NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6303
Phone (505) 476-6000 Fax (505) 476-6030
www.nmenv.state.nm.us

BILL RICHARDSON
Governor

DIANE DENISH
Lieutenant Governor

RON CURRY
Secretary

CINDY PADILLA
Deputy Secretary

FACT SHEET/STATEMENT OF BASIS
November 5, 2007

SELECTION OF A REMEDY FOR CORRECTIVE ACTION AT MATERIAL DISPOSAL AREA H, SWMU 54-004 AT TECHNICAL AREA 54 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) H, Solid Waste Management Unit (SWMU) 54-004 at Technical Area (TA) 54. The United States Department of Energy (DOE) and University of California conducted a Corrective Measures Study (CMS) to evaluate different alternatives for remediation of MDA H and submitted a Revised CMS Report submitted on June 30, 2005 (LANL 2005a). NMED approved the Revised CMS Report on October 31, 2007.

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

PERMITTEES: LANL is owned by DOE and co-operated by DOE and Los Alamos National Security, LLC (LANS) (collectively, the Permittees). The Permittees are located at the following address:

DOE/National Nuclear Security Administration (NNSA)
Los Alamos Site Office, 528 35th Street
Los Alamos, New Mexico 87544

Los Alamos National Laboratory
P.O. Box 1663, MS M992
Los Alamos, New Mexico 87545

Permittees' primary contact for this action is: Ms. Lorrie Bonds-Lopez, Los Alamos National Laboratory, P.O. Box 1663, MS J591, Los Alamos, New Mexico, 87544.

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 under 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, a RCRA Permit (Permit) was issued to the Permittees to operate a hazardous waste treatment and storage facility at LANL pursuant to the HWA § 74-4-4.2. On March 8, 1990 EPA issued to the Permittees the Hazardous and Solid Waste Amendments (HSWA) portion of the LANL Permit, effective on May 23, 1990, and revised it on May 19, 1994. Effective January 2, 1996 the NMED received from EPA final authorization to implement its corrective action program under HWA and its implementing regulations, HWMR. The HWMR require corrective action at sites where releases of hazardous waste have occurred. On January 15, 1999, the Permittees applied to the NMED to renew their RCRA Permit. Pursuant to 40 CFR 270.51 incorporated in 20.4.1.900 NMAC, the 1989 Permit remains in effect until a final decision is made on the renewal request.

MDA H consists of nine disposal shafts. Eight of nine disposal shafts at MDA H (Shafts 1-8) are listed in the HSWA Module of the LANL's Permit. One shaft (Shaft 9) received hazardous waste after July 26, 1982, and therefore MDA H is considered a hazardous waste management unit under RCRA. In 2000, NMED directed the Permittees to address all nine shafts under corrective action as per 20.4.1.500 NMAC (incorporating 40 CFR 264.101) (NMED 2000). All applicable closure and post-closure requirements for Shaft 9 contained in 40 CFR 264.90(f) and 40 CFR 264.110(c) and incorporated in 20.4.1.500 NMAC must also be satisfied by the selected corrective measure. Pursuant to Section VII.E.2 of the Order, after the selection of remedy, the Permittees shall submit a Corrective Action Implementation (CMI) Plan that must meet the general requirements for closure of MDA H. The CMI Plan shall include the specific design of the selected remedy(s) including construction specifications, operation and maintenance plans, performance monitoring for the selected remedy, and an implementation schedule. Within ninety days after the implementation of the CMI plan, the Permittees shall submit a Remedy Completion Report to NMED in accordance with Section VII.E.6.a of the Order. Following NMED approval of the Remedy Completion Report, the Permittees must submit a request for a modification of the Permit to implement post-closure care pursuant to Section III.W.1 of the Order and 40 CFR 270.42(c). The permit modification request must include a plan for conducting post-closure care at MDA H. MDA H contains both radioactive materials and hazardous waste or constituents. Although the management of radioactive waste is not regulated under the HWA, the Permittees have chosen to address radionuclides together with the hazardous waste under the CMS.

The Permittees conducted a RCRA Facility Investigation (RFI) for MDA H and submitted an RFI Report in May, 2001 (LANL 2001b) and an addendum to the RFI Report in October 2002 (LANL 2002). NMED approved both the documents on April 11, 2003 (NMED 2003). The CMS Report was submitted on May 30, 2003 (LANL 2003). After conducting the review of the CMS Report NMED issued a Notice of Disapproval (NOD) on October 20, 2004 (NMED 2004a). The Permittees submitted a revised CMS Report on June 30, 2005 (LANL 2005a). NMED directed the Permittees to conduct quarterly monitoring of subsurface vapor-phase contamination to collect additional data that would support selection of an appropriate remedy (NMED 2004b). The Permittees have been collecting subsurface samples, and submitting monitoring reports to NMED since 2005 (LANL 2005c, 2006a, 2006b, 2006c). NMED has prepared this statement of basis for remedy selection at MDA H pursuant to the Section VII.D.7 of the Order. NMED approved the Revised CMS Report on October 31, 2007.

