

NMED DOE Oversight Bureau Results from 2010-2011 Split Confirmation Sampling at Material Disposal Area B at Technical Area 21, Los Alamos National Laboratory, Los Alamos, New Mexico

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Overview photograph of enclosures and waste containers (right) at Material Disposal Area (MDA) B, looking east. (Photo courtesy of LANL.)

Introduction

Beginning in July of 2010, Los Alamos National Laboratory (LANL or the Laboratory) began excavating a historic waste disposal area on DP Road in Los Alamos, New Mexico. Material Disposal Area (MDA) B served as a landfill for contaminated materials, including; clothing, equipment, containers and general refuse from the Manhattan Project work conducted at labs and buildings at Technical Area (TA) 21. The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB or OB) collaborated on a verification project with LANL and LANL's contractors during the clean-up of MDA B. The clean up involved excavation and removal of all waste from the trenches that make up MDA B. NMED and LANL split soil samples from fully excavated locations in the disposal trenches as they became accessible. These split samples were intended to verify and confirm that LANL had indeed met their clean-up levels. The NMED DOE OB analyzed soil/tuff sample splits from 56 of these confirmation sampling locations during the excavation, including one from the total depth of a borehole in a backfilled location. This report presents the data from NMED's split samples.

Background and Project Implementation

History of MDA B

Material Disposal Area (MDA) B, Solid Waste Management Unit (SWMU) 21-015, at Technical Area (TA) 21 is a historical disposal site for process wastes from the Laboratory operations at TA-21 (DP East and DP West). The approximately 6-acre site is located on DP Mesa (between DP Canyon to the north and Los Alamos Canyon to the south) in Los Alamos, New Mexico and contains unlined disposal trenches cut into the bedrock (tuff). The site received waste from 1944-1948, including both radioactively contaminated waste and chemical waste. The waste items were thought to include laboratory utensils and glassware, chemicals, furniture, personal protective equipment (PPE), and trash.

No formal record of waste was maintained and the disposal history has largely been gained through historical reports, memoranda and employee interviews. (LANL, 2006.)

The site was fenced after its closure in 1948. The western two-thirds of the site was paved following 1966 borehole sampling along the perimeter of the MDA by the U.S. Geological Survey (USGS). In 1980 surface stabilization was completed at the eastern end of the MDA to address post-closure subsidence. A new fence was installed at a greater perimeter and new compacted and seeded soil replaced the existing vegetation in 1982, and in 1983 an experimental cap was added on the eastern end of the site. (LANL, 2011.)

The investigation and remediation of MDA B was required under the March 1, 2005 (revised June 18, 2008) Compliance Order on Consent (Consent Order) between the New Mexico Environment Department (NMED) and Los Alamos National Laboratory (LANL). Investigations during the 1990's and early 2000's at MDA B focused on potential subsurface releases from the trenches and on surface characterization. The investigations included geophysical surveys, surface sampling, angled boreholes, and soil-gas sampling.

Project Implementation

LANL and NMED agreed to perform waste removal under the Investigation/Remediation Work Plan (IRWP) instead of performing a corrective measures evaluation report and corrective measures implementation plan. In 2006 LANL submitted to the NMED Hazardous Waste Bureau (HWB) an IRWP for MDA B (LANL, 2006a), which described LANL's proposed waste removal scope of work (LANL, 2006b). The IRWP included four main objectives (from LANL 2006b):

- Objective #1: Characterize types and quantities of waste at MDA B
- Objective #2: Remove and properly dispose of the excavated wastes
- Objective #3: Perform confirmation sampling in the trenches after wastes are removed
- Objective #4: Prepare and implement a post-remediation SAP to define the nature and extent of any residual contamination

In 2009, LANL conducted a three-phase direct-push sampling/probing project to further attempt to characterize the waste in the trenches prior to full-scale excavation. The "Sampling and Analysis Plan for Direct-Push Technology at Material Disposal Area B" (LANL, 2009a) outlined the project and Phase I core sampling results are reported in "Investigation Report for Direct-Push Sampling, Material Disposal Area B, Solid Waste Management Unit 21-015, at Technical Area 21" (LANL, 2009b). The Laboratory was also requested by the NMED HWB to continue vapor monitoring for tritium at the adjacent MDA V in support of the MDA B remediation activities (NMED, 2010).

