Department of Energy
Field Office, Albuquerque
Los Alamos Area Office
Los Alamos, New Mexico 87544

DEC 20 1993

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William K. Honker, Chief
RCRA Permits Branch
Environment Protection Agency,
Region 6
1445 Ross Ave., Suite 1200
Dallas, Texas 75202-2733

Dear Mr. Honker:

This letter is in reply to the Notice of Deficiency (NOD) issued by Region 6 regarding the Resource Conservation and Recovery Act (RCRA) Facility Investigation Sampling Plans for D Building and Hillsides 138 and 140. These sampling plans address units located within Operable Unit 1078, at the Los Alamos National Laboratory (RCRA Permit Number NM0890010515). The NOD was received by this office on November 22, 1993. Enclosed is the reply to the NOD. Should you or your staff have any questions about the information submitted, please contact Steve Slaten of my staff at (505) 665-5050.

Sincerely,

Joseph C. Vozella, Chief
Environment, Safety and Health
Branch

LESH:4SS-002

Enclosure

cc:
See page 2

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cc w\enclosure:
K. Sisneros, NMED
1190 St. Francis Dr.
P.O. Box 26110
Santa Fe, NM 87502
T.Taylor, ES&H, LAAO
K. Bitner, ERPO, AL,

cc w/o enclosure:
R. Harris, EM-452, HQ
S. Slaten, ES&H, LAAO
K. Schenck, Scientech, LAAO
J. Shipley, ERWM, LANL, MS-J591
R. Vocke, EM-13, LANL, MS-M992
RPF, LANL, MS-M707

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possiblility of fine and imprisonment for knowing violation.

Document Title:

Notice of Deficiency Response for Operable Unit 1078, D Building and Hillsides 138 and 140

Name: for Warren D. Neff Date: 12/15/93

James F. Jackson
Deputy Director
Los Alamos National Laboratory

Name: Joseph Vozella Date: 12/20/93

Joseph Vozella, Chief
Environmental Safety & Health Branch
Los Alamos Area Office - DOE

RESPONSE TO THE NOTICE OF DEFICIENCY ISSUED FOR THE D BUILDING (STRATUM 1) SAMPLING PLAN AND THE HILLSIDES 138 AND 140 SAMPLING PLAN

D Building

Comments:

LANL understands that EPA's D Building comments 1 through 4 do not represent deficiencies in the sampling plans and, therefore, do not require a formal response. The comments do, however, warrant discussion and provide LANL the opportunity to clarify its position on several key issues.

1.) Background for the D Building Subarea SWMUs, p. 3 - The work plan indicates that if the health risk calculated for the entire SWMU aggregate is below the level of concern, then NFA will be proposed for all SWMUs in that group. DOE may propose individual SWMUs for NFA, but the risk assessment for each individual SWMU should meet the requirements of no risk at a target risk of 10^{-6}.

Response: LANL understands that solid waste management units (SWMUs) are treated individually for permit modifications. LANL also reiterates that the goals of the sampling plan are to provide soil sample data for screening and risk assessments. For the screening assessment, sample locations were targeted at individual SWMUs to determine if there are hazardous constituents at levels above SALs (i.e. contaminants of concern). However, risk assessment in the D Building area requires data from beyond the confines of individual SWMUs.

In the risk assessment, the D Building Subarea SWMUs are investigated together because of their proximity and because many of the SWMUs in this aggregate no longer exist as individually identifiable entities with distinct boundaries. The sampling plan was designed, not only to look at the SWMUs individually, but to evaluate the combined effect of the SWMUs on potentially exposed individuals. Risk calculations will not be averaged over the entire aggregate, but will be based on reasonable, site-specific exposure areas, which for TA-1 will generally be residential backyards. These exposure areas are approximately one-quarter the size of Stratum 1. LANL will only propose NFA for the aggregate if all possible exposure areas in the aggregate have a combined risk of less than 10^{-6} for carcinogens and a combined hazard index less than one for systemic toxicants.

2.) 2.3 Composite Pilot Study, p. 12 - Composite samples may dilute or otherwise misrepresent soil concentrations at specific points and therefore, should be avoided as the only inputs to risk assessment. Composite soil samples may only be used to assess the presence or absence of contamination. (Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), EPA, December, 1989).

EPA risk assessment guidance calls for calculating the 95 percent upper-confidence limit (95% UCL) on the arithmetic mean of site contamination. (Guidance for Data Usability in Risk Assessment (Part A), U.S. EPA Publication 4285.7-09A, 1992). Composites may be used in the risk assessment only to represent average concentrations. Therefore, composite soil samples would not provide the necessary analytical data to use in a risk assessment. To properly calculate the 95% UCL, discrete grab samples of soil would be required. In addition, the use of discrete samples allows for the determination of the vertical and horizontal extent of contamination at the site.

Response: The purpose of the composite pilot study in Section 2.3 is to evaluate the potential benefits of compositing methods. The study outlines how a combination of composite samples and discrete samples (e.g., such as those routinely taken for QA/QC) along with a re-analysis strategy can be used for a screening assessment as well as in a risk assessment. The study does not assume that **only** composite samples will be used as the inputs to either a risk assessment or screening assessment.

The approach described in Section 2.3 is consistent with EPA 1989 guidance that states, "For media such as soil, sediment, and ground water, composite samples generally may be used to assess the presence or absence of contamination; however, they may be used in risk assessment only to represent average concentrations . . . " This statement does not imply that composite samples cannot be used to form the necessary upper **95% confidence limits** on the contaminant of concern (COC) averages or arithmetic means over the requisite exposure units for use in a risk assessment (Gilbert, 1987). Composite samples only cannot be used effectively to estimate the upper **95th percentile** for the distribution of discrete measurements and may be inappropriate if the goal is to find hot spots.

Compositing is not only cost effective but may also improve the precision of the estimate for the COC mean concentrations over exposure units and their corresponding upper 95% confidence limits. Thus, compositing may be an ideal sample collection method for risk assessment. The goal of the D Building area pilot study is to numerically demonstrate the benefits of compositing.

3.) 3.1.2 D Building (Stratum 1) Decisions, p. 18 - LANL's definition of contaminant of concern (COC) is confusing. A hazardous constituent is still a hazardous constituent independent of it's concentration. Too much emphasis is being placed on the importance of screening action levels at the RFI stage. The primary objective should be to determine if a release has occurred and the extent of the release.

Response: LANL acknowledges and agrees that a hazardous constituent is still a hazardous constituent independent of its concentration. However, a hazardous constituent may not be a contaminant of concern (COC) with regard to health-based

considerations. COCs are constituents whose concentration levels in one or more environmental medium are at or above a level that may present a risk to human health or the environment. A COC is typically identified as a constituent which exceeds a media-specific screening action level (SAL), or exceeds background concentration when the background is greater than the SAL.

As described in the "Technical Assumptions for Data Collection and Evaluation" document, identification of COCs is an important component of site screening assessments. The screening assessment is designed to identify the highest levels of contamination at the site. If COCs are identified in the screening assessment, then further action (investigation or remediation) at the site will be required. The technical assumptions document also states that "Where no contaminants of concern have been identified, the site will be proposed for NFA". LANL interprets this to mean that determination of the extent of contamination is not required. In addition to determining which sites present a potential problem, COCs are used to focus risk assessments. The comparison of contaminant concentrations to SALs to focus investigations is consistent with EPA guidance in both proposed Subpart S and EPA's Risk Assessment Guidance for Superfund (1989). LANL believes that this approach is important for timely, cost-effective investigations.