FACILITY OPERATIONS

Los Alamos National Laboratory (LANL) is an approximately 40 square mile federal facility located adjacent to the town of Los Alamos, New Mexico. LANL is surrounded by the Pueblo of 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 mesa to the canyon bottoms. The majority of the buildings and technical areas (TAs) are located on the mesa tops. LANL has been in operation since the early 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 co-operated by the Los Alamos National Security, LLC (LANS). 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 1940's and continue to present day.

HISTORY AND SITE INVESTIGATIONS AT MDA H

MDA H is a 70-ft by 200-ft (0.32 acres) fenced area located at TA-54. TA-54 is located in the east-central portion of the Laboratory on Mesita del Buey with Pajarito Canyon to the south and Canada del Buey to the north. The MDA H consists of nine inactive disposal shafts; each shaft is cylindrical with a diameter of 6 ft and a depth of approximately 60 ft. From May 1960 until August 1986, MDA H received classified, solid-form waste generated by the Laboratory. The shafts contain various hazardous chemicals, radionuclide-contaminated materials, and materials contaminated by high explosives. Brief descriptions of the disposal activities were recorded in a log book. The waste inventory was compiled from information in the MDA H operation logbook that included information about the period of use and the date each shaft was capped (LANL, 2001a & b). The total mass of all waste is estimated to be approximately 391,299 lbs (LANL 2005a). The waste included metals (aluminum, barium, beryllium, cadmium, chromium, copper, lithium, steel, lead, mercury, silver and tungsten), high explosives, plutonium, tritium, uranium, graphite, paper, and plastic. The exact quantities and nature of the waste are not

known, but the available information identifies the type of potential hazardous and radionuclide waste disposed of at MDA H. The documented logbook information was supplemented by review of waste disposal records and process knowledge of current and former site operations (LANL, 2005a). The waste in Shafts 1-8 is covered with a three feet layer of concrete topped with a three feet layer of crushed tuff; and the waste in Shaft nine is covered with six feet of concrete.

The shallow surface soils at MDA H are underlain by approximately 250 feet of the Tshirege Member of the Bandelier Tuff. Approximately 10 feet of relatively porous rhyolitic sediments of the Cerro Toledo Interval are present directly beneath the Tshirege Member tuff. The Cerro Toledo Interval is underlain by the Otowi Member of the Bandelier Tuff. In general, the Guaje Pumice Bed, which the Permittees estimate as being approximately 20 feet thick in this area, separates the Bandelier Tuff from underlying basalts. Generally, the Cerros del Rio Basalt extends beneath the Guaje Pumice Bed to below the top of the regional aquifer, which is approximately 1,000 feet below the ground surface at MDA H.

A RCRA Facility Investigation (RFI) was conducted at MDA H in 1994 and 1995 to determine if any release of contaminants to the environment had occurred and to define the nature and extent of contamination, if present. Four boreholes were drilled around the nine shafts (3 boreholes were drilled to depths of 90 feet below ground surface (bgs) and one boring was advanced to the depth of approximately 260 feet bgs), and 33 tuff samples were collected from these boreholes. Samples were submitted to an off-site contract laboratory for analysis of inorganic and organic chemicals, poly chlorinated biphenyls (PCBs), pesticides, and radionuclides. Samples were also collected in the single drainage that carries surface runoff from MDA H into Pajarito Canyon.

Results of the RFI (LANL 2001) indicated that tritium, inorganic, and organic chemicals had been released to the subsurface. The Permittees conducted a human health risk assessment based on the results of RFI investigation, and concluded that there was no current unacceptable risk to human health based on a residential exposure scenario. For noncarcinogenic chemicals, the detected concentrations did not exceed 1/10 of NMED's soil screening action levels (SALs) based on a residential land use scenario. Detected concentrations of carcinogenic chemicals did not exceed their respective SALs and had a total incremental cancer risk of approximately 1×10^{-7} (below NMED's target excess cancer risk of 1×10^{-5}). Tritium was the only radionuclide detected in the samples collected from the boreholes drilled around MDA H. Tritium concentrations exceeded LANL's SAL; however, the detected concentrations were at depths that are not accessible to current receptors. The Permittees conducted an ecological risk assessment based on the results of the RFI and concluded that there is no current potential for adverse impacts to ecological receptors at MDA H.

