lead.

The **Chemical Pit** was operated from early 1960 through June 1964. There are no logbook entries for waste disposed of in the chemical pit. Available records indicate that wastes include "a variety of chemicals, pyrophoric metals, natural uranium powders and hydrides, sealed vessels containing sodium-potassium alloy, compressed gases, and unspecified equipment". Plutonium and uranium-contaminated objects are also reported to be present in the chemical pit, as well as

"low-level radioactive waste placed in the pit that may have included cardboard boxes containing materials from chemistry labs, as well as 55-gallon barrels of sludge from the waste treatment plants at building 35, DP West and TA-45".

MDA C also has 108 shafts, primarily used for disposing of beta-and gamma-contaminated wastes from the Chemistry and Metallurgy Research (CMR) building at TA-03. Other Laboratory groups also used the MDA C shafts for waste disposal. Shafts were separated into Shaft Groups, which are described below.

Shaft Group 1 (Shafts 56-67) is located south of Pit 5 and shafts were used for disposal from February 1958 through October 1959. Based on the information provided in the LASL logbook 9593, the shafts were used to dispose of material containing barium, tritium, radium, lanthanum-140, strontium-89 and -90, tantalum, cerium waste, two cerium sources, fission products, one lanthanum-140 static source, phosphoric acid, depleted uranium, a charcoal trap, and polonium-beryllium-fluorine compounds.

Shaft Group 2 (Shafts 1 – 55) is located between Pit 1 and Pit 3 and shafts were used for disposal from November 1959 through May 1967. Based on the information provided in the LASL logbooks 9593 and 11363, the shafts were used to dispose of materials containing: include barium-140, lanthanum-140, fission products from the Omega Reactor, uranyl phosphate, graphite slugs, a cobalt-60 capsule, radioactive graphite, radioactive tantalum, 1 gram (g) of irradiated plutonium, thallium, irradiated uranium graphite, lead-beryllium sources, thorium, cesium, strontium, plasma thermocouples, fuel elements (rods), cobalt-60 slugs and sources, sulfuric acid solution, zirconium carbide, a copper sphere, two "rabbit" tubes of beryllium, reactor seals, alpha emitters in solution, acid solutions, actinium components, various uranium isotopes, depleted uranium, cerium-141, yttrium, silver-110, sodium-22, cesium-137, cesium-144, plutonium waste, Oak Ridge alloy (enriched uranium), benzene, isopropyl alcohol, neptunium-237, contaminated materials and trash, americium-241, biological waste, classified material, radium-226, lead, silver, and "induced activity" (activation products, usually from a linear accelerator).

Shaft Group 3 (Shafts 68-107) is located west of Pits 1 through 4 and shafts were used for disposal from October 1962 through April 1974. Based on the information provided in the LASL logbooks 11363 and 12442, the shafts were used to dispose of materials containing: plutonium-contaminated trash, fission products, aluminum sheets and tubes, acids, cesium-137, sodium, cobalt-60, antimony, lanthanum-140, cobalt-60 sources, polonium, beryllium, vacuum pump oil, empty glass bottles, graphite, plutonium, boron, fuel element end caps, thermocouples, acetone, uranium, zirconium carbide, zinc and aluminum residues, barium, irradiated tantalum, tuballoy (a uranium alloy), shell waste, yttrium-91, radioactive chemicals and organic solutions, hydrochloric acid waste, plutonium in ether solution, zinc and mercury solutions, depleted uranium chips, miscellaneous sources, Oak Ridge alloy solution, iridium-192, tantalum, indium-114, animal tissues, solvents, a Los Alamos Molten Plutonium Reactor Experiment rod assembly, waste oil, detonator components, Navy reactor experiment reactor parts, trinitrotoluene element samples, americium-242, aluminium-105, zinc-65, neptunium-237, contaminated materials and trash, americium-241, classified material, actinium-227, radium-226, lead, silver, strontium-90 and "induced activity".

The **Strontium Disposal Shaft** is located a few feet from the South corner of the MDA C fence. The shaft is 25 feet deep and was used to dispose of a strontium-90 source sometime in the 1950s or 1960s.

HISTORY OF INVESTIGATIONS

DOE conducted RCRA Facility Investigations (RFI) from 1993 to 2004. During these investigations, the following contaminants were discovered above background values:

- Lead, silver, tetrachloroethene (PCE), americium-241, plutonium-238, plutonium-239, thorium-232, and uranium-238 (surface soil samples)
- Aluminum, antimony, arsenic, barium, beryllium, calcium, chromium, cobalt, copper, lead, magnesium, nickel, selenium, and thallium; acetone, bis(2-ethylhexyl) phthalate, 1,1-dichloroethene, methylene chloride, 2-methylphenol, toluene, americium-241, cesium-134, cesium-137, cobalt-60, europium-152, plutonium-238, plutonium-239, sodium-22, strontium-90, tritium, uranium-235, and uranium-238 (boreholes)
- TCE, PCE (pore gas)
- Tritium (shallow vapor probes)

DOE conducted field investigations under the 2005 CO in phases: Phase I (2004 – 2007), Phase II (2008 – 2009), and Phase III (2010 – 2011).

Phase I included radiological and geophysical surveys to supplement the surface samples from the Phase I RCRA Facility Investigation (RFI). During this investigation, 33 new boreholes were drilled and sampled with the existing boreholes. Results of the Phase I investigation show vapor-phase concentrations of TCE, chloroform, tritium, dichlorodifluoromethane, and PCE above background values, with TCE and PCE in very high concentrations. Uranium isotopes were also detected above background values in core samples.