4.) LANL should not use the term full suite of chemical analyses unless they are completing analyses for Appendix IX. Nor should the term total metals be used when the actual metal analysis is a subset of SW 846 method 6010. The use of these terms is misleading, and may imply that more analyses is being performed than is actually occurring.

Response: The term "full suite of analyses" was initially used by LANL in the "RFI Work Plan for OU 1078," Section 5.3.2.2 (approved by EPA Region VI in January, 1993) and is intended to define a list of analyses to be run on specified samples as identified in each SWMU sampling plan. It is LANL's understanding that EPA considers the term "full suite of analyses" to be potentially misleading in that it may imply that more analyses are being performed than are actually occurring. Therefore, in sampling work plans, OU 1078 will use a different term such as SWMU-specific analyte suite.

The term total metals is not intended to imply that the entire list of SW-846 Method 6010 metals will be analyzed, rather it refers to the analytical method in which the specific soil sample is subjected to a hot nitric acid leach which results in the release of ("total recoverable") metals in that soil sample into solution. This terminology is used to differentiate this method from the toxic characteristic leaching procedure (TCLP) test which uses a weak acid leaching procedure and is consistent with the use of the term "total" as defined in Chapter Three, Volume 1A of EPA SW-846. As stated in both the D Building and Hillsides 138/140 sampling plans, the list of inorganic constituents of concern is limited to 12 RCRA metals (Ag, As, Ba, Be, Cd, Cr, Hg, Ni, Pb, Sb, Se, Tl), and is based on archival information and process knowledge.

Deficiencies:

1.) <u>Introduction, p. 1</u> - This work plan does not include a sampling plan for Stratum 2 which is the northern portion of former D building. Text on page 1 indicates that Stratum 2 was sampled in March, 1993, as construction work was occurring at the Los Alamos Inn. Because EPA had significant comments on the March, 1993 work plan, DOE unofficially requested that EPA not submit a Notice of Deficiency on the work plan, but rather DOE would rewrite the work plan to address EPA concerns. Does DOE now want EPA to review the portion of the original March, 1993 work plan which addresses the sampling plan for Stratum 2? If not, then DOE should provide a work plan which addresses Stratum 2 area.

<u>Response</u>: LANL acknowledges that the D Building (Stratum 1) Sampling Plan does not include a sampling plan for Stratum 2. Stratum 2 was sampled in March 1993 in accordance with the March 1993 sampling plan, as construction was anticipated at the Los Alamos Inn. Four Stratum 2 locations (sample points 01-4026, 01-4027, 01-4029, and 01-4030) were resampled as part of the D Building (Stratum 1) Sampling Plan implementation in September 1993. LANL will submit the results along with the original March 1993 sampling plan within 60 days of the validation of the analytical data from the March sampling of Stratum 2 and those Stratum 2 locations resampled in September 1993. This information will also include either a proposal for no further action or a Phase II sampling plan. LANL estimates that this information will be provided to the EPA in late Spring, 1994.

2.) <u>2.1 Sampling for Screening Assessment, p. 8</u> - A rough comparison between Figure 1-2 (Ahlquist verifications sampling performed in the mid-1970's) and Figure 2-1 (currently proposed sampling locations) would indicate that many of the sampling locations chosen are not located where anticipated higher concentrations of contaminants might be. This contradicts the August 1993 work plan which says sampling is focused on locations for which there is a greater chance that contamination exists. LANL shall provide a map overlaying proposed new sampling locations with those in Figure 1-2. Figure 2-1 is so busy that it is difficult to determine the actual sampling locations. This new map should also indicate the six sampling points which are located in potential areas of residual contamination.

<u>Response:</u> Figure 2-2, a revised D Building Area map shows actual RFI sample locations in red and Ahlquist's sample locations in green. The six judgmental sampling points originally identified for location in potential areas of residual contamination include: 01-4050 through 01-4055. Additional or alternative locations with potential residual contamination were planned; however, the steep terrain behind the Los Alamos Inn prohibited drilling and sample collection at those locations.

Hillsides 138 and 140

Deficiencies:

1.) Tables 1 and 2 - LANL shall provide an explanation of the data as presented in these two tables. Specifically, for the data which is presented as being less than a certain number (e.g. <5.8), does this mean less than the detection limit or less than the quantification limit? An overall explanation of what type of data is presented is required. Data which is considered estimated should also be indicated. The detection limits for each metal should also be indicated.

Response: Table 1 (Hillside 140) and Table 2 (Hillside 138) have been substantially revised and are attached to this response and now include an explanation of the less-than values. The tables present all FY92 analytical results for the twelve RCRA metals specified in the Work Plan and associated gross radiological screening results for samples collected from Hillsides 138 and 140 in TA-1. A total of 46 soil samples consisting of 35 discrete samples, 4 field replicates, 2 laboratory replicates, and 5 composites from Hillside 138; and 60 soil samples consisting of 46 discrete samples, 6 field replicates, 1 laboratory replicate, and 7 composites from Hillside 140 were submitted for metals analyses. LANL and Subpart S screening action levels for metals are provided in the top portion of both tables. Shaded results indicate soil samples which exceeded the LANL SAL and/or the radiological criteria of 30 pCi/g gross beta activity or 20 pCi/g gross alpha activity. Arsenic and beryllium results marked with a "*" exceed the SAL, but are below background levels (see response 2 below).

Sample locations marked with "**" indicate that the method used by EM-9 to report less-than values is the sample detection limit. The sample detection limits are determined by the standard SW-846 approach for determining method detection limits and then calculating the sample-specific detection limit using the sample preparation and analysis data. This method provides a sample detection limit that represents at least the 95% confidence limit for the specific sample. The remaining data values in both tables were provided by IT Corporation's Oak Ridge laboratory, and report the sample quantitation limit.

2.) LANL shall provide a comparison between analysis results for metals and what is normal levels for the same metals in background samples. Background information must be provided with all analysis results.

Response: A list of background values are provided in Table 3 for comparison to results of analyses conducted for the twelve RCRA metals of concern at Hillsides 138 and 140. The numbers listed show the range and mean of the element concentration. The values are taken from a program currently underway at LANL to determine background concentrations of naturally-occurring elements in non-contaminated soils and tuff on the Pajarito Plateau. LANL believes that background concentrations for

tuff, rather than soil, provide a more direct comparison to concentrations of the soils sampled on Hillsides 138 and 140. Soils sampled in the background program are actually true pedogenic soils formed on relatively stable surfaces in a variety of textures and parent materials, and have undergone considerable geochemical changes that result in enrichment and/or depletion of various elements depending on the age of the soil and the stratigraphic horizon in which the sample was collected. The samples collected on Hillsides 138 and 140 were generally taken in relatively young colluvial and alluvial material which has not undergone the type of processes associated with pedogenic soils. Two metals (arsenic and beryllium) in the list of twelve have background values that exceed SALs. These are shown highlighted in the table.

It should also be noted that to date all elements considered in the background study were analyzed using delayed neutron activation except for beryllium, cadmium, and lead which were analyzed using standard Inductively Coupled Plasma and/or Atomic Absorption (ICP/AA) methods. Efforts are currently underway to provide background information for all elements of concern using standard EPA SW-846 methods. In a future phase report for OU 1078, statistical analyses will be conducted on Hillsides data to establish site-specific background values for use in determining if a release has occurred for elements that have local background values that are above SALs.

3.) <u>J2/TU, Hillside 140 FY92 Surface Soil Sampling Summary, p. 4</u> -

3a.) LANL shall provide a map indicating the location of all fifty-nine samples which were analyzed for metals and SVOCs. This map shall also indicate any samples which exceeded action levels for metals (antimony and thallium).