NMED reviewed the RFI Report and concluded that the extent of contamination for tritium and organic chemicals had not been adequately defined. NMED directed the Permittees to collect additional subsurface samples, and analyze them for tritium and volatile organic compounds (VOCs) to further characterize releases from the disposal shafts. NMED also directed Permittees to install an ambient air monitoring station adjacent to MDA H to collect biweekly ambient air

samples, analyze them for tritium for a year, and collect an additional sediment sample in the drainage channel located in Pajarito Canyon south of MDA H. The Permittees drilled two additional borings, adjacent to MDA H on the northwest and east perimeters, and collected additional subsurface data as directed by NMED. They reported the results in an addendum to the RFI Report (LANL 2002).

The highest concentration of tritium detected in the ambient air at MDA H over a period of one year was 70.1 pCi/m^3, less than the NMED risk guidelines for both residential and industrial worker scenarios. Chemicals of potential concern were not detected in the sediment sample collected from the drainage channel in Pajarito Canyon indicating that contamination had not been transported off site by storm water run-off. VOCs were detected in the pore gas samples that were collected from various depths from the three boreholes drilled around MDA H, indicating that a contaminant release had occurred. No defined trends were evident from the data.

Since additional investigations conducted during the RFI indicated that there was a release of tritium and VOCs from the shafts at MDA H, NMED directed the Permittees to conduct quarterly subsurface vapor monitoring to characterize tritium and VOCs in subsurface vapor and to monitor subsurface moisture content (NMED 2004b). The Permittees have been conducting quarterly monitoring and submitting Periodic Monitoring Reports to NMED since (LANL 2005c, 2006a, 2006b, 2006c). Analytical results confirm the presence of VOCs and tritium in all vapor samples. The results do not indicate an increasing or decreasing trend over time and do not show increasing or decreasing trends with depth. However, the monitoring locations do not include the Cerro Toledo Interval or the underlying Otowi Member of the Bandelier Tuff. Reliable groundwater data has not been collected from the regional aquifer in the vicinity of MDA H. NMED has therefore directed the Permittees to evaluate the current monitoring well network at TA-54. The Permittees must replace or rehabilitate monitoring wells or selected well screens in existing wells, and evaluate the need for additional monitoring wells around TA-54.

The NMED concluded that although the RFI suggested that there was no present day risk to human health or to the ecological receptors, the waste disposed at MDA H could present a threat to human health and the environment over a longer timeframe. On December 27, 2000, NMED directed the Permittees to submit a CMS Plan (NMED 2000). The Permittees submitted a CMS Plan on March 3, 2001 (LANL 2001b) that was approved by NMED on December 7, 2001 (NMED 2001). The objective of the CMS was to evaluate corrective measure alternatives to determine what corrective action is required at MDA H that will be protective of human health and the environment in the future. The Permittees submitted a CMS report to NMED on May 30, 2003 (LANL 2003). The report was reviewed by NMED and was found to be deficient. A notice of disapproval (NOD) was issued by NMED on October 20, 2004 (NMED 2004a). The Permittees responded to the NOD and submitted a revised report to NMED on June 30, 2005 (LANL 2005a). The Revised CMS Report evaluated five corrective measure alternatives and provided a recommended remedial alternative to implement at MDA H.

CORRECTIVE MEASURE ALTERNATIVES

The Permittees proposed five corrective measure alternatives for MDA H: three containment alternatives and two removal alternatives. The three containment alternatives (1, 2 and 3) leave the waste inventory in the shafts and include installation of engineered measures to protect human health and the environment. The current concrete and crushed-tuff caps would be retained, and the site would remain fenced to provide protection against disturbance of the caps overlaid with a vegetative cover for a period of at least 100 years. The two removal alternatives (4 and 5) propose complete excavation of all shafts and disposal of wastes either in off-site facilities or on-site units at the Laboratory. A general description of each alternative considered in the CMS is provided below.

Alternative 1 – Upgrade Existing Surface Layer. This alternative includes upgrading the existing natural vegetative cover and implementing an appropriate monitoring and maintenance program. According to the Permittees' proposal, the upgrade will consist of grading and contouring the existing surface to optimize runoff control, covering the newly contoured surface with a gravel and soil mix, and vegetating the soils with shallow-rooting native grasses and plants. However, the Permittees pointed out that the monitoring program may not be reliable because of the existing concrete covers over the shafts, and the attendant difficulties associated with installing the monitoring equipment at the required depths.

Alternative 2 - Engineered ET Cover. Alternative 2 includes constructing an engineered evapotranspiration (ET) cover over the existing surface of the shafts and implementing an appropriate monitoring and maintenance program.

