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John Kieling, Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6303

Subject: Chromium Background Study Work Plan

Dear Mr. Kieling:

Enclosed please find two hard copies with electronic files of the Chromium Background Study Work Plan.

If you have any questions, please contact Kent Rich at (505) 665-4272 (krich@lanl.gov) or Ramoncita Massey at (505) 665-7771 (ramoncita.massey@em.doe.gov).

Sincerely,

Bruce Robinson, Program Director
Environmental Remediation Program
Los Alamos National Laboratory

Sincerely,

David S. Rhodes, Director
Office of Quality and Regulatory Compliance
Los Alamos Environmental Management
Field Office

BR/DR/KR:sm

Enclosures: Two hard copies with electronic files – Chromium Background Study Work Plan (EP2017-0072)

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Chromium Background Study Work Plan

Primary Purpose	As part of the technical approach presented in supplemental investigation reports (SIRs), the primary focus for defining the extent of contamination is characterizing contamination that potentially poses an unacceptable risk and may require additional sampling. As such, comparison with soil screening levels (SSLs)/screening action levels (SALs) is used as an additional step following a determination of whether extent is defined by decreasing concentrations with depth and distance and whether concentrations are below estimated quantitation limits or detection limits. The SSL/SAL comparison is not necessary if concentrations of all chemicals of potential concern (COPCs) are decreasing with depth and distance. If, however, concentrations increase with depth or distance or do not exhibit any obvious trends, the SSLs/SALs are used to determine whether additional sampling for extent is warranted. If the COPC concentration is sufficiently below the SSL/SAL (i.e., the SSL/SAL is 10 times [an order of magnitude] or more than all concentrations), the COPC does not pose a potential unacceptable risk, and no further sampling for extent is warranted. The validity of the assumption that the COPC does not pose a risk is confirmed by the results of the risk-screening assessments. In the case of chromium, at sites where there is no previous indication that hexavalent chromium was used and released, the U.S. Department of Energy (DOE) and Los Alamos National Security, LLC (LANS) have compared concentrations to trivalent chromium SSLs instead of total chromium SSLs to determine whether additional sampling for extent is warranted. Because historical uses of hexavalent chromium at Los Alamos National Laboratory (LANL or the Laboratory) are limited (e.g., as a corrosion inhibitor in cooling towers and electroplating) and site conditions do not favor the formation of hexavalent chromium from trivalent chromium, DOE and LANS believe the use of the residential SSL for trivalent chromium in the nature and extent discussions is appropriate. However, the natural occurrence of hexavalent chromium in soil, sediments, and various bedrock units (Bandelier Tuff) at the Laboratory has not been quantified. The purpose of this study is to determine the naturally occurring speciation of chromium in soil, sediment, and Bandelier Tuff units on the Pajarito Plateau. Samples of all media will be collected and analyzed for total and hexavalent chromium.
Characterization Strategy	To capture potential variability, three “reference” sites have been identified for sampling. The criteria for selecting reference locations is to obtain data from distinct locations across the Pajarito Plateau that represent potential variability in key attributes that may affect chromium speciation, including the organic content in soil that may be a function of precipitation and plant abundance, iron content, and varying natural geochemistry of bedrock units that underlie mesa top soil (e.g., Bandelier Tuff Tshirege Units 2, 3, and 4). At each reference site, samples will be collected from mesa-top soil, from the underlying bedrock unit, and from mesa-slope sediment and tuff. Figure 1 shows the proposed reference sites, and Figure 2 shows a schematic of the sampling locations that will be used at each of the reference sites. The references sites were selected from areas within Laboratory property that have not been impacted by Laboratory operations. Each site is also located within a different Bandelier Tuff units (e.g., one site in Qbt2, one site in Qbt3, and one site in Qbt4). Four soil samples will be collected from two sampling locations at each reference site, nominally from 0.0–1.0 ft below ground surface (bgs) and 1.0–2.0 ft bgs intervals. The thickness of each interval may be adjusted to split the total thickness of soil actually identified at each sample site but will not exceed 1.0 ft. These soil samples will be collected from the wall of “potholes” that will be hand-dug through the soil profile. This approach will enable detailed descriptions of the soil profile, including particle size, organic content, soil maturity, etc. These attributes may be important to understand variability that may be present in chromium speciation. The spade-and-scoop method will be used to collect the soil from the pothole wall.