<u>Response:</u> 3a.) Figure 1 shows the locations of 43 discrete soil samples on Hillside 140 and 3 soil samples in the Septic Tank 135 outfall area that were analyzed for metals and SVOCs by depicting the sample location numbers in light blue. The remaining discrete samples submitted for metals and SVOC analyses which are not shown separately on the figure include six field replicates and one laboratory replicate (from discrete identical sample locations). Seven composite samples were also submitted for SVOC and metals analyses. The composites include at least one discrete sample analyzed for SVOCs and metals and are identified in light blue on the map. Samples which exceeded SALs for metals are identified with a small green triangle, while samples which exhibited gross alpha activity greater than 20 pCi/g are depicted by black squares, and samples which exhibited gross beta activity greater than 30 pCi/g are depicted with red circles.

The seven shaded thallium results exceeding the SAL on Table 1 are depicted with green triangles on Figure 1. The remaining thallium values reported as being less than a value that exceeds the SAL may in fact exceed the SAL; however, due to differences in analytical methods and the use of different laboratories, LANL cannot confirm whether the SAL was exceeded due to the fact that some results were reported as less than a detection limit that was greater than SALs. The only Hillside 140 sample split

with the EPA (01-1143) was reported below thallium detection limits by both LANL and EPA laboratories. Aliquots from a select number of these samples that LANL has archived will be submitted for re-analysis and the results will be presented in a phase report.

The seven samples which exceed the SAL for antimony are also depicted with green triangles on Figure 1. LANL has submitted aliquots from those seven samples for re-analysis, and results will be presented in a phase report. EPA Region VI did analyze the sample split from 01-1143 for antimony and results were below the detection limit.

3b.) The information presented in "Table 2, Hillside 140 Soil Samples Exceeding Criteria", does not correlate with information presented in Figure 1, Hillside 140. The information presented in Table 2 and Figure 1 both for Hillside 140 should match. There are 18 points on Figure 1 indicating sample results exceeding action levels for antimony; whereas, there are only 8 samples indicated in Table 2 as having exceeded action levels. Table 2, for Hillside 140 should include all the data which exceeded action levels for metals, even if those data are questionable. The questionable data may be indicated with an explanation in the table.

Response: 3b.) LANL acknowledges and apologizes for the discrepancy between the former Table 2 and Figure 1 for Hillside 140 results. As discussed in response 3a above, the data presented in Table 1 now corresponds with the data depicted in Figure 1 for Hillside 140. However, as discussed in response 3a above, not all discrete samples submitted for SVOC and metals analyses are shown on the map since field replicates, laboratory replicates, and composite samples have identical sample locations as the discrete samples. Soil sample locations which were analyzed for metals and SVOCs are depicted by light blue sample location numbers. The remaining discrete samples submitted for metals and SVOC analyses which are not shown on the figure include six field replicates, one laboratory replicate, and seven composite samples (from identical sample locations).

3c.) LANL shall provide a complete explanation of why the data for the seven antimony values are questionable.

Response: 3c.) Results of the data validation conducted on all FY92 Hillside sample data indicated that the nine antimony exceedances (seven on Hillside 140 and two on Hillside 138) may be the result of false positive results because samples in the immediate vicinity of those exceeding the SAL were all much lower and at a similar value, and because the nine samples were all part of the same EM-9 laboratory request number and may collectively be in error for antimony analysis. Additionally, EPA Region VI did analyze the sample split from 01-1143 for antimony and results were below the detection limit. LANL screened sample numbers 01-1143, 01-5016, and 01-5025 for antimony using X-ray fluorescence (XRF) with a detection limit for antimony of approximately 33 ppm. These routine screening results showed no antimony above the detection limit. As stated above, aliquots from the seven archived samples were

recently resubmitted for antimony analysis. These results will be available in early January 1994 and will be reported to EPA upon receipt and validation.

4.) <u>2.3 SE Los Alamos Inn, Hillside 138 FY92 Surface Soil Sampling, p. 5 and Table 2</u> -

4a.) The tables in the work plan are misnumbered and revised tables should be submitted with the correct numbers (Table 1 is Hillside 138 and Table 2 is Hillside 140).

<u>Response:</u> 4a.) LANL acknowledges and apologizes for the mislabeled table cover sheets and misnumbered tables in the sampling plan. As discussed in response 3 above, the tables have been substantially revised. Table 1 presents Hillside 140 metals and gross radiological screening data and corresponds to Figure 1; Table 2 presents Hillside 138 metals and gross radiological screening data and corresponds to Figure 2.

4b.) LANL may propose action levels which are more stringent than those proposed in Subpart S, but they may not propose action levels which are any less stringent than those proposed in Subpart S. The action level for antimony should be changed to 30 ppm.

<u>Response:</u> 4b.) The SALs in the LANL Installation Work Plan (IWP) are different from the action levels listed in Proposed 40 CFR 264 Subpart S either because: 1) LANL developed these action levels following the Subpart S methodology and incorporated more recent toxicity values available from EPA's Integrated Risk Information System (IRIS) data base and Health Effects Assessment Summary Tables (HEAST), or 2) Subpart S action levels represent numbers rounded to one significant figure (i.e., action level = 24 mg/kg and Subpart S reported 20 mg/kg). The following table illustrates several examples of discrepancies in action levels and provides an explanation as to the source of these discrepancies. The method for calculation of SALs is described in detail in Appendix J of the 1993 LANL IWP.

The SAL for antimony is 32 ppm versus the slightly lower Subpart S action level of 30 ppm. Subpart S provides several "example" levels but the user of this guidance document is free to calculate action levels independently using the provided equations and assumptions, and to use updated toxicity values when necessary. The calculation for the two antimony values is the same; however, the Subpart S value was rounded to one significant digit. The Subpart S value is higher for some constituents than the LANL SAL because the value was rounded up, which proves to be less conservative than the LANL SAL. The SAL for antimony (32 ppm) should remain the appropriate value for LANL's purposes because it was calculated following the Subpart S guidance, adequately protects human health, and is consistent with the value listed in LANL's IWP.

Metal	Proposed Subpart S Action Level in Soil (mg/kg)	LANL SAL in Soil (mg/kg)	Comments
Antimony	30	32	Subpart S rounded final number.
Arsenic	80	0.4	RCRA used toxicity value for systemic effects; LANL used the carcinogenic toxicity value. Arsenic is a known human carcinogen (Class A).
Barium	4000	5600	Toxicity value was revised by the EPA from 0.05 mg/kg-day to 0.07 mg/kg-day.
Beryllium	0.2	0.16	Subpart S rounded final number.
Cadmium	40	80	Subpart S used toxicity value of 5E-04 mg/kg-day (water); LANL used 1E-03 mg/kg-day (food/soil).
Mercury	20	24	Subpart S rounded final number.
Nickel	2000	1600	Subpart S rounded final number.
Silver	200	400	Toxicity value was revised by the EPA from 3E-03 mg/kg-day to 5E-03 mg/kg-day.

4c.) The action level for mercury is 20 ppm in the proposed Subpart S, and that is the action level which should be used by Los Alamos. A comparison of this action level (20 ppm) with the data presented for Hillside 138 indicates that all but two of the samples analyzed exceeded the action level for mercury.

Response: 4c.) The LANL SAL for mercury is 24 ppm versus the slightly lower Subpart S action level of 20 ppm. As discussed in response 4b above, the method of calculation for the two mercury values is the same; however, the Subpart S value was rounded to one significant digit. In several cases for different chemical constituents, the Subpart S value is higher than the LANL SAL because the value was rounded up, which proves to be less conservative than the SAL. The SAL for mercury (24 ppm) should remain the appropriate value for LANL's purposes because it is no less accurate than the Subpart S action level, adequately protects human health, and is consistent with the value listed in LANL's IWP.