The MDA B Sampling and Analysis Plan (MDA B SAP) was developed (and revised; see LANL 2010a, c, d) by LANL to address overburden, soil, waste and confirmation sampling during the project.

Beginning in February 2010, the overburden material was removed from the site, then enclosures were installed over the trench locations in order to control any potential releases that might have occurred during excavation. A total of 13 enclosures were constructed, but many were combined into larger, single, fixed enclosures, with the exception of two that were moveable. Excavation of the trenches began on June 30, 2010, using a hydraulic excavator. The enclosures included various continuous monitors during the excavation to alert personnel of any unexpected or unsafe conditions within the trenches or enclosures. Excavations were monitored from adjacent but separate control trailers.

Confirmation Sampling & Analysis

The New Mexico Environment Department participated in the confirmation sampling from Objective #3 (above). The confirmation sampling was conducted after selected rows in the trenches were completely excavated, with the goal of confirming that clean-up levels had been met. Once the confirmation samples were analyzed and accepted by LANL as meeting the clean-up goals, the trenches were backfilled with “clean” fill.

Staff from NMED met with LANL staff and Department of Energy Los Alamos Site Office (DOE LASO) staff prior to confirmation sampling to arrange for split samples. NMED decided to split samples for a few major contaminants of concern, including metals, isotopic uranium and isotopic plutonium. The number and location of split samples was dependent on the timing of sampling events, relevant wastes removed from near the specific location to be sampled, available funding, and the potential need for re-sampling. NMED staff were instructed to coordinate sample splits with the contracted sampling team (Northwind).

Due to the training and personal protective equipment (PPE) requirements for the confirmatory sampling, LANL (contracted) sampling staff conducted the physical sampling while NMED staff viewed the sampling process from a distance or via a live-feed remote camera. NMED staff did not view every split sampling event. The samplers followed the process in the MDA B Sampling and Analysis Plan (SAP), Revisions 0, 1, and 2 (LANL 2010a, c, d) with modifications made as they became apparent and necessary. NMED also split a sample from the total depth of a borehole in a backfilled row.

Narrative descriptions of a confirmation sampling event and a borehole sampling event as observed by NMED staff can be found at the end of this report.

As confirmatory sample locations and sampling time became available, LANL’s contract sampling team was instructed to notify NMED for the opportunity to split at the available location(s). In some cases confirmation sampling events were missed by NMED due to a lack of notification. In order to provide NMED the opportunity for a split sample in the event that no notification was practical (i.e., weekends, holidays), LANL sampling staff would collect samples for NMED and allow NMED the option of accepting them or having them disposed of by the LANL sampling team. Sample custody was transferred from LANL sampling staff to NMED staff after the samples had been cleared by a Radiation Control Technician.

NMED’s split samples were sent to either ALS Laboratory Group (formerly Paragon Analytics, Inc.) in Ft. Collins, Colorado (samples taken in 2010), or Test America, Inc. in Earth City, Missouri (samples taken in 2011). The requested analyses were the same for all confirmation samples (excluding the borehole sample):

- TAL List Metals (including Total U) and mercury (SW-846:6010/6020 and SW-846:7471)
- Isotopic Plutonium (Pu-239/240, Pu-238) (HASL-300)
- Isotopic Uranium (U-238, &235, U-234) (HASL-300)

The borehole sample was analyzed for the following analytes by Test America in Earth City, MO:

- Perchlorate (EPA 314.0)
- Strontium-90 (HASL-300)
- Total Uranium by ICP-MS (SW-846:6020)

Sample Results

The NMED DOE OB collected 55 split confirmation samples and one (1) split sample from the total depth of a borehole into a backfilled location. The 55 split confirmation samples represent 25 rows, although some sampling overlapped into adjacent rows and was not apparent until GPS coordinates were obtained for the actual sampling location. Ten (10) of the 25 rows were only split on the excavation floor location, while the remaining 15 split sampled rows included the excavation floor and sidewalls (north and south walls). The clean up goals stated in the 2006 IRWP (LANL, 2006b) included achieving levels at or below the residential Soil Screening Levels (SSL) for metals and the residential Screening Action Levels (SALs) for radionuclides.