Characterization Strategy (cont'd)	Four mesa-top tuff samples will be collected from four sampling locations at each reference site. Two of the tuff samples will be collected below the deepest soil sampling locations and two from distinct locations. The tuff samples are intended to characterize the potential variability within Tshirege Units 2, 3, and 4. The mesa-top tuff samples will be collected with a hand auger from the bottom of the soil potholes dug for two of the tuff locations, and separate potholes will be dug for the other two tuff locations. The first several inches at the soil-tuff interface will be bypassed to minimize the potential that the tuff data are not biased by small amounts of soil that has infiltrated fractures and pore spaces in the tuff. A hand auger will be used to collect the mesa-top tuff samples. Four tuff samples will also be collected from exposed mesa-slope locations to characterize the potential for differences in chromium speciation where tuff is more openly exposed to weathering in air versus the condition that may exist beneath mesa-top soil. The samples will be collected from drainages for consistency with the nature of tuff samples that are commonly collected for aggregate area investigations. These samples will be collected using a hand auger. Four sediment samples will be collected from two separate mesa-slope drainages at each reference site nominally from 0.0–1.0 ft bgs. Typically, sediment samples are different from soil samples in that much of the iron coating (FeOH) that is commonly present on grains in soil have been eroded off. The lesser amount of iron on sediment grains and the potentially lower organic content could result in different chromium speciation. Sediment samples will be collected from medium-grained sand and smaller deposits because of the generally higher surface area in finer-grained deposits that should provide better resolution of chromium speciation because concentrations should be higher. These samples will be collected using the spade-and-scoop method.
Identifying Sampling Locations	Specific sampling locations and sampling intervals for each medium will be determined in real-time for each of the three reference sites based on field conditions, including soil thickness, particle size, and other factors. Detailed field notes will be taken of the characteristics of each sample to support interpretation of chromium-speciation data.
Sample Location Surveys	Surveys will be conducted in accordance with the latest version of Standard Operating Procedure (SOP) EP-ERSS-SOP-5028, "Coordinating and Evaluating Surveys." The surveyors will use a Trimble GeoXT handheld global positioning system (GPS) or equivalent to provide "map-grade" coordinates to document sampling locations. The coordinate values will be expressed in the New Mexico State Plane Coordinate System (transverse mercator), Central Zone, North American Datum 1983. Elevations will be reported as per the National Geodetic Vertical Datum of 1929. All GPS equipment used will meet the accuracy requirements specified in the SOP.
Procedures	Soil, sediment, and tuff samples will be collected in accordance with ER SOP-20069, "Soil, Tuff, and Sediment Sampling." Hand augers will be used to collect tuff from mesa-top and mesa-slope locations. The hand auger is advanced by turning the auger into tuff until the barrel is filled. The tuff is removed from the auger and placed in a stainless-steel bowl for homogenization. The process is repeated until the sampling depth is reached and sufficient material is available to satisfy the volume required for the analytical suite. Soil and sediment samples will be collected from pothole walls and drainages, respectively, using a stainless-steel spade or scoop and a stainless-steel bowl for homogenization before they are placed in sampling bottles.

Chain of Custody for Samples	The collection, screening, and transport of samples will be documented on standard forms generated by the Sample Management Office. These include sample collection logs, chain-of-custody forms, and sample container labels. Sample collection logs will be completed at the time of sample collection and signed by the sampler and a reviewer who will verify the logs for completeness and accuracy. Corresponding labels will be initialed and applied to each sample container, and custody seals will be placed around container lids or openings. Chain-of-custody forms will be completed and signed to verify that the samples are not left unattended.
Quality Assurance/ Quality Control Samples	Quality assurance and quality control samples will include field duplicate, equipment rinsate, and field trip blank samples. These samples will be collected following the current version of SOP 5059, "Field Quality Control Samples." Field duplicate samples will be collected at an overall frequency of at least 1 for every 10 regular samples as directed by Section XXVI of the June 2016 Consent Order.
Laboratory Analytical Methods	Analytical suites are identified in Table 1. All analytical methods are presented in the Laboratory's statement of work for analytical laboratories.
Investigation-Derived Waste Management	Investigation-derived waste generated during sampling activities will be managed in accordance with ER DIR-SOP-10021, "Characterization and Management of Environmental Programs Waste," available at http://permalink.lanl.gov/object/tr?what=info:lanl-repo/eprr/ERID-259199. The SOP incorporates the requirements of all applicable U.S. Environmental Protection Agency and New Mexico Environment Department (NMED) regulations, DOE orders, and Laboratory requirements.
Schedule	Sample collection is anticipated to be conducted in June 2017, The results will be presented in a summary report presented to NMED no later than August 31, 2017.