4d.) While the transportation and migration rates of some metals may closely parallel that of some radioactive isotopes, no conclusions concerning collocation and codeposition of metals and radioactivity may be drawn from the sampling results from the Hillside samples. The original hillsides sampling plan was not developed to demonstrate collocation of metals and radioactivity, rather the sampling plan was designed to locate points of above background radioactivity

and additional analyses were conducted at those points for metals and SVOCs. In fact, the presence of above background radioactivity in the drainage where no action levels for metals were exceeded might tend to indicate that certain species of radioactivity are more mobile than some of the metals of concern. Therefore, the sentence indicating the initial data suggests codeposition and collocation of metals and radioactivity in this section is inaccurate and should be removed.

Response: 4d.) LANL acknowledges that the original hillsides sampling plan was not developed specifically to demonstrate collocation of metals and radioactivity, and that LANL is not proposing to use the codeposition and collocation theory in any decision-making process at this point, other than as an indicator of contamination for judgmental sample locations. Because of applying the collocation theory on the hillsides in selecting sample locations, we provide the following reasons as justification.

Traditionally, discussion of variable constituent mobilities refers to the movement of constituents in the subsurface environment where the mechanisms for movement are limited. Given the right conditions, hazardous constituents such as halogenated hydrocarbons may move in the subsurface at a different rate (e.g., as a vapor) than plutonium which cannot move as a vapor or a gas. However, subsurface movement of constituents is not an issue for the hillsides in TA-1. Constituent mobility of non-volatile compounds on the surfaces of canyon hillsides depends on gravity and the medium or matrix in which the constituent is situated. Surface soils (and associated constituents) would be expected to move via: 1) dispersion by the wind, 2) re-entrainment in surface water and movement along with running water, and 3) by surface creep wherein particles are moved down a hillside when disturbed by animals, incorporation with vegetation, or association with snow or ice. None of these mechanisms should cause a stratification of constituents in a lateral sense. Some constituents may be moved by surface water while others may not in situations where discharges contained ions or molecules in solution (soluble constituents). If these ions were not subsequently hydrolyzed or otherwise precipitated out on the soil substrate or interstices of soil particles, they could be re-solubilized by coming into contact with surface water. These soluble constituents would, however, be the first constituents moved out of the initial deposition area, and in the 35 years since the discharges ceased on Hillsides 138 and 140, any such soluble constituents should have been moved off the hillsides and into Los Alamos Canyon.

LANL also expected to find above background levels of radioactivity in hillside drainages where SALs for metals are not exceeded based on the following rationale. Where concentrations of radionuclides decrease, the detectability at insignificant levels is still possible. Where concentrations of inorganics decrease below SALs, levels are reached at which detection is unlikely. Since concentrations of insoluble constituents on a static substrate decrease with distance from the source, there will be locations at various distances from the outfall areas at which collocated inorganics fall below and radionuclides remain above their respective detection levels.

4e.) LANL shall provide a map indicating the location of the 44 samples analyzed for metals for Hillside 138. Samples exceeding action levels should be indicated.

Response: 4e.) The map of Hillside 138 (Figure 2) shows the location of 35 discrete soil samples (location 01-5128 represents two samples) which were analyzed for metals by depicting the sample location numbers in light blue. The remaining discrete samples submitted for metals and SVOC analyses which are not shown on the figure include four field replicates, two laboratory replicates, and five composite samples (from identical sample locations). Samples which exceeded the LANL metals SALs are identified with a small green triangle, while samples which exhibited gross alpha activity greater than 20 pCi/g are depicted by black squares, and those which exhibited gross beta activity greater than 30 pCi/g are depicted with red circles.

5.) Section 3.1.2 Scope of Surface Sampling, p. 7 - LANL shall provide a map which shows the location of the proposed sampling grid including potential sampling points.

Response: LANL has provided two additional maps which show FY92 soil sample locations (in green), FY93 soil sample locations (in red), and FY93 single stage water sampling locations (in blue). Hillside 138 sample locations are provided in Figure 3 and Hillside 140 sample locations are provided in Figure 4.

6.) Section 3.1.3 Field Screening and Sample Analyses, p. 8 -

6a.) How will field screening be implemented with the XRF? An explanation of the manner in which this instrument will be used should be provided.

Response: 6a.) LANL did not propose to use X-ray fluorescence (XRF) as a field screening technique during the implementation of the hillsides sampling plan. The Spectrace 9000 was acquired by LANL after the completion of the FY92 Hillsides sampling effort, and was used on a subset of archived samples as a quality assurance check for spurious analytical metals data. LANL has found that with the Spectrace 9000, only silver, nickel, lead, barium, selenium, and potentially chromium can be measured in soils at concentrations less than SALs. The other six metals of interest to LANL at TA-1 cannot be measured with the XRF at concentrations approaching their respective SALs. Additionally, soil moisture and particle size greatly effect XRF results when samples are screened in the field. For these reasons, and because LANL feels that radiological measurements are most useful in judgmentally locating sample points, LANL has not used the XRF to judgmentally choose soil sample locations. All soil samples collected on the mesa top and from Hillsides 138 and 140 during FY93 were run for some XRF metals in the EM-8 count laboratory, again for quality assurance checks for future analytical metals data.

6b.) Sample selection for metals analysis should be based on field screening results with the XRF rather than on radioactivity of greater than 17,000 counts per minute. The extent of the metals contamination should be defined, and samples should be taken preferentially near areas with confirmed contamination rather than randomly selected.

Response: 6b.) Since radioactivity can be measured (activity, in picocuries) on soils at much lower levels than can concentrations of hazardous constituents on soils, LANL has used radioactivity (as measured with field screening instruments) for defining judgmental sample locations on hillsides where both hazardous and radioactive constituents were discharged. Relatively larger concentrations of hazardous constituents must be present to be detected using chemical measuring or screening techniques. For example, 1 pCi/g of Pu-239 detected on a gram of soil is equivalent to 1.63×10^{-11} grams of Pu-239. Twenty pCi/g of Pu-239 (alpha activity) is equivalent to 3.26^{-10} grams of Pu-239. When compared to the metals levels that can be measured using XRF (the primary screening technique available), gross alpha measurements are more sensitive by a factor of four orders of magnitude. The detection limit for lead using the XRF instrument available to LANL (Spectrace 9000) is 18 micrograms of lead per gram of soil. (Only barium has a lower XRF detection limit which is 10 micrograms of barium per gram of soil).

FY92 sampling of soils in the drainages immediately below discharge points on Hillside 138 (where hazardous constituents such as mercury are measurable) exhibit radioactivity, while constituents above SALs are no longer found in soils in the same drainage at distances further away from the discharge points where radioactivity on soil is still detectable. (The mercury levels are also below the XRF detection limit in the drainage below the outfall area).

The only field screening instruments capable of identifying contamination in the drainages at levels observed using ICP or AA methods and radiochemistry on FY92 samples are beta and/or gamma detectors. The use of radiological screening instruments including the FIDLER (low energy X- and gamma-ray detector) has resulted in successfully locating judgmental samples. Mapping of FIDLER counts for FY92 (and then FY93) sample locations provided the data representation used to infer that 17,000 counts per 200 seconds is an appropriate threshold for identifying which samples would be submitted for the hillside-specific analyte list. Data that demonstrates the utility of LANL's approach will be provided in an upcoming phase report.