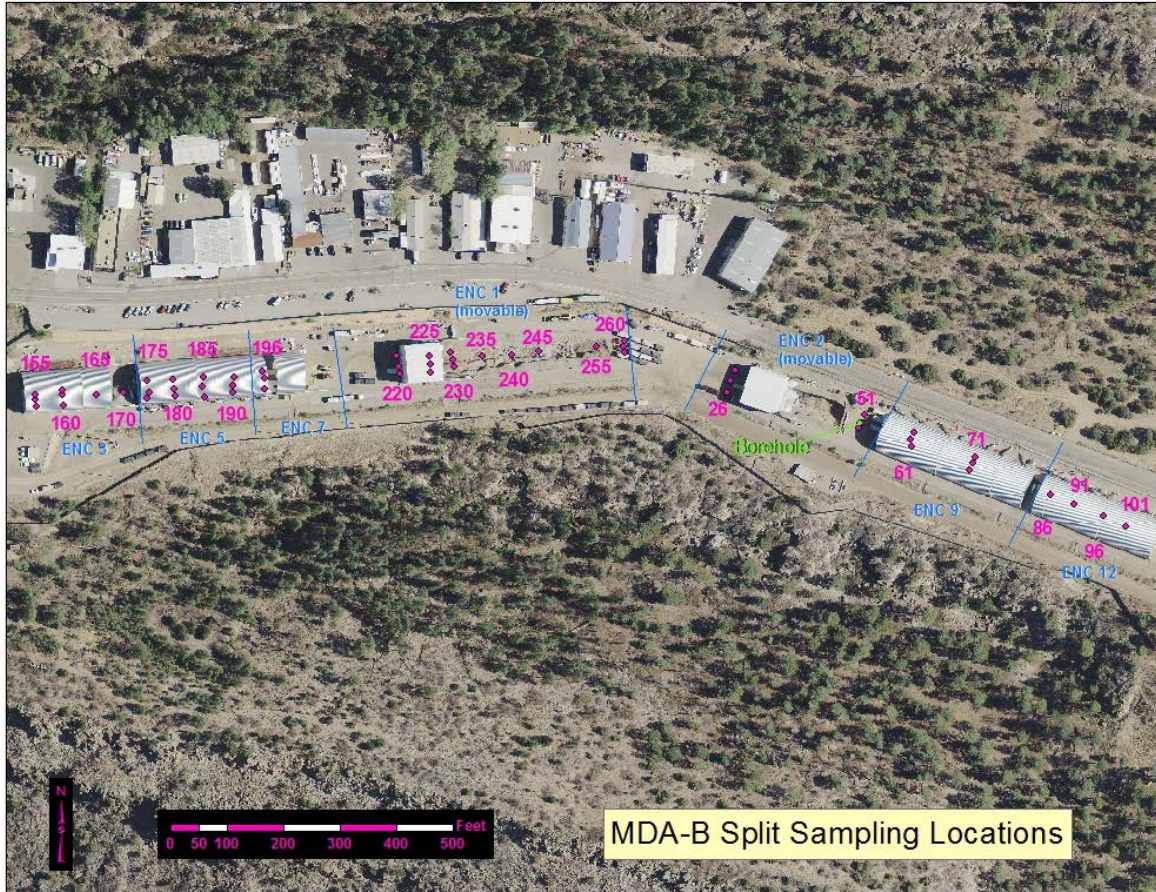
The results from NMED’s split samples showed only 3 occasions when a residential SSL was exceeded (2 arsenic and one uranium), and 18 occasions when a residential SAL was exceeded (15 for Plutonium 239/240 and all 3 reported isotopes of uranium in one sample). In all instances where NMED’s results exceeded a SSL/SAL, LANL’s results also exceeded the SSL/SAL. There were 3 instances when LANL results exceeded the SAL for Plutonium 239/240 but NMED’s results did not exceed the SAL. The exceedances are presented in the following table.