The administrative history during the Phase I RFI includes an Investigation Report (IR) for MDA C submitted by DOE on December 6, 2006 (IR 2006)[5]. On February 19, 2007, NMED issued a Notice of Disapproval (NOD 2007) [6] on the IR and subsequently issued a Direction to Modify the Investigation Report (DTM IR 2007) [7] which required a Phase II Investigation Work Plan (IWP) to be submitted to fulfill the requirements of 2005 CO prior to resubmission of the IR.

Phase II objectives were to:

(1) define the nature and extent of the target analyte list metals at the surface of MDA C and,

(2) characterize subsurface pore-gas concentrations of volatile organic compounds

[5] Los Alamos National Laboratory, December 6, 2006. "Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009," Los Alamos National Laboratory document LA-UR-06-8096, Los Alamos, New Mexico, (Phase I IR 2006).

[6] State of New Mexico Environment Department, February 19, 2007. "Notice of Disapproval (NOD) for Material Disposal Area (MDA) C, Solid Waste Management Unit 50-009, at Technical Area 50", New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NOD 2007)

[7] State of New Mexico Environment Department, April 4, 2007. "Direction to Modify the Investigation Report for Material Disposal Area (MDA) C, Solid Waste Management Unit 50-009, at Technical Area 50", New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (DTM IR 2007)

(VOCs) and tritium. Five new boreholes were installed, eight boreholes were extended, and seven new deep boreholes were installed near existing shallow boreholes. Surface and near-surface sampling showed results of six metals detected above background values.

On April 23, 2007, DOE submitted the Phase II Investigation Work Plan for MDA C (Phase II IWP 2007)[8]. NMED issued a NOD for the Phase II IWP (NOD Phase II IWP 2007)[9]. In response to the NOD, DOE submitted a revised Phase II IWP on July 31, 2007 (Phase II IWP Rev. 1 2007)[10]. NMED issued an Approval with Modification (AWM Phase II IWP Rev.1)[11]

VOCs were detected with results similar to the 2007 Phase I investigation. Concentrations decreased with depth and decreased with distance from the disposal sites. TCE and PCE were detected at concentrations that pose a risk to groundwater contamination. Results show tritium concentrations decreasing with depth and decreasing with distance from the disposal areas.

After completing the field work requirements of the approved Phase II IWP, DOE submitted the Phase II IR on May 7, 2009 (Phase II IR 2009)[12]. After reviewing the Phase II IR, NMED issued an NOD on August 31, 2009 (NOD Phase II IR)[13] and, in response to the revised document (Phase II IR Rev. 1)[14] and NOD response, NMED issued another NOD (2nd NOD Phase II IR)[15] on October 15, 2009.

Phase III was implemented to define the vertical extent of VOCs in pore gas, evaluate concentrations of metals in the Tschicoma dacite, and determine whether contaminants had migrated to groundwater. DOE responded to the second NOD for the Phase II IR and submitted a Phase III Investigation Work Plan for MDA C (Phase III IWP 2010)[16] on February 5, 2010.

[8] Los Alamos National Laboratory, April 23, 2007. "Phase II Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-07-2581, Los Alamos, New Mexico (Phase II IWP 2007).
[9] State of New Mexico Environment Department, June 25, 2007. "Notice of Disapproval for the Phase II Investigation Work Plan for Material Disposal Area (MDA) C, Solid Waste Management Unit 50-009, at Technical Area 50," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NOD Phase II IWP 2007)
[10] Los Alamos National Laboratory, July 31, 2007. "Phase II Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," Los Alamos National Laboratory document LA-UR-07-5083, Los Alamos, New Mexico (Phase II IWP Rev. 1 2007)
[11] State of New Mexico Environment Department, August 13, 2007. "Approval with Modifications for the Phase II Investigation Work Plan for Material Disposal Area (MDA) C, Solid Waste Management Unit 50-009, at Technical Area 50," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (AWM Phase II IWP Rev.1).
[12] Los Alamos National Laboratory, May 7, 2009. "Phase II Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-09-2842, Los Alamos, New Mexico (Phase II IR 2009).
[13] State of New Mexico Environment Department, August 31, 2009. "Notice of Disapproval Phase II Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico (NOD Phase II IR).
[14] Los Alamos National Laboratory, October 1, 2009. "Phase II Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," Los Alamos National Laboratory document LA-UR-09-6266, Los Alamos, New Mexico (Phase II IR, Rev. 1)
[15] State of New Mexico Environment Department, October 15, 2009. "Second Notice of Disapproval, Phase II Investigation Report for Material Disposal Area C, Solic Waste Management Unit 50-009, at Technical Area 50," New Mexico Environment Department letter to D. Gregory (DOE-LASO) and D. McInroy (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (2nd NOD Phase II IR).
[16] Los Alamos National Laboratory, February 05, 2010. "Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-10-0613, Los Alamos, New Mexico (Phase III IWP 2010).

NMED responded with an NOD (NOD Phase III IWP)[17], and after incorporation of the NOD comments into a revised document (Phase III IWP Rev.1)[18], NMED issued an Approval with Modifications for the Phase III IWP on May 11, 2010 (AWM Phase III IWP Rev.1)[19]. Subsequently, DOE submitted the Phase III IR on July 15, 2011 (Phase III IR 2011)[20], and NMED approved it in a letter dated December 8, 2011 (Approval Phase III IR)[21].

As part of the Phase III IWP activities, four new boreholes were advanced into the top of the Tschicoma dacite. Sampling results did not confirm metals in the Tschicoma dacite. Results of pore-gas sampling showed similar results to previous investigations, and data from the new boreholes successfully defined nature and extent of the VOC plume. Groundwater sampling results indicated that vapor-phase migration of VOCs and tritium has not contaminated the regional aquifer.