7.) Section 3.2.3 Field Screening and Sample Analyses, p. 10 - The same comment as 6b. above. LANL should not presume that all metals are collocated with areas of above background radioactivity.

Response: LANL's response is included in response 4d and 6b above.

References:

EPA, 1986, Test Methods for Evaluating Solid Wastes; Physical/Chemical Methods, SW-846, Third Edition, Washington D.C.

EPA, 1989, Risk Assessment Guidance for Superfund, Volume I, Part A: Human Health Evaluation Manual, OSWER OS-230, 9285.701A.

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TABLE 1

Hillside 140 Soil Samples

TABLE 1
Hillside 140 Soil Samples

Sample Location	Ag mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Hg mg/Kg	Ni mg/Kg	Pb mg/Kg	Sb mg/Kg	Se mg/Kg	Tl mg/Kg	ALPHA pCi/g	BETA pCi/g
LANL SAL-->	400	0.4	5600	0.16	80	400	24	1600	(500)	32	400	6.4		
Subpart S SAL-->	200	80	4000	0.2	40	400	20	2000		30	200	6		
01-1017	<2.2	0.9 *	34.6	<1.1	<1.1	<2.8	0.3	<5.6	<11.2	<22.4	<1.7	<56.1	5.7	28.5
01-1045	<2.5	1.6 *	47.9	<1.2	<1.2	3.4	0.3	<6.2	40.0	<24.8	<1.9	<62.	2.9	15.6
01-1083	<2.4	1.1 *	40.9	<1.2	<1.2	3.5	0.3	<5.9	15.9	<23.5	<1.8	<58.8	2.2	15.3
01-1089	<2.3	0.9 *	53.1	<1.1	<1.1	4.2	0.1	<5.7	15.9	<23.	<1.7	<57.5	6.2	22.7
01-1090	<2.1	<0.4	12.2	<1.1	<1.1	<2.6	0.2	<5.3	<10.6	<21.2	<1.6	<53.	3.4	17.2
01-1094	<2.3	1.6 *	46.5	<1.2	<1.2	3.5	0.3	<5.8	32.5	<23.2	<1.7	157.0	154.6	670.2
01-1095	<2.4	1.8 *	32.8	<1.2	<1.2	<3.	0.3	<6.	29.9	<23.8	<1.8	80.9	50.8	147.8
01-1096	<2.3	1.2 *	28.3	<1.1	<1.1	<2.9	0.3	<5.7	17.5	<22.8	<1.7	<57.	3.8	14.5
01-1096 Field Rep.	<2.3	1.1 *	27.9	<1.1	<1.1	<2.9	0.3	<5.7	13.6	<22.9	<1.7	<57.3	NC	NC
01-1097	<2.5	0.6 *	48.9	<1.2	<1.2	3.7	0.3	<6.2	34.6	<24.9	<1.9	146.0	121.1	445.2
01-1098	<2.3	0.7 *	17.0	<1.2	<1.2	<2.9	0.1	<5.8	17.0	<23.4	<1.8	<58.5	8.6	36.3
01-1109	<2.3	0.6 *	5.8	<1.1	<1.1	<2.9	0.3	<5.7	<11.5	<22.9	<1.7	<57.3	113.0	220.6
01-1110	<2.5	1.4 *	53.2	<1.2	1.2	3.1	0.3	<6.2	33.0	<24.9	1.9	169.0	84.7	188.3
01-1111	<2.	<0.4	13.5	<1.	<1.	<2.5	0.2	<5.1	13.7	<20.4	<1.5	<51.	26.6	69.1
01-1111 Field Rep.	<2.2	1.4 *	23.8	<1.1	<1.1	<2.7	0.3	<5.4	19.4	<21.8	<1.6	68.5	24.9	88.5
01-1112	<2.2	1.2 *	31.0	<1.1	<1.1	4.2	0.3	<5.6	20.3	<22.2	<1.7	78.7	17.2	52.3
01-1113 **	<1. DL	2.5 *	228.0	2.2 *	<0.7 DL	6.3	<0.0 DL	2.9	35.0	74.0	<0.2 DL	<0.2 DL	4.4	22.2
01-1142 **	<1. DL	1.6 *	284.0	3.3 *	<0.7 DL	11.5	0.0	7.6	60.0	119.0	0.2	<0.2 DL	6.7	32.2
01-1143 **	<1. DL	1.7 *	257.0	2.8 *	<0.7 DL	11.6	0.0	6.9	64.0	107.0	0.3	<0.2 DL	5.8	26.8
01-1144	<2.2	0.9 *	30.5	<1.1	<1.1	<2.8	0.2	<5.6	21.3	<22.5	<1.7	<56.2	4.1	19.4
01-1144 Field Rep.	<2.2	1.1 *	31.4	<1.1	<1.1	<2.8	0.3	<5.5	16.7	<22.1	<1.7	<55.4	4.1	19.4
01-1147	<2.6	1.3 *	34.0	<1.3	<1.3	<3.2	0.1	<6.4	26.4	<25.7	<1.9	<64.2	3.9	15.4
01-1156 **	<1. DL	0.8 *	227.0	2.2 *	<0.4 DL	8.1	<0.0 DL	5.4	29.0	87.0	<0.2 DL	<0.2 DL	1.0	12.8
01-1157 **	<1. DL	1.5 *	309.0	2.7 *	<0.7 DL	10.7	<0.0 DL	5.7	38.0	99.0	0.2	<0.2 DL	8.2	25.0

= Screening Action Level (SAL) exceeded

= Values in excess of 20 pCi/g for Alpha and 30 pCi/g for Beta

* = SALs exceeded, but at or below background level as determined from samples of the Bandelier Tuff

NC = Not Counted

** = Analysis performed by EM-9

<1. DL = Less than the sample detection limit, all other "<" are less than the sample quantitation limit

Pb SAL (500) = Soil screening action level based on EPA OSWER Directive 9355.4-02, "Interim Guidance on Establishing Lead Cleanup Levels at Superfund Sites', Office of Solid Waste and Emergency Response 1989.