The Permittees proposed to build the ET cover consisting of three layers, which includes topsoil/gravel underlain by crushed tuff and a biointrusion barrier. The surface of the ET cover would consist of 0.5-ft-thick topsoil/gravel layer with dense, shallow-rooting vegetation that facilitates moisture removal by evaporation. This thin layer of gravel/soil mix would promote initial plant growth on the cover and control erosion without compromising the evapotranspiration features of the cover. The second layer would consist of a thick layer (3.0-ft) of crushed tuff to promote evapotranspiration. The third layer would consist of a 1.0-ft-thick biobarrier constructed of various materials, including cobbles or metal chain-link fencing. The Permittees believe that a cobble barrier is effective in inhibiting intrusion from both burrowing animals and deep-rooted plants, whereas metal fencing will be effective against burrowing animals only.

Regular maintenance would include examination of the engineered ET cover for excessive erosion, gullying, ponding of water, and the overall condition of the vegetative cover. The monitoring system will be implemented underlying the biobarrier to measure moisture changes for evaluation of the ET cover performance.

Alternatives 3a and 3b - Shaft Encapsulation and Engineered ET Cover. Alternatives 3a and 3b will use currently available commercial encapsulation technologies combined with the construction of an engineered ET cover. The Permittees proposed the use of a mixture of grout or micro-concrete incorporated into the native tuff for encapsulation of the shafts. The grout will be designed for low permeability to water, and long-term chemical and physical stability.

Bench-scale tests will determine the mechanical properties of strength and stiffness to optimize the structural integrity of the system. Both partial encapsulation of the shafts (Alternative 3a) and complete encapsulation of the shafts (Alternative 3b) are feasible at MDA H.

For the partial shaft encapsulation, the Permittees proposed an engineered vertical sidewall (30 feet in depth) around the entire perimeter of the shafts. The barrier will be constructed by injecting grout slurry mixed with ground native tuff into the subsurface. This design configuration is intended to restrict plant roots and animals from penetrating the shafts laterally along fractures in the tuff, and to discourage human intrusion.

For the complete shaft encapsulation alternative, the Permittees proposed the construction of a perimeter wall around each shaft to a depth of 60 feet or more. Interlocking boreholes 2 to 3 feet in diameter will be constructed, without disturbing the contents of the shaft, around the perimeter of each shaft by a rotary drilling rig. As each new borehole is drilled, cement slurry or other grout mixture will be injected into the tuff around the shafts. A base or barrier will be constructed under each shaft and be connected to the perimeter wall to completely isolate each shaft from the surrounding tuff. The Permittees anticipate that this design configuration will offer effective protection against plant, animal and human intrusion, as well as water infiltration.

Alternative 4: Complete Excavation and Off-Site Disposal. For this alternative, the Permittees proposed the complete removal and off-site disposal of all waste in the shafts. Trenching will be conducted parallel to the line of the shafts and will take place in 6-feet increments to expose the line of shafts. The tuff adjacent to the shafts will be excavated to a depth of 62 feet below ground surface at a minimum slope of 1.5:1. The Permittees estimate that the complete footprint of the excavation will measure approximately 72,000 cubic yards (260 ft x 120 ft x 62 ft).

For worker safety, waste removal must be conducted using remote methods in the area immediately surrounding the shafts because of the high explosives inventory and potential pyrophoric properties of the depleted uranium. Engineering controls, such as use of inert atmospheres, will be required to prevent the uranium hydride from igniting during excavation. Excavated material containing uranium hydride will then be allowed to react under controlled conditions. The estimated volume of waste to be removed by remote excavation is 4800 cubic yards. Waste will be removed and transported to temporary structures for sorting, declassification, characterization, and packaging. Wherever practical, waste minimization techniques will be applied to the removed wastes (e.g., decontamination and recycling of metals). Excavated wastes determined to be hazardous or mixed wastes may require treatment to satisfy land disposal restriction requirements in accordance with 20.4.1.800 NMAC. Such treatment can be accomplished using existing Laboratory treatment facilities or at permitted off-site facilities. Because of security considerations, the Permittees would conduct all excavation and declassification activities under the cover of temporary surface structures. These structures may be considered nuclear facilities, which would impose additional requirements on design and operation.

The nearby roadways would need to be closed temporarily while the high explosives and depleted uranium are being removed. In addition, sheet piling, shoring, and blast-proofing

material will be used along approximately 200 feet of the Mesita del Buey Road right-of-way to protect road users and the integrity of the road structure. Piling would extend 15 feet above grade for security purposes and for potential blast shielding. Utilities along Mesita del Buey Road would have to be protected and/or relocated, including the water line supplying Areas G and L.