Analytes that exceeded SSL/SALS										
Metals (mg/Kg)					Rads (pCi/g)					
Arsenic (SSL=4)		Uranium (SSL=235)		Uranium-234 (SAL=170)		Uranium-2345 (SAL=17)		Uranium-238 (SAL=87)		
	NMED	LANL	NMED	LANL	NMED	LANL	NMED	LANL	NMED	LANL
Row 160 Floor	5.7	5.71								
Row 160 North Wall	4.2	4.02								
Row 51 North Wall			7400	5790	2900	2250	140	156	3000	2260

Plutonium- 239/240 (SAL=33 pCi/g)					
	NMED	LANL		NMED	LANL
Row 175 North Wall	49.8	36.4	Row 245 Floor	54.8	148
Row 180 Floor	52.9	68.5	Row 260 North Wall	51	55.1
Row 185 Floor	135	215	Row 51 Floor	40	34.2
Row 185 South Wall	39.2	36.5	Row 61 Floor	(28.3)	61.5
Row 190 Floor	58.8	56.5	Row 61 South Wall	76.5	99.6
Row 190 North Wall	293	608	Row 71 Floor	111	121
Row 190 South Wall	(0.109)	124	Row 71 North Wall	513	626
Row 196 Floor	85	61	Row 71 South Wall	215	263
Row 235 Floor	227	286	Row 91 Floor	(23.2)	36.6

A sample was also split from the total depth (of 10.481 ft bgs, according to LANL data) of a borehole in Row 51. The row had been backfilled prior to the borehole sampling. None of the analytes from the split sample exceeded the applicable SSLs.

Due to the heterogeneous nature of the soil and tuff, variations between NMED and LANL’s results were observed in the split sample results, although the overall relative levels of contaminants were generally similar.



Locations of sample splits between NMED and LANL overlain on an aerial photograph. Numbers indicate rows and ENC = enclosure number and approximate boundaries.
(Prepared by Kim Granzow, NMED DOE OB.)

Summary

The New Mexico Environment Department (NMED) Department of Energy Oversight Bureau (DOE OB) analyzed soil/tuff sample splits from 56 confirmation sampling locations as per LANL's IRWP Objective #3 (LANL 2006b) during the excavation, including one from the total depth of a borehole in a backfilled location. There were 3 occasions when a residential Soil Screening Level (SSL, for metals) was exceeded, and 18 occasions when a residential Screening Action Level (SAL, for radionuclides) was exceeded. LANL's "Investigation/Remediation Report for Material Disposal Area B, Solid Waste Management Unit 21-015" (LANL, 2011, p.31) makes the following statements regarding all exceedances with the exception of arsenic and one plutonium 239/240 results:

"A primary assumption of the residential scenario is that exposure to contaminated media occurs from 0-10 ft bgs [below ground surface]. This exposure depth interval (0-10 ft bgs) is the standard depth applied to the residential scenario in all Consent Order risk assessments, as well as associated dose assessments and has been accepted by the NMED and DOE in the investigation reports submitted to date."

Regarding the arsenic and plutonium 239/240 results mentioned above, the report states:

"...the arsenic data was not statistically different from background data, thereby meeting the cleanup goal for arsenic," and "The 95% UCL (9.85 pCi/g) for plutonium 239/240 from 0-10 ft bgs was below the residential SAL."

In general, the majority of the split samples between NMED and LANL provided similar analytical results. During excavation, sampling and laboratory analysis it was observed that the heterogeneity of the crushed tuff resulted in some differences in results from split samples, as well as differences in results from multiple analyses of one sample (as seen in lab duplicate analyses).

References

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- NMED, 2005. Compliance Order on Consent. Rev 2008.
- NMED, 2011. March 8, 2011. "Extended Tritium Vapor Sampling, Material Disposal Area (MDA) V, Technical Area 21," New Mexico Environment Department letter to G.J. Rael (DOE-LASO) and M.J. Graham (LANL) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2011, 201232)

Narrative descriptions of sampling procedures as observed by NMED staff:

Confirmation sampling process performed by Northwind as observed by NMED DOE OB

On October 19, 2010, DOE OB staff observed the confirmation sampling of Row 195 (determined later during GPS survey to actually be Row 196) in Enclosure #7. The sampling was observed via a closed-circuit live-feed video from the control trailer for Enclosure #7. A team of samplers from Northwind (LANL's contractor performing the sampling) began the process at approximately 10:30AM. The samplers were dressed in Level C PPE. LANL provided the sample bottles and custody seals for the NMED DOE OB requested split samples (TAL metals and uranium, Isotopic Plutonium and Isotopic Uranium).