The VOC plume is located directly beneath MDA C. The highest concentration of VOCs is beneath the eastern area of MDA C beneath pits 1, 2, 3, 4, and 5. At depth, the highest concentrations are located in the Qbt 1vu, Qbt 1vc, Qbt 1g, and Qct members of the Bandelier Tuff, approximately 100 – 200 feet bgs. Pore-gas sampling data from 2019 shows very similar results to data from 2011, suggesting that there have not been additional significant releases of contaminants. TCE, PCE, and chloroform have been detected nearby at TA-63 (TA-63 Soil Vapor 2023)[22]. Monitoring results show that VOCs are present in the Tschicoma dacite, but below concentrations that threaten groundwater.

Under the 2005 CO, DOE submitted a CME for MDA C (CME 2012)[23] on September 28, 2012. NMED did not review the 2012 CME. Meanwhile, NMED and DOE negotiated revisions to the 2005 CO, which resulted in the 2016 CO being signed and finalized in June 2016. Since June 2016, the cleanup of legacy waste has been conducted, in accordance with Section VIII of the 2016 CO, under a Campaign Approach, and the schedule for cleanup is decided every year through an Annual Planning Process described in Section VIII.C of the 2016 CO. DOE submitted the revised CME on June 30, 2021 (CME 2021) in accordance with Fiscal Year 2021 Appendix B of the 2016 CO.

[17] State of New Mexico Environment Department, March 29, 2010. "Notice of Disapproval Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," New Mexico Environment Department letter to G. Rael (DOE-LASO) and M. Graham (LANS) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NOD Phase III IWP).
[18] Los Alamos National Laboratory, April 28, 2010. "Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," Los Alamos National Laboratory document LA-UR-10-2468, Los Alamos, New Mexico (Phase III IWP Rev.1)
[19] State of New Mexico Environment Department, May 11, 2010. "Approval with Modifications Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," New Mexico Environment Department letter to G. Rael (DOE-LASO) and M. Graham (LANS) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (AWM Phase III IWP Rev.1).
[20] Los Alamos National Laboratory, July 15, 2011. "Phase III Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-11-3429, Los Alamos, New Mexico, (Phase III IR 2011).
[21] State of New Mexico Environment Department, December 8, 2011. "Approval Phase III Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," New Mexico Environment Department letter to G. Rael (DOE-LASO) and M. Graham (LANS) from J. Kieling (NMED-HWB), Santa Fe, New Mexico. (Approval Phase III IR).
[22] Los Alamos National Laboratory, March 27, 2023. "Technical Area 63 Transuranic Waste Facility Soil Vapor Monitoring System Report, January 2023 (Quarter 22)," Los Alamos National Laboratory Document LA-UR-23-22949, Los Alamos, New Mexico (TA-63 Soil Vapor 2023)
[23] Los Alamos National Laboratory, September 28, 2012. "Corrective Measures Evaluation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory Document LA-UR-12-24944, Los Alamos, New Mexico, (CME 2012)

CORRECTIVE MEASURE ALTERNATIVES

In the 2021 CME (CME 2021), the DOE has identified five Corrective Measures Alternatives. The alternatives were evaluated with the threshold criteria: (a) be protective of human health and the environment, (b) attain media cleanup objectives, (c) control the source(s) of releases, and (d) comply with applicable standards for the management of wastes. In the 2021 CME (CME 2021), DOE set forth the following corrective measures alternatives:

- Alternative 1 – no action
- Alternative 2 – soil barrier, natural attenuation, and institutional controls
- Alternative 3A – multilayer cover, passive and/or/active SVE, and institutional controls
- Alternative 3B – ET cover, passive and/or/active SVE, and institutional controls
- Alternative 4 – excavation, plume monitoring, and institutional controls

Alternative 1 – No Action: Under Alternative 1, no action would be taken. Institutional controls would not be maintained, vapor and groundwater would not be monitored, and no maintenance of the surface soil would be performed. This alternative does not meet the following threshold criteria: (a) be protective of human health and the environment, (b) attain media cleanup objectives, and (c) control the source(s) of release. DOE stated that Alternative 1 meets only this threshold criteria: (d) comply with applicable standards for management of wastes because no waste will be generated.

Alternative 2 – Soil Barrier, Natural Attenuation, and Institutional Controls:

Under Alternative 2, the existing soil cover would be graded, 4 inches of topsoil would be added, and the site would be revegetated. The site would be inspected and maintained, including repair of damage from animal burrows and removal of deep-rooted vegetation. Institutional controls would be implemented to control access to the site. Vapor and groundwater would be monitored to observe natural attenuation of the VOC plume and to investigate whether groundwater contamination from vapor migration is occurring. If monitoring indicates groundwater contamination or vertical migration of VOC vapors at a concentration exceeding action level, additional corrective actions would be implemented.

In the 2021 CME (CME 2021), Institutional Controls and monitoring of vapor and groundwater were assumed to occur for 100 years, and DOE would request a certificate of completion with controls from NMED.

DOE stated that Alternative 2 would meet the following threshold criteria: (a) be protective of human health and the environment, (c) control the source(s) of release, and (d) comply with applicable standards for the management of wastes because no waste will be generated in this alternative. DOE further asserted that Alternative 2 also would meet the following threshold criteria: (b) to attain media cleanup objectives as long as contaminant releases from the site do not exceed media cleanup standards for soil or groundwater.