Waste shipped off-site must meet Department of Transportation shipping requirements and the Treatment, Storage, and Disposal (TSD)-specific waste acceptance criteria and any other applicable permit conditions before shipment and disposal activities could be implemented. Most non-radioactive hazardous wastes could be disposed of at a number of permitted hazardous waste disposal facilities. However, a portion of the hazardous waste at MDA H has the potential to be radioactively contaminated (i.e., mixed waste) and therefore may be disposed of only at facilities licensed to manage mixed waste up to an authorized limit. Several TSD facilities may be appropriate for one or more categories of waste that may be present in the shafts inventory. The Permittees listed Nevada Test Site, Duratek in Tennessee, Perma-Fix in Florida, Waste Control Specialists in Texas, Allied Technology Group in Washington, and Envirocare in Utah as potential candidate facilities for waste disposal.

All waste requiring off-site disposal would be transported on Pajarito Road. The Permittees estimated that a maximum of 1500 cubic yards of material would be transported on public roads. All overburden materials removed under the excavation alternative would be placed at an approved site within 2000 feet of MDA H. A plastic liner would be used to protect the site from cross-contamination. Up to 40,000 cubic yards of overburden material would be removed from the excavation area. Any of the removed overburden materials characterized as solid, hazardous, mixed waste or low-level waste (LLW) would be managed according to applicable waste management and disposal requirements. Removed overburden materials determined to be contaminated would be replaced by clean fill. For the purpose of evaluating corrective measure alternatives, the Permittees assumed that 10% of the removed overburden materials would be contaminated and replaced with clean fill.

To implement the excavation alternative, the Permittees would construct a facility for waste sorting and controlled reaction of uranium hydride, a tent over the excavation for security purposes, a waste declassification facility, a storage vault, and a storage area for removed materials. Appropriate personal protective equipment (PPE) must be used in areas of excavation, material sorting, declassification, characterization, and packaging.

Alternative 5: Complete Excavation and On-Site Disposal. The excavation component of Alternative 5 is the same as Alternative 4. However, the excavated wastes would be disposed of on-site at the Laboratory rather than off-site. Based on the Permittees' proposal, the declassified material removed from the shafts would be disposed of either in a Laboratory hazardous waste disposal unit that will have to be permitted and constructed, or as LLW at Area G at TA-54. Any non-hazardous, low-level radioactive waste that meets the waste acceptance criteria for disposal at the Laboratory's Area G will be disposed of at Area G. The evaluation of disposal at Area G cannot be completed before waste has been excavated because of uncertainty of the waste inventory in the shafts. Since mixed-waste disposal is not permitted in any Laboratory area, the

presence of mixed waste will negate full on-site disposal unless a new, permitted disposal unit that is suitable for disposal of mixed waste is constructed. Alternately, it may be possible that, following treatment to satisfy land disposal restrictions of 40 CFR 268 and 20.4.1.800 NMAC, treated wastes or residuals will not require disposal as hazardous or mixed waste. Two options available for on-site hazardous waste disposal units are (1) a landfill permitted under RCRA/New Mexico HWA, or (2) a Corrective Action Management Unit (CAMU). A CAMU may only be used for managing remediation wastes, not as-generated wastes. The Permittees' evaluation indicates that Alternative 5 is not as cost-effective as Alternative 4.

CORRECTIVE MEASURE RECOMMENDED BY THE PERMITTEES

The Permittees recommended Alternative 2, construction of an engineered ET cover with long-term maintenance and monitoring, as the preferred corrective measure.

In terms of the technical feasibility and reliability, the Permittees believe the ET cover will effectively prevent releases of waste (excluding VOCs and tritium) to the environment from waste disposed in the shafts. The ET cover will function over the 1000-year evaluation period even with loss of institutional controls. The ET cover is relatively easy to install. It will take 5 months for the Permittees to design and construct the ET cover. This Alternative is expected to achieve performance standards in the vadose zone immediately based on 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 under conditions similar to those at MDA H (Dwyer 2001). In order to ensure the continued performance of an ET cover, the Permittees proposed to conduct regular maintenance and monitoring throughout the 100-year institutional control period once the vegetative cover has been established. However, this alternative, similar to other containment alternatives listed by the Permittees, does not address the plume of VOCs and tritium that are currently present in the soil pore gas in the vicinity of MDA H. This ET cover also does not prevent future releases of these compounds to the subsurface from the shafts at MDA H.

Implementation and operation of the three containment alternatives pose minimal safety risk to nearby communities. The hazards faced by workers from Alternatives 1, 2, and 3 primarily include industrial accidents. The Permittees' experience during construction and monitoring of covers at TA-49 and TA-54 indicates that workers are adequately protected by adhering to regulatory health and safety practices required by the Occupational Safety and Health Administration, and DOE Orders. Off-site air emissions will not exceed regulatory levels. The depleted uranium will all be converted to a stable oxide form in a period from 200 to 1000 years.