TABLE 1 (continued)
Hillside 140 Soil Samples

Sample Location	Ag mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Hg mg/Kg	Ni mg/Kg	Pb mg/Kg	Sb mg/Kg	Se mg/Kg	Tl mg/Kg	ALPHA pCi/g	BETA pCi/g
LANL SAL-->	400	0.4	5600	0.16	80	400	24	1600	(500)	32	400	6.4		
Subpart S SAL-->	200	80	4000	0.2	40	400	20	2000		30	200	6		
01-1162	<2.3	<0.5	53.0	<1.1	<1.1	10.0	0.8	<5.7	13.3	<22.9	<1.7	<57.2	3.8	13.2
01-1168	<2.3	1.3 *	56.3	<1.1	<1.1	82.8	0.1	<5.7	36.8	22.8	<1.7	<56.9	3.1	14.0
01-1168 Field Rep.	<2.2	0.4 *	41.4	<1.1	<1.1	28.7	0.1	<5.6	20.8	<22.4	<1.7	<56.1	NC	NC
01-1174	<2.2	<0.4	21.8	<1.1	<1.1	<2.8	0.1	<5.6	<11.1	<22.3	<1.7	<55.7	3.1	15.6
01-1202	<2.1	0.7 *	29.9	<1.	<1.	<2.6	0.2	<5.2	15.6	<20.8	<1.6	63.5	2.7	17.3
01-1202 Field Rep.	<2.1	0.7 *	30.2	<1.1	<1.1	<2.7	0.2	<5.3	13.9	<21.2	<1.6	<53.	2.7	17.3
01-1248	<2.4	0.9 *	16.5	<1.2	<1.2	<2.9	0.1	<5.9	12.4	<23.6	<1.8	<58.9	5.7	20.2
01-1249	<2.4	1.2 *	28.5	<1.2	<1.2	<3.	0.1	<5.9	<11.8	<23.6	<1.8	<59.	3.2	15.0
01-1251 **	1.3	1.2 *	250.0	3.0 *	<0.7 DL	9.7	<0.0 DL	4.7	45.0	114.0	0.2	<0.2 DL	7.5	32.8
01-1253	<2.3	0.7 *	32.7	<1.1	<1.1	<2.8	0.1	<5.7	16.5	<22.8	<1.7	<56.9	3.2	13.8
01-1253 Field Rep.	<2.2	0.6 *	34.8	<1.1	<1.1	<2.8	<0.1	<5.6	15.5	<22.3	<1.7	<55.7	2.4	14.2
01-1256 **	<1. DL	1.1 *	239	2.9 *	<0.7 DL	7	0.0	3.8	39.0	99.0	0.2	<0.2 DL	4.1	25.9
01-1260	<2.2	0.6 *	47.9	<1.1	<1.1	<2.7	<0.1	<5.5	15.8	<21.9	<1.6	<54.7	3.9	16.0
01-1300 **	<1. DL	5.9 *	248.0	3.2 *	<0.7 DL	6.4	<0.0 DL	4.0	30.0	6.0	<0.2 DL	<20. DL	4.1	20.3
01-1301 **	1.0	0.9 *	14.0	<1. DL	0.1	2.2	0.1	<1.5 DL	185.0	0.2	<0.2 DL	<0.2 DL	12.9	61.8
01-1302 **	<1. DL	0.8 *	226.0	2.2 *	<0.7 DL	2.4	<0.0 DL	2.0	16.0	<4. DL	<0.2 DL	<20. DL	2.4	13.2
01-1303 **	<1. DL	3.0 *	230.0	2.8 *	<0.7 DL	5.0	0.0	3.0	36.0	<4. DL	<0.2 DL	<20. DL	5.8	23.7
01-1304 **	2.0	1.5 *	32.0	<1. DL	0.3	3.9	0.2	<1.5 DL	28.6	0.2	<0.2 DL	<0.2 DL	12.0	40.4
01-1305 **	<1. DL	1.2 *	39.0	<1. DL	0.4	4.4	0.1	<1.5 DL	50.0	0.4	<0.2 DL	<0.2 DL	9.3	34.4
01-1305 Lab Rep. **	<1. DL	1.1 *	33.0	<1. DL	--	--	0.1	--	--	--	--	<0.2 DL	--	--
01-1306 **	<1. DL	1.4 *	277.0	3.7 *	<0.7 DL	9.6	0.0	7.0	49.0	<4. DL	<0.2 DL	<20. DL	12.7	44.1
01-1307 **	<1. DL	2.6 *	237.0	3.3 *	<0.7 DL	7.7	<0.0 DL	4.0	45.0	<4. DL	<0.2 DL	<20. DL	5.1	22.8
01-1308 **	<1. DL	1.7 *	27.0	<1. DL	0.3	3.5	0.1	<1.5 DL	32.6	0.12	<0.2 DL	<0.2 DL	10.6	47.7
01-1309 **	<1. DL	1.4 *	223.0	2.7 *	<0.7 DL	28.2	0.0	39.0	<4. DL	<4. DL	<0.2 DL	<20. DL	7.2	22.2

= Screening Action Level (SAL) exceeded

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Pb SAL (500) = Soil screening action level based on EPA OSWER Directive 9355.4-02, "Interim Guidance on Establishing Lead Cleanup Levels at Superfund Sites', Office of Solid Waste and Emergency Response 1989.

TABLE 1 (continued)
Hillside 140 Soil Samples

Sample Location	Ag mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Hg mg/Kg	Ni mg/Kg	Pb mg/Kg	Sb mg/Kg	Se mg/Kg	Tl mg/Kg	ALPHA pCi/g	BETA pCi/g
LANL SAL-->	400	0.4	5600	0.16	80	400	24	1600	(500)	32	400	6.4		
Subpart S SAL-->	200	80	4000	0.2	40	400	20	2000		30	200	6		
01-1310 **	<1. DL	2.9 *	62.0	<1. DL	0.5	6.9	0.2	<1.5 DL	63.4	0.2	<0.2 DL	<0.2 DL	17.9	78.0
01-1311 **	4.5	0.8 *	25.0	<1. DL	0.2	3.3	0.1	<1.5 DL	29.4	0.2	<0.2 DL	<0.2 DL	9.9	40.1
01-1312 **	<1. DL	3.2 *	32.0	<1. DL	3.4	16.5	0.0	37.0	36.9	0.3	<0.2 DL	<0.2 DL	63.4	249.0
01-1313 **	<1. DL	0.7 *	39.0	<1. DL	0.4	1.7	0.0	37.2	10.5	0.4	<0.2 DL	<0.2 DL	62.0	148.6
01-1314 **	<1. DL	2.5 *	48.0	<1. DL	0.5	4.0	0.1	<1.5 DL	1.9	0.2	<0.2 DL	<0.2 DL	25.1	101.4
01-1080 - 01-1086 C	<2.3	1.2 *	35.1	<1.2	<1.2	<2.9	0.3	<5.9	13.9	<23.5	<1.8	<58.7	3.4	14.0
01-1087 - 01-1093 C	<2.3	1.5 *	37.7	<1.1	<1.1	<2.9	0.3	<5.7	18.0	<22.9	<1.7	<57.3	6.3	27.5
01-1160 - 01-1164 C	<2.3	1.1 *	59.7	<1.2	<1.2	5.5	0.2	<5.8	21.1	<23.3	<1.7	<58.1	2.0	11.8
01-1165 - 01-1171 C	<2.3	<0.5	50.0	<1.1	<1.1	4.3	0.1	<5.7	19.2	<22.7	<1.7	<56.8	3.2	13.9
01-1172 - 01-1176 C	<2.2	<0.4	24.9	<1.1	<1.1	<2.8	0.1	<5.6	11.7	<22.3	<1.7	<55.9	4.1	13.2
01-1250 - 01-1254 C	<2.3	1.1 *	39.7	<1.2	<1.2	<2.9	0.1	<5.8	21.2	<23.2	<1.7	<58.	5.1	16.6
01-1255 - 01-1260 C	<2.3	1.1 *	46.6	<1.1	<1.1	2.8	0.1	<5.7	20.8	<22.7	<1.7	<56.7	4.3	17.3

= Screening Action Level (SAL) exceeded

= Values in excess of 20 pCi/g for Alpha and 30 pCi/g for Beta

* = SALs exceeded, but at or below background level as determined from samples of the Bandelier Tuff

NC = Not Counted

** = Analysis performed by EM-9

<1. DL = Less than the sample detection limit, all other "<" are less than the sample quantitation limit

Pb SAL (500) = Soil screening action level based on EPA OSWER Directive 9355.4-02, "Interim Guidance on Establishing Lead Cleanup Levels at Superfund Sites', Office of Solid Waste and Emergency Response 1989.