North wall: A backhoe with a small, decontaminated bucket was used to access an area approximately half way up the north wall of the excavated trench. The backhoe operator excavated into the wall (tuff), placing the initial excavated material into the bottom of the trench to be reburied pending sample results. After a small amount of excavation, the excavated tuff from the trench wall that was used for the confirmation sample was placed from the bucket onto a large sheet of plastic outside of the trench. An RCT scanned the sample before releasing it to the sample team. (The criterion was less than 20 cpm at the bucket for release.) The sample team broke up the sample using rock hammers and homogenized the reduced material in a large stainless steel bowl. A steel scoop was used to place the sample into the sample bottles. The bottles were capped and the exterior of the bottle was cleaned with Fantastik®. Once all of the sample bottles for the north wall location had been filled, the equipment was cleaned and decontaminated (per LANL's SOP-5061, Field Decontamination of Drilling and Sampling Equipment). A Radiatoin Control Technician (RCT) cleared the backhoe bucket for use in the next location.

Floor: The confirmation sample from the floor/base/bottom of the trench was taken in the same way as the sample from the north wall; a small bucket on the backhoe was used to excavated a small depth and then a sample was placed on a plastic sheet outside of the trench. The sample was reduced, homogenized and placed into sample bottles as noted above for the north wall confirmation sample. The sample bottles and equipment were cleaned, decontaminated and cleared by the RCT.

South Wall: Due to the cramped nature of the physical enclosure a backhoe could not be used to sample the south wall. The south wall sample was taken by a contractor in an extendable boom (seated on the north side of the trench) who manually excavated the trench wall by scraping and "chipping" the tuff into a large stainless steel bowl. Once enough tuff had been collected, the sample was reduced, homogenized and placed into sample bottles as noted above for the north wall and floor confirmation samples. The sample bottles and equipment were cleaned, decontaminated and cleared by the RCT.

All samples were taken to an RCT prior to final release for off-site shipment and the DOE OB picked up the samples the following day.

Total Depth borehole sampling process performed by Northwind as observed by NMED DOE OB

On July 15, 2011, DOE OB staff observed the open-air total depth sampling of a borehole in Row 51 of the Enclosure 2 area (LANL Location ID MDAB6144483, LANL Sample ID SDMDAB-11-22290). The trench had previously been completely excavated, confirmation samples had been taken and the trench had then been backfilled, reportedly using clean fill dirt and two layers of cobbles. Sampling began at 08:56 in very smoky conditions due to the Las Conchas Fire. No core barrel was used initially. The driller went through clean fill until approximately 7 feet in depth, where there was an approximately 2-foot thick layer of cobbles. From approximately 9 feet to 12 feet was clean fill, followed by another 2-foot thick layer of cobbles. For the 15-20' interval the core barrel was utilized, but continued through clean fill. Included in the clean fill was a small piece of a clear glass bottle rim. The stainless steel core barrel was also utilized for the 20-25' interval and the tuff at the base of the trench was encountered at approximately 21 ½' in depth.

The borehole went to a total depth of 25' and the intact core was removed at 09:53. The core barrel was opened and Northwind sampling staff broke off the lowest 1' of core leaving approximately 2 ½ feet of core for sample collection. The sampler used a rock hammer and gloved hands to roughly break the core into a few pieces and place those pieces into a rectangular stainless steel container. The sampler then used a rock hammer to break

up and crush the core pieces into “enough powder” to fill the sample containers. The crushed tuff was mixed in the stainless steel container using a small stainless steel scoop to homogenize the crushed tuff. The sample containers were filled using the stainless steel scoop. The crushed tuff was field screened for volatile organic compounds.

During the entire process a Radiation Control Technician (RCT) was performing field screening for radioactivity.

(On July 14, 2011, a sample was taken by LANL sampling staff from the total depth of a different borehole and split between LANL and NMED. The borehole sampling was intended to evaluate any contaminants that had migrated into the consolidated tuff in the bottom of the trench.)