Excavation of the waste in the shafts (Alternatives 4 and 5) will guarantee that waste disposed of at MDA H will be of no further risk at the site, and thus there are no further operation and maintenance requirements at MDA H with the exception of any necessary remediation of contaminated media. Alternatives 4 and 5 would be more reliable because long-term

maintenance of Alternatives 1, 2, or 3 cannot be assured after the 100-year institutional control period. The Permittees estimated that Alternative 4 will require 46 months to complete (6 months to design and 40 months to construct). Alternative 5 will take approximately 70–110 months to complete (6 months to design and 38 months to construct; 12–60 months to acquire a RCRA permit and 6 months to construct an on-site landfill capable of accepting the waste).

The hazards faced by both workers and the community from Alternatives 4 and 5 include industrial accidents, transportation accidents, exposure to hazardous materials, potential fires and explosions during excavation and removal that could result in releases of radioactive and hazardous materials. Engineering controls to reduce the potential for fires and explosions will increase the difficulty and time necessary for completing Alternatives 4 and 5.

Based on the risk assessment results, the Permittees conclude that leaving wastes in the shafts at MDA H poses 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 recreational receptors through the use of barriers that will restrict access to both human and ecological receptors. The improvement in protection of human health offered by Alternatives 2 and 3 will further reduce the estimates of the risk and dose, which would be below all applicable federal and state criteria, standards, or regulations for the protection of human health.

The Permittees' ecological screening assessment indicates that there is no unacceptable long-term ecological risk with implementation of any one of the containment alternatives. The implementation of Alternatives 1, 2, and 3 will involve small-area (0.3 acres), short-term disturbances to the surface soil, plants, and animals within and around MDA H. The activities associated with implementing these alternatives are expected to last 6 to 12 months. An additional two years are estimated to fully establish the vegetative cover. Implementation of Alternatives 1, 2, and 3 will cause minimal damage to the biological resources in and around MDA H, and have no effect on cultural resources.

Alternatives 4 and 5 will provide the same or greater level of protection for human health as the containment alternatives. Alternatives 4 and 5 will result in the maximum potential exposure to workers and the public during waste excavation, sorting, declassification and transport activities, and the maximum reduction in potential exposure to the community after completion of the implementing activities.

The implementation of Alternatives 4 and 5 will involve disturbing approximately 3 acres of soil and impacting plants and animals within and around MDA H. The activities associated with Alternative 4 are expected to last approximately 40 months and would last approximately 50 months for Alternative 5. An additional two years are estimated to fully establish the vegetative cover. The Permittees do not expect long-term impacts on the plant and animal species in and surrounding MDA H. 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 Permittees' 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.

Alternatives 1 and 2 have the lowest total cost at 2005 values of $643,000 and $774,000, respectively, whereas Alternatives 4 and 5 have the highest total cost at 2005 values of $51,906,000 and $68,563,000, respectively. Alternative 3 has a relatively low total cost at the 2005 value of $2,976,000.

CORRECTIVE MEASURES SELECTED BY NMED

NMED acknowledges that Alternative 2, the engineered ET cover recommended by the Permittees, would be effective in reducing or limiting the amount of water that percolates into the shafts under design conditions. If properly maintained, the engineered ET cover may reduce or limit the surface erosion, and therefore can 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 intrusion of deep-rooting plants and burrowing animals. In addition, this alternative does not address the current and future releases of VOCs and tritium to the subsurface at MDA H.

NMED questions the long-term reliability of the engineered ET cover in preventing the intrusion of deep-rooting plants and burrowing animals. According to the conceptual design of the engineered ET cover for MDA H, the total depth of the cover is approximately 4.5 feet over the existing surface layer. Based on the Permittees' findings at MDA H (LANL 2005), the site-specific deep-rooting plants can extend roots to depths as deep as 23 feet (7 meters), and local burrowing animals can excavate to depths deep to 10 feet (3 meters). The ET cover, with its 1.0-foot biointrusion barrier directly atop the current surface of the shafts, does not have the capability to prevent potential biointrusion to the shafts from the surrounding areas. The potential for biointrusion to the shafts from the surrounding areas poses not only the risk of transport of waste to the surface, but also the risk of creation of conduits that could 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.

Furthermore, the continuous release of VOCs and tritium to the subsurface from the shafts indicates the need for stabilizing the shafts to control or minimize the releases at MDA H. Recent monitoring data show that trichlororethylene (TCE), a carcinogen, has been detected in the subsurface pore gas at a concentration of 2,600 micrograms (µg) per cubic meter, which is a high enough concentration to partition into groundwater and theoretically result in an aqueous concentration greater than the drinking water maximum contaminant level (MCL) of 5 µg per liter (LANL 2006b). In other corrective actions, the Permittees have proposed to evaluate partitioning of vapor-phase compounds using the Henry's law, as defined by the following equation:

$$C_{vapor} = C_{water} \times H' \qquad (1)$$

In Equation 1, C_{water} is a VOC concentration in groundwater that results from partitioning of vapor-phase VOCs in soil pore gas. C_{vapor} is the vapor-phase VOC concentration in contact with

groundwater under equilibrium conditions. 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, for mitigating the potential impact. Based on this approach, vapor-phase concentrations of the VOCs that are the primary contaminants of concern at MDA H have been determined that could result in concentrations in groundwater at their respective MCLs. Vapor-phase concentrations of TCE, perchloroethylene (PCE), 1,1,1-trichloroethane (TCA) and toluene would need to be less than 2,100, 3,800, 141,000, and 272,000 µg per cubic meters, respectively, in soil pore gas to eliminate the potential of partitioning to groundwater at the corresponding MCL.

Based on the concentrations observed in the subsurface at MDA H, only TCE has the potential to partition to groundwater from the soil vapor-phase contamination at a concentration greater than the MCL. Due to continuous releases of VOCs from the shafts to the subsurface, however, the Permittees cannot ensure that the vapor-phase contaminant concentrations will remain below the criteria established using Henry's law. More specifically, the Permittees have not sampled soil gas at depths greater than approximately 250 feet below the ground surface. The vapor-phase transport of VOCs beneath MDA H is complex and has not been fully evaluated by the Permittees (LANL 2005a). In addition, the groundwater monitoring wells installed by the Permittees in the vicinity of MDA H (including R-20, R-22, R-32, and R-16) cannot provide reliable data to evaluate whether or not VOCs released from TA-54 have reached the regional aquifer (LANL 2005b). The soil pore gas monitoring is the only means available at MDA H that can provide evidence to assure that vapor-phase VOCs are not a potential source of significant contamination for the regional aquifer. In particular, toluene was recently detected consecutively in two rounds of the regional groundwater samples collected from R-20, which is located between TA-54 and the municipal well PM-2 that supplies drinking water to the community. The source of the toluene has not been identified. NMED therefore has determined that it is appropriate to implement Alternative 3b (complete encapsulation of the shafts), along with a soil-vapor extraction system, at MDA H to prevent biointrusion and eliminate the VOC contaminant source detected in soil pore gas so that the drinking water resource can be conservatively protected.

Alternative 3b will isolate the shafts from the environmental media to offer the greatest protection against potential intrusion of plants and animals, and accidental human access. This complete encapsulation alternative will prevent water from entering the shafts, and thus minimize the potential for contaminant migration into the surrounding tuff through aqueous-phase transport. This alternative may stabilize the existing shaft configurations. Existing commercial technologies can be used to place the engineered vertical barriers to a depth of 60 feet or more. These technologies are well established, and include specific worker health and safety protocols. Since installing the barriers requires no disturbance of the shafts or exposure of

the waste to the atmosphere, no safety issues associated with the materials in the MDA H inventory are involved. Grout will be injected into the tuff beneath the shafts from areas outside the shafts so that the material in the shafts is not disturbed. The top of each shaft will also be covered with an engineered cap. Bench-scale and/or pilot-scale studies must be conducted to develop the correct grout mixture to meet the specifications for constructing the barriers. The materials used for encapsulation of the MDA H shafts would consist of a mixture of grout or microconcrete incorporated into the native tuff present at the site. To be effective over a long period, the grout must remain chemically and physically stable. The mechanical properties of strength and stiffness must be determined by bench-scale tests to maximize the structural integrity for the total system. The monitoring techniques for both construction and long-term performance are also well established. Implementation of the Alternative 3b can be achieved using existing proven and commercially available technologies for formulation of the grouts for all phases of construction. As part of Alternative 3b, an engineered ET cover will also be installed to cover the entire surface of MDA H. The ET cover will be required to meet performance criteria over 1000-year period.

As described by the Permittees, moisture-monitoring equipment will be installed within and below the ET cover, and neutron probes will be used to monitor moisture levels in existing boreholes to verify that this alternative is performing its design of losing rather than gaining moisture. The total time required for designing and implementing Alternative 3b, including bench and pilot tests, and construction, is one year. An additional period of two years will be needed to establish a vegetative cover. In order to ensure the continuous performance of this alternative, the Permittees must conduct regular inspection, maintenance and monitoring throughout the 100-year institutional control period. Implementation of this alternative has minimal impacts on human health and the environment as described before. The total cost is comparatively moderate at the 2005 value of $2,976,000. In case the volumetric water content detected from the monitoring wells rises above 11%, the Permittees will trigger the contingency plan by inspecting, reevaluating and even upgrading the ET cover.