C = Composite samples (one or more discrete samples were analyzed from this composite)

TABLE 2

Hilside 138 Soil Samples

TABLE 2
Hillside 138 Soil Samples

Sample Location	Ag mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Hg mg/Kg	Ni mg/Kg	Pb mg/Kg	Sb mg/Kg	Se mg/Kg	Tl mg/Kg	ALPHA pCi/g	BETA pCi/g
LANL SAL-->	400	0.4	5600	0.16	80	400	24	1600	(500)	32	400	6.4		
Subpart S SAL-->	200	80	4000	0.2	40	400	20	2000		30	200	6		
01-5004 **	<1. DL	2.9 *	144.0	<10. DL	0.1	10.6	0.2	6.5	16.6	0.2	0.3	<0.1 DL	3.2	10.6
01-5011 **	<1. DL	1.5 *	108.0	<10. DL	0.2	8.5	1.5	5.3	15.9	0.1	<0.2 DL	<0.1 DL	1.2	10.2
01-5016 **	1.7	1.9 *	229.0	2.9 *	0.4	29.0	18.1	5.8	63.2	102.0	<0.2 DL	<0.2 DL	21.5	10.9
01-5018 **	13.8	3.5 *	49.0	<1. DL	0.7	<223 DL	373.0	1.8	548.0	0.5	0.4	<2. DL	256.6	19.2
01-5025 **	1.1	1.6 *	200.0	3.0 *	0.4	10.9	1.7	6.1	39.0	107.0	0.2	<0.2 DL	3.8	14.0
01-5028 **	14.3	3.6 *	75.0	<1. DL	1.8	<202 DL	1416.7	2.3	430.0	2.1	0.6	<2. DL	312.7	27.0
01-5028 Field Rep. **	32.7	6.8 *	100.0	<1. DL	1.9	<311 DL	454.0	1.6	667.0	3.5	0.6	<2. DL	NC	NC
01-5041	<1.	4.3 *	100.0	<0.6	0.6	3.3	0.0	<3.6	<23.4	<5.4	0.3	<19.	0.8	12.0
01-5046	<1.	1.7 *	51.9	<0.3	<0.5	2.5	0.0	<3.6	<15.9	<5.4	<0.2	<19.	1.7	13.2
01-5048 **	23.2	2.2 *	36.3	<1. DL	<1. DL	234.0	26.87	24.0	170.0	<1. DL	0.3	<1. DL	464.0	38.4
01-5049 **	6.0	1.5 *	16.0	<1. DL	0.2	<90 DL	21.0	<1.5 DL	100.0	0.2	0.2	<2. DL	157.5	30.6
01-5049 Field Rep. **	5.0	1.5 *	20.0	<1. DL	0.3	<159 DL	22.0	<1.5 DL	124.0	0.3	0.2	<2. DL	116.3	24.0
01-5056 **	2.6	1.8 *	35.6	<1. DL	<1. DL	51.2	20.6	21.9	62.8	<1. DL	<0.2 DL	<1. DL	111.6	14.2
01-5057 **	12.7	1.5 *	30.9	<1. DL	<1. DL	130.0	21.5	21.1	180.0	<1. DL	0.2	<1. DL	724.6	112.2
01-5057 Lab Rep. **	16.2	1.6 *	--	<1. DL	0.4	124.0	--	--	--	--	0.2	--	--	--
01-5058 **	26.4	2.8 *	63.8	1.2 *	<1. DL	310.0	213.3	33.0	266.0	<1. DL	0.4	<1. DL	450.9	41.2
01-5058 Lab Rep. **	24.1	2.7 *	--	--	--	--	--	--	--	--	0.3	--	--	--
01-5061 **	<1. DL	2.4 *	88.0	<10. DL	0.8	4.3	0.2	4.1	23.6	0.3	0.2	<0.1 DL	4.8	14.4
01-5065 **	<1. DL	0.4 *	<10. DL	<10. DL	0.1	0.4	0.0	<1.5 DL	3.1	<0.1 DL	<0.2 DL	<0.1 DL	4.6	15.5
01-5080 **	25.8	1.6 R *	30.0	<1. DL	0.6 R	<287 DL	146.7	<1.5 DL	249.0	0.2	<0.4 R DL	<2. DL	626.8	79.7
01-5081 **	20.7	2.8 R *	21.0	<1. DL	0.8 R	<340 DL	112.0	<1.5 DL	279.0	0.1	<0.2 R DL	<2. DL	644.3	43.3
01-5082 **	36.2	3.9 R *	54.0	<1. DL	0.9 R	<382 DL	341.7	<1.5 DL	324.0	0.1	<0.2 R DL	<2. DL	872.8	88.5

= Screening Action Level (SAL) exceeded

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* = SALs exceeded, but at or below background level as determined from samples of the Bandelier Tuff

R = Rejected based on data validation results

NC = Not Counted

** = Analysis performed by EM-9

<1. DL = Less than the sample detection limit, all other "<" are less than the sample quantitation limit

Pb SAL (500) = Soil screening action level based on EPA OSWER Directive 9355.4-02, "Interim Guidance on Establishing Lead Cleanup Levels at Superfund Sites', Office of Solid Waste and Emergency Response 1989.

TABLE 2 (continued)
Hillside 138 Soil Samples

Sample Location	Ag mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Hg mg/Kg	Ni mg/Kg	Pb mg/Kg	Sb mg/Kg	Se mg/Kg	Tl mg/Kg	ALPHA pCi/g	BETA pCi/g
LANL SAL-->	400	0.4	5600	0.16	80	400	24	1600	(500)	32	400	6.4		
Subpart S SAL-->	200	80	4000	0.2	40	400	20	2000		30	200	6		
01-5083 **	9.5	1.8 R *	62.0	<1. DL	0.4 R	<239 DL	139.0	<1.5 DL	136.0	0.1	<0.2 R DL	<2. DL	258.4	29.5
01-5084 **	11.5	2.4 R *	50.0	<1. DL	0.5 R	<313 DL	176.7	<1.5 DL	176.0	0.1	<0.2 R DL	<2. DL	180.0	31.4
01-5085 **	10.9	1.3 R *	22.0	<1. DL	0.2 R	<398 DL	29.0	<1.5 DL	104.0	0.1	<0.2 R DL	<2. DL	724.0	75.5
01-5086 **	8.7	1.7 R *	37.0	<1. DL	0.3 R	<244 DL	93.3	<1.5 DL	182.0	0.1	<0.2 R DL	<2. DL	352.3	39.9
01-5087 **	12.2	1.8 R *	33.0	<1. DL	0.4 R	<137 DL	73.0	<4.4 DL	155.0	0.1	<0.2 R DL	<2. DL	242.2	36.5
01-5091	<2.5	1.1 *	66.3	<1.2	<1.2	4.3	0.2	<6.2	31.0	<24.9	<1.9	<62.3	1.9	15.2
01-5091 Field Rep.	<2.5	1.2 *	55.1	<1.2	<1.2	3.6	0.5	<6.2	23.4	<24.9	<1.9	<62.2	1.9	9.9
01-5098	<2.4	1.5 *	82.6	<1.2	<1.2	6.0	0.2	<6.1	29.9	<24.4	<1.8	<61.1	3.2	12.9
01-5100 **	<1. DL	2.4 *	426.0	2.7 *	<1. DL	17.0	0.2	9.0	53.0	<15. DL	<0.2 DL	<0.2 DL	3.6	11.6
01-5104 **	<1. DL	1.6 *	412.0	2.4 *	<1. DL	29.0	0.1	7.2	157.0	<15. DL	<0.2 DL	<0.2 DL	1.5	12.3
01-5110 **	<1. DL	1.5 *	344.0	2.7 *	<1. DL	19.0	1.1	7.0	47.0	<15. DL	<0.2 DL	<0.2 DL	10.1	12.4
01-5112 **	<1. DL	2.0 *	378.0	2.3 *	<1. DL	12.0	0.1	7.0	42.0	<15. DL	<0.2 DL	<0.2 DL	2.9	16.1
01-5120-6 (0-6") **	2.3	0.6 *	111.0	3.5 *	<1. DL	2.0	0.1	<6.3 DL	22.0	<15. DL	<0.2 DL	<0.2 DL	3.6	17.7
01-5122-T (Trench) **	<1. DL	1.0 *	96.0	4.0 *	<1. DL	5.3	0.1	<6.3 DL	22.0	<15. DL	<0.2 DL	<0.2 DL	2.6	17.4
01-5123-6 (0-6") **	<1. DL	0.6 *	123.0	3.8 *	<1. DL	8.4	2.3	<6.3 DL	32.0	<15. DL	<0.2 DL	<0.2 DL	9.8	15.7
01-5127-T (Trench) **	<1. DL	0.7 *	97.0	4.7 *	<1. DL	5.8	0.5	<6.3 DL	28.0	<15. DL	<0.2 DL	<0.2 DL	4.8	15.8
01-5127-TR ** (Trench) Field Rep.	<1. DL	0.7 *	95.0	4.3 *	<1. DL	5.6	0.5	<6.3 DL	27.0	<15. DL	<0.2 DL	<0.2 DL	5.5	16.5
01-5128-6 (0-6") **	<1. DL	0.8 *	102.0	4.6 *	<1. DL	7.7	2.1	<6.3 DL	38.0	<15. DL	<0.2 DL	<0.2 DL	5.5	17.0
01-5128-T (Trench) **	<1. DL	0.8 *	105.0	4.5 *	<1. DL	3.7	0.3	<6.3 DL	26.0	<15. DL	<0.2 DL	<0.2 DL	2.4	17.5