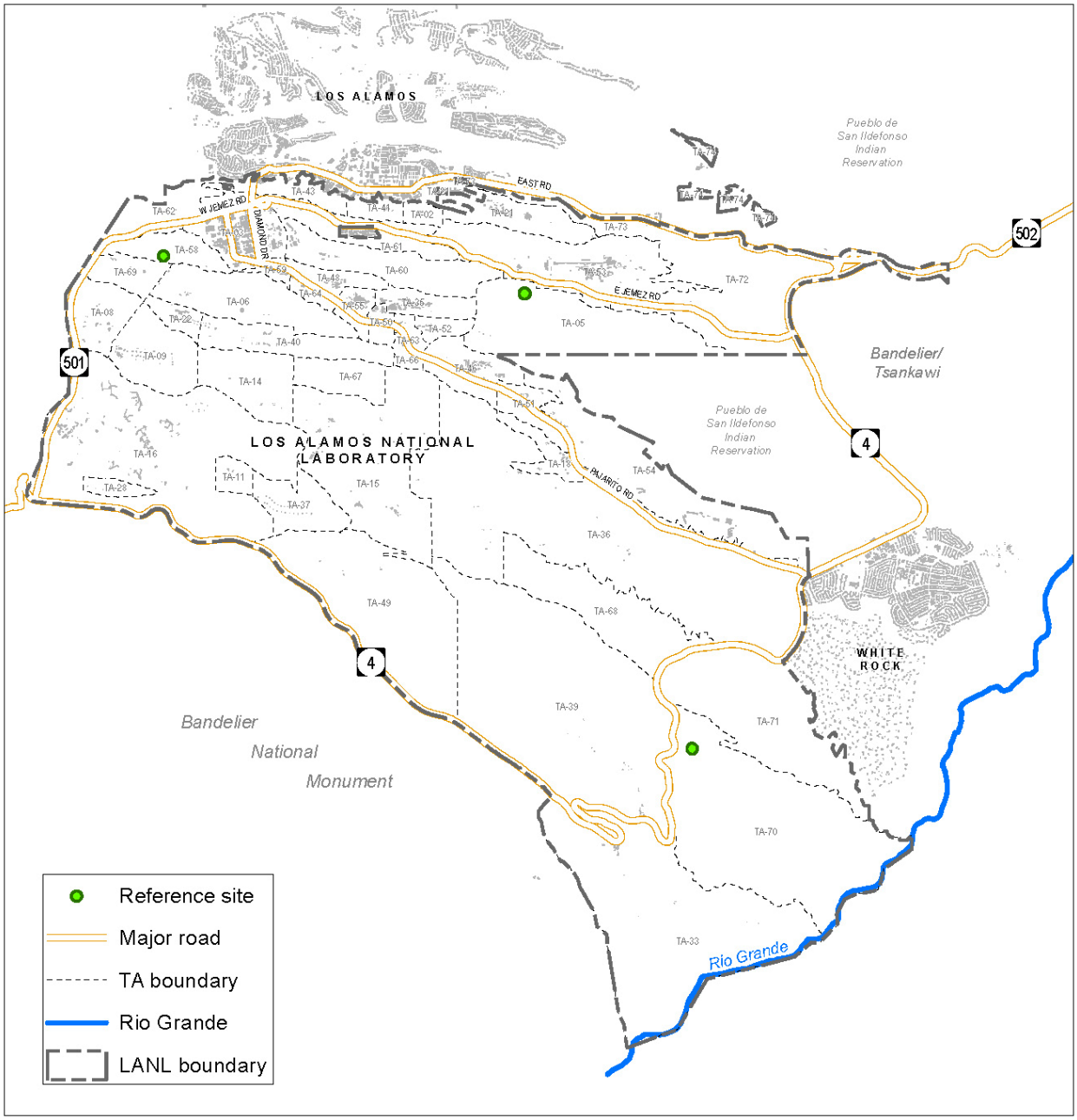

Figure 1 Proposed background reference sites

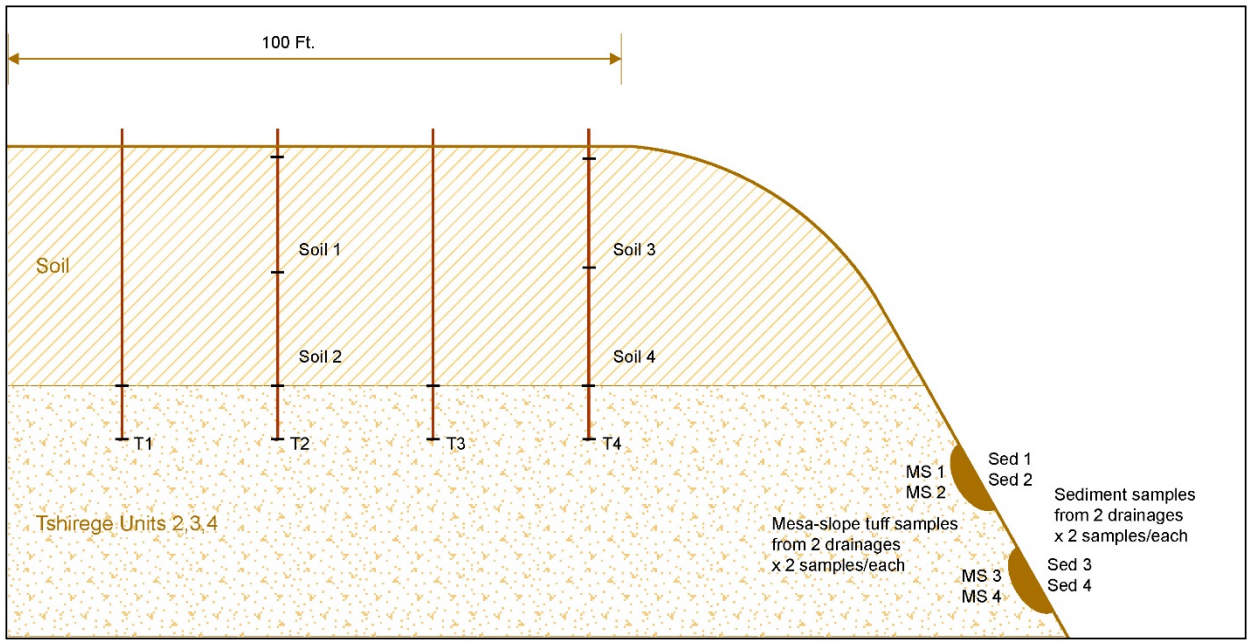

Figure 2 Schematic of proposed sampling for each reference site.

Table 1
Proposed Samples and Analyses for Each Reference Site

Objective	Sample Location	Location	Sample Interval	Target Analyte List Metals (SW-846: 6020)	pH (SW-846:9045C)	Total Organic Carbon (SW-846: 9060)	Hexavalent Chromium (SW-846: 7196)
Determine speciation of chromium in soil	Mesa top	Soil 1, Soil 3	0.0–1.0 ft bgs	X[a]	X	X	X
		Soil 2, Soil 4	1.0–2.0 ft bgs	X	X	X	X
Determine speciation of chromium in buried mesa-top tuff	Mesa top	T1, T2, T3, T4	0.0–1.0 ft below top of tuffb	X	X	X	X
Determine speciation of chromium in tuff exposed in mesa-slope drainages	Mesa-slope drainage channel	MS1, MS2, MS3, MS4	0.0–1.0 ft below top of tuff[b]	X	X	X	X
Determine speciation of chromium in sediment	Mesa-slope drainage channel	Sed 1, Sed 2 Sed 3, Sed 4	0.0–1.0 ft bgs	X	X	X	X

[a] X = Analysis proposed

[b] = The first tuff sample will be collected from several inches below the tuff interface or top of tuff to avoid material that may have infiltrated fractures and pore spaces in the tuff. The thickness of tuff samples collected will be sufficient to meet the volume requirement for laboratory analysis and may be less than 1 ft thickness.