Soil-vapor extraction (SVE), as part of the corrective measures selected by NMED, will mitigate and control vadose zone vapor phase contamination at MDA H. SVE is a proven technology to accelerate removal of the subsurface gases or vapors through 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 Permittees can demonstrate that air emissions will be in compliance with Clean Air Act emission limits. To conservatively protect the regional groundwater from contamination by VOCs in soil pore gas, the Permittees will be required to operate the SVE until VOCs in soil pore gas are reduced to levels at which any of the detected VOCs, in contact with groundwater, theoretically could result in concentrations above half of the lower of the respective MCLs or Water Quality Control Commission (WQCC) standards. For example, TCE in soil pore gas must be reduced to a concentration below 1100 $\mu g/m^3$ in vapor phase to meet the established criteria. Installation of a SVE system will require the installation of vapor monitoring extraction wells in the vicinity of MDA H and extending the depth of existing boreholes to the Otowi member of the Bandelier Tuff.

After VOC concentrations in soil pore gas have been reduced to below half of the corresponding MCLs, the Permittees may convert the SVE to a soil-gas venting system, which employs open boreholes that passively allow the release of subsurface vapors and gases to the atmosphere or to a treatment system. The Permittees will be required to monitor the performance of the soil-gas venting system for at least five years or until VOC concentration limits are maintained for eight consecutive sampling events. In case the soil-gas venting is unable to maintain VOC concentrations below the established criteria in two consecutive sampling events, the Permittees will be required to operate the SVE system again as a contingency plan. The hazards faced by workers and the community from SVE are mainly associated with operations to install boreholes and monitoring wells.

The potential impact of implementing SVE on human health and the environment is comparable to the other hazards associated with implementing Alternative 3b. 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 3b. The Permittees will be required to evaluate the feasibility of SVE in detail based on the contaminant characteristics and subsurface conditions at MDA H. In addition, the Permittees are required to evaluate the current wells located in the vicinity of TA-54 and to submit a plan to address all deficiencies in the groundwater monitoring network at TA-54 with regard to Consent Order and regulated unit closure requirements. Upon selection of a final remedy, NMED will require the Permittees to submit a plan for implementing these corrective measures at MDA H for approval.

NMED did not select Alternatives 4 or 5 because the implementation of these alternatives can pose significant risks to workers and the community, and, because of the potential exposure hazards from excavation and transport of waste, are not necessarily the most protective of human health and the environment. Although the waste inventory at MDA H is incomplete, the limited inventory information available suggests the possible presence of pyrophoric uranium hydride, lithium hydride, high explosives and other reactive compounds. Excavation of these wastes could result in fires or explosions that might release radioactive and hazardous materials to the atmosphere, increasing hazards to workers at the Facility and the public. Robotic excavators would be required, and extensive engineering controls would have to be implemented to control the risk of worker safety and releases to the environment from fires and explosions during removal activities. The excavation activities would have to be performed under a dome or tent under negative pressure, and because of the classified nature of the waste, remilling would be required in some cases to alter the shapes of the materials.

The nine shafts are approximately 60 feet deep and 6 feet in diameter and are located on 0.32 acres close to the edge of the mesa. Excavation to depths of 60 feet in close proximity to the mesa edge could result in destabilization of the mesa south of MDA H. The cost of removal of such a small volume of waste (relative to the volumes of waste disposed at MDAs G and L) is relatively high. In addition, the waste would have to be transported through Los Alamos County and surrounding communities enroute to a disposal site, resulting in increased potential for transport related accidents and associated exposure to human and ecological receptors.

PUBLIC REVIEW OF THE ADMINISTRATIVE RECORD

The Administrative Record for this proposed action consists of a Fact Sheet/Statement of Basis, this Public Notice, the Consent Order, and supporting documentation. The Administrative Record may be 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: *Pam Allen*

The Public Notice, and Fact Sheet/Statement of Basis, and the Consent Order are also available on the NMED website at http://www.nmenv.state.nm.us/hwb/lanlperm.html under MDA H Remedy Selection**.** To obtain a copy of the Administrative Record or a portion thereof, please contact Ms. Pam Allen at (505) 476-6000, or at 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 **November 5, 2007**, to announce the beginning of a 60-day comment period that will end at **5:00 p.m. MST, January 4, 2008.** 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, January 4, 2008** will be considered.

John E. Kieling, Program 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: john.kieling@state.nm.us
Reference: LANL MDA H Remedy Selection (SWMU 54-004)

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 of 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 comment and requests for a public hearing must be filed with Mr. John Kieling on or before **5:00 p.m. MST, January 4, 2007**. 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

Persons having a disability and requiring assistance or auxiliary aid to participate in this process should contact Judy Bentley at the New Mexico Environment Department, Human Resources Bureau, P.O. Box 26110, 1190 St. Francis Drive, Santa Fe, New Mexico, 87502, telephone number: (505) 827-9872. TDY users please access her number via the New Mexico Relay Network at 1-800-659-8331.

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