Alternative 3A – Multilayer Cover, Passive and/or Active SVE, and Institutional Controls:

Under this Alternative 3A, a multilayer standard RCRA subtitle C cover would be installed over MDA C. The cover would consist of:

- Site preparation of the existing soil surface, including 4 feet of existing operational cover above the waste material;
- Construction of a concrete retaining wall;
- A 2-foot layer of compacted natural or amended soil with a maximum saturated hydraulic conductivity of $1x10^{-7}$ cm/s;
- A 40-mil flexible geomembrane liner to limit downward moisture movement (DOE notes that the geomembrane will not maintain its integrity for the performance period required for closure of MDA C);
- A 2-foot soil and vegetation layer graded at slopes between 3% and 5%;

DOE noted that the drainage layer would be included in the generic prescriptive cover for RCRA Subtitle C covers. The drainage layer could act as a cap where in-situ below-ground moisture collects and then percolate downward through the contaminants in semiarid climate where potential evapotranspiration (PET) exceeds precipitation for every month of the year.

Approximately 12,600 cubic yards of rock, 25,000 cubic yards of soil, 19,000 cubic yards of sand, and 38,000 cubic yards of clay would be required to install the cover as well as 11.8 acres of geomembrane.

Passive soil-vapor extraction (SVE) would consist of retrofitting 22 existing open boreholes to a passive SVE system. Retrofit activities will include:

- Extending the wellheads for at current SVE boreholes to extend above the height of the planned cover,
- Armoring wellbore extensions to minimize the risk of destroying the wells during installation of the cover,
- Add one-way check valves and rain/bio shield to the tops of the boreholes,
- Install solar-powered flow meters and data loggers in each borehole,
- Install sampling ports that will connect dataloggers to the LumaSense photoacoustic multi-gas monitor.

An active SVE system would be designed based on data and experience from active SVE operations at MDA L. In this proposed alternative, the SVE would only be activated if increases in source concentrations show significant leakage. Trigger mechanisms to start and stop active SVE would be discussed in meetings with NMED, EM-LA, and N3B. Active SVE boreholes would be installed at an angle extending underneath MDA C to a depth of approximately 100 feet bgs. Boreholes would be cased to total depth for stability. The active SVE system would utilize a single skid-mounted SVE unit which would be cycled between the extraction boreholes during active SVE operation. The SVE unity would utilize a 15-horsepower (hp) blower motor capable of providing 320 standard cubic feet per minute (scfm) at a vacuum of 120 inches of water. Measured concentrations and flow rates of the off-gas would be used to determine the need for treatment.

DOE states that institutional and engineering controls would be implemented at MDA C under this proposed alternative to limit the potential for future exposure to buried waste and potentially contaminated surface and subsurface soil. Controls would be assumed to remain in place for 100 years. Groundwater monitoring, active and passive SVE would be performed, and systems will be maintained for 100 years. A restrictive covenant would be placed on the deed and recorded locally and in the EPA institutional controls database.

DOE also asserted that Alternative 3A meets the following threshold criteria: (a) be protective of human health and the environment, (b) attain media cleanup objectives, (c) control the source(s) of releases, and (d) comply with applicable standards for the management of waste.

Alternative 3B – ET Cover, Passive and/or Active SVE, and Institutional Controls

Under Alternative 3B, an evapotranspiration (ET) cover would be installed over MDA C. A concrete retaining wall would not be required for an ET cover. The existing interim soil cover would serve as the final cover system with the addition of a surface admixture layer to resist erosion, burrowing animals, and deep penetration vegetation. Construction activities would include:

- Site preparation (regrading, clearing, and grubbing) of the existing soil surface, which would include a minimum of 4 feet of existing operational cover above the waste material, and
- Mixing approximately 12,500 cubic yards of 2.5-inch D50 durable rock into the top 2 feet of the existing interim cover to attain a uniform 1-to-2 mixture of rock to soil by volume.

As with Alternative 3A, controls would be assumed to be in place for 100 years including site maintenance, groundwater monitoring, passive SVE, and active SVE. Passive and Active SVE would be operated as described in Alternative 3A. A restrictive covenant would be placed on the deed and recorded locally and in the EPA institutional controls database.

According to DOE, the ET cover excels in semiarid site conditions by evaporating and transpiring water from the cover; the admixture of rock and soil in the surface of the cover along with the design of the cover should mitigate the formation of rills and gullies; and it would also minimize soil loss due to erosion.

DOE stated that Alternative 3B would meet the following threshold criteria: (a) be protective of human health and the environment, (b) attain media cleanup objectives, (c) control the source(s) of releases, and (d) comply with applicable standards for the management of waste.

Alternative 4 – Excavation, Plume Monitoring, and Institutional Controls

Under Alternative 4, the shafts and pits of MDA C would be excavated. The excavated waste materials would be characterized and properly disposed of to current regulations. Excavation of the pits and shafts would be accomplished using standard excavation methods. The excavation would be performed within mobile enclosures to control releases and to provide weather protection for excavation. Excavation may occur similar to excavation activities at MDA B near TA-21 (LANL 2013). After the excavation is completed, confirmation samples of the Bandelier

Tuff would be collected to ensure all contaminated material has been removed from the excavations.

Gas cylinders containing corrosive liquids were discovered during the excavation of MDA B, and it is expected that the wastes excavated from MDA C will include similar cylinders. The liquids would need to be treated on-site using elementary neutralization before the waste is shipped off-site. All waste from the pits and shafts that are assumed to be classified as mixed low-level waste (MLLW) would be transported to Energy Solutions, in Clive, Utah for disposal. Some waste may be classified as newly generated trans-uranic (TRU) waste. Generated TRU waste was not included in the original permit of the Waste Isolation Pilot Plant (WIPP) facility, and a permit modification may be required for the disposal of this waste at WIPP.