= Screening Action Level (SAL) exceeded

= Values in excess of 20 pCi/g for Alpha and 30 pCi/g for Beta

* = SALs exceeded, but at or below background level as determined from samples of the Bandelier Tuff

R = Rejected based on data validation results

NC = Not Counted

** = Analysis performed by EM-9

<1. DL = Less than the sample detection limit, all other "<" are less than the sample quantitation limit

Pb SAL (500) = Soil screening action level based on EPA OSWER Directive 9355.4-02, "Interim Guidance on Establishing Lead Cleanup Levels at Superfund Sites', Office of Solid Waste and Emergency Response 1989.

TABLE 2 (continued)
Hillside 138 Soil Samples

Sample Location	Ag mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Hg mg/Kg	Ni mg/Kg	Pb mg/Kg	Sb mg/Kg	Se mg/Kg	Tl mg/Kg	ALPHA pCi/g	BETA pCi/g
LANL SAL-->	400	0.4	5600	0.16	80	400	24	1600	(500)	32	400	6.4		
Subpart S SAL-->	200	80	4000	0.2	40	400	20	2000		30	200	6		
01-5000 - 01-5004 ** C	<1. DL	2.2 *	159.0	10.0	0.1	9.5	0.2	7.2	19.3	<0.1 DL	0.3	<0.1 DL	2.4	11.8
01-5042 - 01-5046 C	<1.	2.2 *	<82.4	<0.6	<0.5	5.1	0.1	4.4	<39.4	<5.3	0.3	<18.7	2.6	12.5
01-5075 - 01-5079, 01-5092 C	<2.2	1.2 *	46.5	<1.1	<1.1	4.0	0.1	<5.6	21.7	<22.4	<1.7	<56.1	3.2	10.2
01-5093 - 01-5098 C	<2.4	1.3 *	59.3	<1.2	<1.2	4.8	0.2	<6.	26.6	<24.2	<1.8	<60.4	1.7	12.6
01-5088 - 01-5091, 01-5099 C	<2.5	1.3 *	61.0	<1.3	<1.3	5.1	0.3	<6.3	25.9	<25.4	<1.9	<63.5	1.5	12.8

= Screening Action Level (SAL) exceeded

= Values in excess of 20 pCi/g for Alpha and 30 pCi/g for Beta

* = SALs exceeded, but at or below background level as determined from samples of the Bandelier Tuff

R = Rejected based on data validation results

NC = Not Counted

** = Analysis performed by EM-9

<1. DL = Less than the sample detection limit, all other "<" are less than the sample quantitation limit

Pb SAL (500) = Soil screening action level based on EPA OSWER Directive 9355.4-02, "Interim Guidance on Establishing Lead Cleanup Levels at Superfund Sites', Office of Solid Waste and Emergency Response 1989.

C = Composite samples (one or more discrete samples were analyzed from this composite)

TABLE 3

Background Values

TABLE 3
Background Values

Element	Medium	Number of Samples	Range of Concentrations	Mean Concentration	LANL SAL
Ag	Tuff	38*	1.7-3.0	-	200
	Soil	74*	1.6-7.5	-	
As	Tuff	16	0.9-3.2	1.9	0.4
	Soil	67	1.2-10.8	5.0	
Ba	Tuff	24	79.9-413.7	151.2	5600
	Soil	75	124.8-828.9	459.1	
Be	Tuff	38	0.4-7.5	4.7	0.16
	Soil	75	1.0-4.4	2.4	
Cd	Tuff	38*	1.0	-	80
	Soil	72*	1.0	-	
Cr	Tuff	31	1.2-49.9	5.6	400
	Soil	74	2.0-71.1	34.7	
Hg	Tuff	38*	0.4-0.7	-	24
	Soil	75*	0.3-1.4	-	
Ni	Tuff	#	-	-	1600
	Soil	40#	1.6-19	8.9	
Pb	Tuff	34	18.0-57.0	35.8	500
	Soil	73	18.0-56.0	28.4	
Sb	Tuff	2	0.2-0.7	0.5	32
	Soil	57	0.3-1.6	0.7	
Se	Tuff	38*	1.1-4.9	-	400
	Soil	75*	1.7-7.7	-	
Tl	Tuff	**	-	-	6.4
	Soil	46	0.2-0.9	NC	

* = No samples were above detection limit. Values show the range of detection limits for the number of samples analyzed. Mean concentration can not be calculated for values below detection limit.

\# = Values are from soil samples collected on Sigma Mesa and are reported from Ferenbaugh, et al., 1990. No tuff samples were analyzed in the study.

** = No background level has been determined for thallium in tuff, to date.

NC = Not calculated

= Background levels exceed SAL

FIGURE 2-2

D Building Area Sample Locations

EPA ID # NM0890010515

FACILITY NAME Los Alamos Scientific

MAP/OTHER

(See Non-Scanned Objects for Location and Description) D-building area

EPA ID # N M 0 8 9 0 0 1 0 5 1 5

FACILITY NAME Los Alamos Scientific

MAP/OTHER

(See Non-Scanned Objects for Location and Description) figure 1: Hillside 140

FIGURE 1

Hillside 140

EPA ID # N m 0 8 9 0 0 1 0 5 1 5

FACILITY NAME Los Alamos Scientific

MAP/OTHER

(See Non-Scanned Objects for Location and Description) figure 2: Hillside 138

FIGURE 2

Hillside 138

EPA ID # N M 0 8 9 0 0 1 0 5 1 5

FACILITY NAME Los Alamos Scientific

MAP/OTHER

(See Non-Scanned Objects for Location and Description)

figure 3: Hillside 138 FY93 Sample Locations

FIGURE 3

Hillside 138 FY93 Sample Locations

EPA ID # NM0890010515

FACILITY NAME Los Alamos Scientific

MAP/OTHER

(See Non-Scanned Objects for Location and Description)

Figure 4: Hillside 140 FY 93 Sample Locations

FIGURE 4

Hillside 140 FY93 Sample Locations