Activities for excavation of the pits and shafts are:

- Construct relocatable excavation enclosures with supplied air and high-efficiency particulate air filters to control releases and provide weather protection,
- Waste removal activities using standard excavation techniques,
    - Digging up waste will likely destroy some monitoring boreholes,
- Analysis and segregation of the waste for off-site shipment and disposal based on the waste acceptance criteria of the receiving facility,
- Treatment of corrosive liquids by elementary neutralization,
- Collection and analysis of confirmation samples from the excavation sidewalls and floor,
- Replacement within the original excavation of any environmental media meeting industrial soil screening levels (SSLs) and then backfilling to grade with erosion controls,
- Off-site shipment and disposal of wastes that do not meet industrial SSLs.

The DOE estimated that approximately 412,000 cubic yards of MLLW would be generated and require off-site disposal.

Pore gas monitoring of the VOC plume will continue after excavation and backfill activities have been completed. Due to excavation activities, it was estimated that up to seven monitoring boreholes may have to be replaced. Institutional and engineering controls would be implemented to restrict access to MDA C during site activities. After waste removal and site restoration activities are complete, the site would be restricted to industrial land use. A restrictive covenant would be placed on the deed and recorded locally and in the EPA institutional controls database.

DOE asserted that Alternative 4 would meet the following threshold criteria: (a) be protective of human health and the environment, (b) attain media cleanup objectives, (c) control the source(s) of releases, and (d) comply with applicable standards for the management of waste.

CORRECTIVE MEASURES RECOMMENDED BY THE DOE

The DOE recommended Alternative 3B, i.e., ET cover, SVE, and institutional controls, as the preferred corrective measure.

In terms of technical feasibility and reliability, the DOE predicted that the ET cover will effectively

prevent releases of solid and liquid wastes (excluding VOCs and tritium) to the environment from waste disposed of in the pits and shafts. DOE also noted that there is potential for continued release of VOC from the vadose zone that can migrate downwards and diffuse into the groundwater (CME 2021). DOE stated that the ET cover will function over the 1000-year evaluation period even with a loss of institutional controls (CME 2021). Another noted benefit is that the ET cover would be relatively easy to install and would not require direct worker exposure to buried wastes. DOE expected this alternative to achieve performance standards in the vadose zone immediately based on the use of annual grasses to provide ET in the first growing season. An additional two years would be needed to fully establish the vegetative cover with perennial grasses and plants as successors to the annual grasses.

If properly maintained, engineered ET covers have been demonstrated to be reliable to minimize downward water movement at the Los Alamos airport landfill at TA-73, which has similar mesa top and weathering conditions to MDA C (Dwyer 2001)[24]. In order to ensure the continued performance of an ET cover, the DOE proposed conducting regular maintenance and monitoring throughout the 100-year institutional cover period once the vegetative cover has been established. This alternative does not prevent future releases of tritium and VOCs to the subsurface from the pits and shafts at MDA C.

Implementation and operation of the four containment alternatives pose minimal safety risks to nearby communities, according to DOE. The hazards faced by workers from Alternatives 1, 2, 3A, and 3B primarily include industrial accidents. The Permittee's experience during the construction and monitoring of covers at TA-49 and TA-54 indicates that workers are adequately protected by adhering to health and safety practices required by the Occupational Safety and Health Administration (OSHA), and DOE orders. Off-site air emissions shall not exceed regulatory levels. DOE states that the depleted uranium will be converted to a stable oxide form over a period of approximately 100 to 200 years (CME 2021).

DOE stated that the hazards faced by workers and the community from implementing Alternative 4 include industrial accidents, transportation accidents, exposure to hazardous materials, potential fires and explosions during excavation and removal that could result in releases of hazardous and radioactive materials. Engineering controls to reduce the potential fires and explosions would increase the difficulty and time necessary for completing Alternative 4.

Based on the risk assessment results, the DOE concluded that leaving wastes in the pits and shafts at MDA C would pose no unacceptable risk or dose to human health over the 100-year institutional control period for workers and the 1000-year evaluation period for future residents and recreation receptors, using barriers that restricts access for human and ecological receptors. According to DOE, Alternatives 2, 3A, and 3B offer improvements in the protection of human health that would further reduce the estimated risk and dose, which would be below all applicable federal and state criteria, standards, or regulations for the protection of human health.

DOE's ecological screening assessment indicated that there is no unacceptable long-term ecological risk with the implementation of any one of the containment alternatives. The

[24] Dwyer, S.F., January 2001. "Finding a Better Cover," *Civil Engineering*, Vol. 71, No. 1, pp. 58-63. (Dwyer, 2001)

implementation of Alternatives 2, 3A, and 3B would involve short-term disturbances to the surface soil, plants, and animals within and around MDA C. DOE expected the activities associated with implementing these alternatives to last between 6 to 12 months, plus an additional two years to fully establish the vegetative cover. Implementation of Alternatives 2, 3A, and 3B would cause minimal damage to the biological resources in and around MDA C and have no effect on cultural resources, according to DOE.

Alternative 4 would provide the same or greater level of protection for human health as the containment alternatives. DOE states that Alternative 4 would result in the maximum potential exposure to workers and the public during waste excavation, sorting, declassification, and transport activities. Alternative 4 would also result in the maximum reduction in potential exposure to the community after the completion of the implementing activities.

The implementation of Alternative 4 would involve disturbing the approximately 12 acres of soil and impacting plants and animals within and around MDA C. The activities associated with Alternative 4 were expected to last approximately 3 years, plus an additional 2 years are estimated to fully establish the vegetative cover. The DOE does not expect long-term impacts on the plant and animal species and surrounding MDA C. Cultural resources in the area potentially may be impacted by any fire or explosions that accidentally occur during excavation and by construction of an overburden storage area. The DOE's environmental impact assessment concludes that no cumulative effects on air quality, waste management, or other aspects of the environment would occur for any of the alternatives.

DOE's 2021 cost estimates for each alternative are as follows. $0 for Alternative 1; $16,000,000 for Alternative 2, $39,336,000 for Alternative 3A; $12,105,000 for Alternative 3B; and $805,260,000 for Alternative 4. Alternative 4 is the most thorough and expensive cleanup measure.

CORRECTIVE MEASURES SELECTED BY NMED

For maximum protection of public and environmental health and safety, and to ensure that the drinking water resource can be conservatively protected, NMED has determined that Alternative 4 (Excavation, Plume Monitoring, and Institutional Controls), along with a passive and active soil-vapor extraction system at MDA C to remove the waste and eliminate the VOC contaminate source detected in soil pore gas, is the most appropriate cleanup measure. Based on vapor-gas sampling data, VOCs are present in the Tschicoma Dacite at depths of approximately 600 feet bgs, though not at concentrations that can result in exceedances of the maximum contaminant level (MCL) when soil gas is in contact with groundwater. Alternative 4 is the most conservative option and provides the maximum protection of the human health and the environment.

SVE, as part of the corrective measures selected by NMED, will mitigate and control vadose zone vapor phase contamination at MDA C. The SVE system will be installed and activated after excavation and backfill activities are completed. SVE is a proven technology to accelerate the removal of subsurface gases or vapors by applying a vacuum. The vacuum may be applied to one or more wells. This technology commonly requires a treatment system for the vapor that is extracted from the subsurface, unless the DOE can demonstrate that air emissions will comply with Clean Air Act emission limits. Installation of an SVE system will require the installation of

vapor monitoring extraction wells in the vicinity of MDA C and possibly extending the depth of existing boreholes to the Otowi member of the Bandelier Tuff.

Excavation of waste in the shafts pursuant to Alternative 4 will guarantee that waste disposed of at MDA C will present no further risk at the site and there will be no operation and maintenance requirements at MDA C, except for any necessary remediation of contaminated media. Cleanup under Alternative 4 will be more reliable than Alternatives 1, 2, 3A, and 3B because long-term maintenance under the other alternatives cannot be assured after the 100-year institutional control period. Similarly, implementation of Alternatives 1, 2, 3A and 3B are likely to require additional corrective measures following the 100-year institutional control period. In contrast, DOE estimated that Alternative 4 would not need long-term maintenance or future corrective measures after completion in 3 years.

Based on the concentrations observed in the subsurface at MDA C, TCE and PCE have the potential to partition to groundwater from the soil vapor-phase contamination at concentrations greater than the MCL. However, due to releases of VOCs from the pits and shafts to the subsurface, the DOE cannot ensure that the vapor-phase contaminants concentrations will remain below the criteria established using Henry's law. More specifically, the DOE has not sampled soil gas at depths greater than approximately 600 feet below ground surface. In addition, the groundwater monitoring wells installed by the Respondents in the vicinity of MDA C (including R-60, R-46, and R-14) cannot provide reliable data to evaluate whether VOCs released from TA-54 have reached the regional aquifer (CMS for MDA H 2005)[25]. The soil pore gas monitoring at MDA C is the only method available to provide evidence to assure that vapor-phase VOCs released from MDA C have not reached the regional aquifer (CMS for MDA H 2005).

NMED acknowledges that Alternative 3B (ET cover, passive and/or active SVE, institution controls), recommended by the DOE, would be effective in reducing or limiting the amount of water that percolates into the pits and shafts under design conditions. The ET cover, Alternative 3B, requires the vigilant maintenance and involves more variables that undermine the long-term reliability. If properly maintained, the ET cover may reduce surface erosion, and therefore could effectively prevent direct exposure of the waste and minimize surface transport of contaminants in the future. However, NMED's assessment indicates that the ET cover can only partially prevent bio-intrusion of deep-rooting plants and burrowing animals. In addition, Alternative 3B does not address the current and future releases of VOCs and tritium to the subsurface at MDA C given the uncertainty associated with inventory of waste disposed at MDA C over the years.

Moreover, NMED questions the long-term reliability of an ET cover in preventing the intrusion of deep-rooting plants and burrowing animals over the lifetime of the ET cover. According to the conceptual design of the ET cover for MDA C, the total depth of the cover is approximately 4 feet over the existing surface layer and waste, with a 2.5-inch diameter D50 durable rock mixed into the top two feet of the cover. Based on DOE's findings at MDA H (CMS for MDA H 2005), the site-specific deep-rooting plants can extend roots to depths as deep as 23 feet (7 meters (m)), and local burrowing animals can excavate to depths up to 10 feet (3 meters(m))

[25] Los Alamos National Laboratory, June 2005. "Corrective Measures Study Report for Material Disposal Area H, Solid Waste Management Unit 54-004, at Technical Area 54, Revision 1," Los Alamos National Laboratory document LA-UR-05-0203, Los Alamos, New Mexico. (CMS for MDA H 2005).

deep. The ET cover does not have the capability to prevent potential bio-intrusion to the pits and shafts from surrounding areas. The potential for bio-intrusion to the shafts from the surrounding areas poses the risk of not only the transport of waste to the surface but also the risk of creating conduits that can channel water through the shafts. Therefore, it is possible that decayed root systems and animal burrows could result in unexpected increases in infiltration and percolation through the shafts.

Recent monitoring data show that TCE, a carcinogen, has been detected in the subsurface pore gas at concentrations reaching up to 75,000 µg/m^3, which is a high enough concentration to partition into groundwater and theoretically results in an aqueous concentration greater than the drinking water MCL of 5 µg per liter (CME 2021). The DOE has proposed to evaluate the partitioning of vapor-phase compounds using Henry's law, as defined by the following equation:

$$\boldsymbol{C_{air} = C_{water}\, x\, H'} \qquad (1)$$

In Equation 1, C_{water} is a volumetric concentration of the contaminant in water that results from the partitioning of vapor-phase VOCs in soil pore gas. C_{air} is the volumetric concentration of the contaminant in air (or soil vapor). H' is the dimensionless Henry's law constant for the specific VOC.

This is a very conservative approach to evaluate the potential for contamination of groundwater by VOCs in soil pore gas. This approach assumes the worst-case scenario under which VOCs in soil pore gas would be constantly available for partitioning to groundwater. Criteria established for the vapor-phase VOC concentrations using this approach will therefore guarantee the safety of any portion of groundwater without the need to depend on natural attenuation processes, such as diffusion and dilution, to mitigate the potential impact. Based on this approach, vapor-phase concentrations of the VOCs that are the primary contaminants of concern at MDA C that could result in concentrations in groundwater at their respective MCLs.

The potential impact of implementing SVE on human health and the environment is comparable to the other hazards associated with implementing Alternative 4. The cost for installation and operation of the SVE and soil-gas venting will be very low compared to the other costs associated with Alternative 4. The DOE will be required to evaluate the feasibility of SVE in detail based on the contaminant characteristics and subsurface conditions at MDA C. In addition, the DOE will be required to evaluate the current wells located in the vicinity of MDA C and address all deficiencies in the groundwater monitoring network at MDA C. Upon selection of a final remedy, NMED will require the DOE to submit a Corrective Measures Implementation Plan for remediation of MDA C, for approval.

NMED did not select Alternatives 1, 2, 3A, or 3B because the implementation of Alternative 4 is the most conservative option for remediation of MDA C. It removes the source of contamination and eliminates the need for long-term monitoring and maintenance of the cover. Alternative 4 provides the most protection of human health and the environment. It does not pose a significant risk to workers and the community. Waste inventories do not include high explosives or pyrophoric materials that elevate the risk of combustion. The risk of continued or renewed

releases from MDA C poses a greater threat to environmental contamination than the risk to workers and the affected community during a controlled excavation of the wastes. Additionally, NMED cites the success of the soil remediation, which included the excavation of soil containing detonable pieces of high explosives, at Material Disposal Area P (MDA P Closure Certification 2005)[26]. Site preparations for the remediation activities included the mobilization of equipment for excavation, decontamination, safety, and communications. DOE prepared a site-specific health and safety plan that indicated the need for remote excavation to avoid placing personnel in direct contact with potential explosive hazards. A computer-controlled, remotely-operated 25 metric ton, hydraulic excavator was deployed to the site to perform all initial excavation operations. Excavation operations were monitored by an explosive specialist accompanying the robotics operator by observing operations on a video monitor in the control trailer. Excavation was suspended regularly to allow personnel to inspect the materials to ensure that hazardous explosive materials were not overlooked by the operator and to allow for additional inspections whenever suspicious items were observed. Remote excavation continued until the debris was removed and the barium concentrations were below the operational preliminary remediation goals. Then the excavation continued for the removal of contaminated soils using conventional methods. The successful implementation of the remote excavation techniques to ensure worker safety during the remediation of MDA P demonstrates the ability to adequately minimize the hazards faced by workers due to exposure to hazardous materials and the potential fires and explosions during excavation and removal.

NMED notes the presence of a variety of radiological wastes at MDA C. Although NMED does not regulate radiological waste, NMED notes that the radiological contamination will likely extend beyond the 1,000-year evaluation period for this CME. NMED also cites the successful excavation and off-site shipment of waste at MDA B (Remediation Report for MDA B 2013)[27]. MDA B, that was used as a disposal site prior to use of MDA C, was comprised of similar wastes buried in pits dug to approximately 25 feet. Excavation at MDA B was completed using a standard track-mounted hydraulic excavator to expose and remove trench contents for inspection, identification, and removal. Excavation within each area continued until field for radioactive contaminants indicated no detectable activity or until deeper excavation could not be performed because of safety and/or the practical limitations of slope layback requirements. After waste characterization and repackaging, confirmation samples were collected to define the lateral extent of residual contamination. A risk assessment was conducted using the results of the confirmation samples to confirm that residential SSLs were met. The success of excavation at MDA B demonstrate the viability of selecting Alternative 4 for the remediation of MDA C. Excavation and off-site disposal will ensure that there are no new sources of contamination to the subsurface at MDA C.

PUBLIC REVIEW OF THE ADMINISTRATIVE RECORD

The Administrative Record for this proposed action consists of a Statement of Basis, the Public Notice, the Consent Order, and supporting documentation. The Administrative Record may be

[26] Los Alamos National Laboratory, September 2, 2005. "Material Disposal Area P Site Closure Certification Report, Revision 1," Los Alamos National Laboratory document LA-UR-05-6536, Los Alamos, New Mexico, (MDA P Closure Certification 2005).
[27] Los Alamos National Laboratory, June 2013. "Investigation/Remediation Report for Material Disposal Area B, Solid Waste Management Unit 21-015, Revision 2," Los Alamos National Laboratory Document LA-UR-13-24556, Los Alamos, New Mexico, (Remediation Report for MDA B 2013).

reviewed, with prior appointment, at the following location during the public comment period.

NMED Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone: (505) 476-6000
Monday-Friday: 8:00 a.m. to 5:00 p.m.
Contact: Neelam Dhawan

The Public Notice, the Statement of Basis, and the Consent Order are also available on the NMED website at https://www.env.nm.gov/hazardous-waste/lanl/ under MDA C Remedy Selection. To obtain a copy of the Administrative Record or a portion thereof, please contact Ms. Neelam Dhawan at (505) 476-6000, or at the address given above. NMED will provide copies, or portions thereof, of the Administrative Record at a cost to the requestor.

NMED issued this public notice on **September 7, 2023,** to announce the beginning of a 60-day comment period that will end at **5:00 p.m. MST, November 6, 2023**. Any person who wishes to comment on this action, or request a public hearing should submit written or electronic mail (e-mail) comment(s) with the commenter's name and address to the address below. Only comments received on or before **5:00 p.m. MST, November 6, 2023** will be considered.

Neelam Dhawan, LANL Manager
Hazardous Waste Bureau- New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
(505) 476-6000
E-mail: Neelam.dhawan@env.nm.gov
Reference: LANL MDA C Remedy Selection (SWMU 50-009)

Written comments must be based on reasonably available information and include, to the extent practicable, all referenced factual materials. Documents in the administrative record need not be re-submitted if expressly referenced by the commenter. Requests for a public hearing shall provide: (1) a clear and concise factual statement the nature and scope of the interest of the person requesting the hearing; (2) the name and address of all persons whom the requestor represents; (3) a statement of any objections to this action, including specific references to any conditions being addressed; and (4) a statement of the issues which the commenter proposes to raise for consideration at the hearing. Written comments and requests for a public hearing must be filed with Ms. Neelam Dhawan on or before **5:00 p.m. MST, November 6, 2023**. NMED will provide a thirty (30) day notice of a public hearing, if scheduled.

Final Decision: NMED must ensure that the selected remedy is consistent with the Hazardous Waste Act, the Hazardous Waste Management Regulations, and the Consent Order. All written comments submitted on this matter will become part of the administrative record, be considered in formulating a final decision, and may result in a different remedy being selected. NMED will respond in writing to all written public comments received during the public comment period. This response will specify which provisions, if any, have been changed in the final decision and

the reasons for the changes; and briefly describe and respond to all public comments raised during the public comment period. All persons presenting written comments or who requested notification in writing will be notified of the decision by mail. These responses will also be posted on the NMED website.

After consideration of all the written public comments received, NMED will approve, disapprove, or approve the Remedy with modifications. In all cases, the Permittees will be provided by certified mail a written notice in accordance with the Consent Order. NMED will make the notice available to the public.

ARRANGEMENTS FOR PERSONS WITH DISABILITIES

Any person with a disability requiring assistance or auxiliary aid to participate in this process should contact Kate Cardenas, Non-Discrimination Coordinator, by phone at (505) 469-0732, or via email at nd.coordinator@env.nm.gov. Toll-free numbers are available for TDD or TDY users to access the New Mexico Relay Network at 1-800-659-1779 (voice); TTY users: 1-800-659-8331.

DISCRIMINATION

NMED does not discriminate on the basis of race, color, nation origin, disability, age or sex in the administration of its programs or activities, as required by applicable laws and regulations. NMED is responsible for coordination of compliance efforts and receipt of inquiries concerning non-discrimination requirements implemented by 40 C.F.R. Parts 5 and 7, including Title VI of the Civil Rights Act of 1964, as amended; Section 504 of the Rehabilitation Act of 1973; the Age Discrimination Act of 1975, Title IX of the Education Amendments of 1972, and Section 13 of the Federal Water Pollution Control Act Amendments of 1972. If you have any questions about the notice or any of NMED's non-discrimination programs, policies or procedures, or if you believe that you have been discriminated against with respect to a NMED program or activity, you may contact: Kate Cardenas, Non-Discrimination Coordinator, NMED, 1190 St. Francis Dr., Suite N4060, P.O. Box 5469, Santa Fe, NM 87502, (505) 469-0732, or via email at nd.coordinator@env.nm.gov. You may also visit our website at https://www.env.nm.gov/non-employee-discrimination-complaint-page/ to learn how and where to file a complaint of discrimination.

REFERENCES

Dwyer, S.F., January 2001. "Finding a Better Cover," *Civil Engineering*, Vol. 71, No. 1, pp. 58-63. (Dwyer, 2001).

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Los Alamos National Laboratory, September 2, 2005. "Material Disposal Area P Site Closure Certification Report, Revision 1," Los Alamos National Laboratory document LA-UR-05-6536, Los Alamos, New Mexico, (MDA P Closure Certification 2005).

Los Alamos National Laboratory, December 6, 2006. "Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009," Los Alamos National Laboratory document LA-UR-06-8096, Los Alamos, New Mexico, (Phase I IR 2006).

Los Alamos National Laboratory, April 23, 2007. "Phase II Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-07-2581, Los Alamos, New Mexico (Phase II IWP 2007).

Los Alamos National Laboratory, July 31, 2007. "Phase II Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," Los Alamos National Laboratory document LA-UR-07-5083, Los Alamos, New Mexico (Phase II IWP Rev. 1 2007).

Los Alamos National Laboratory, May 7, 2009. "Phase II Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-09-2842, Los Alamos, New Mexico (Phase II IR 2009).

Los Alamos National Laboratory, October 1, 2009. "Phase II Investigation Report for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50, Revision 1," Los Alamos National Laboratory document LA-UR-09-6266, Los Alamos, New Mexico (Phase II IR, Rev. 1)

Los Alamos National Laboratory, February 05, 2010. "Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50," Los Alamos National Laboratory document LA-UR-10-0613, Los Alamos, New Mexico (Phase III IWP 2010).

Los Alamos National Laboratory, April 28, 2010. "Phase III Investigation Work Plan for Material Disposal Area C, Solid Waste Management Unit 50-009, at Technical Area 50,

Revision 1," Los Alamos National Laboratory document LA-UR-10-2468, Los Alamos, New Mexico (Phase III IWP Rev.1)

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