**Response to the Disapproval of the Investigation Report for
Lower Mortandad/Cedro Canyons Aggregate Area,
Los Alamos National Laboratory, EPA ID No. NM0890010515, HWB-LANL-11-082,
Dated June 13, 2012**

INTRODUCTION

To facilitate review of this response, the New Mexico Environment Department's (NMED's) comments are included verbatim. The comments are divided into general and specific categories, as presented in the disapproval letter. Los Alamos National Laboratory's (LANL's or the Laboratory's) responses follow each NMED comment.

GENERAL COMMENTS

NMED Comment

1. *The construction worker receptor was not evaluated at Lower Mortandad/Cedro Canyons Aggregate Area. Current and foreseeable future land use is industrial and as such, the construction worker receptor must be included in risk assessments where intrusive activities, such as digging and excavation may occur. For many constituents, evaluation of a residential receptor would be protective of a construction worker receptor; however, this is not the case for some inorganic constituents such as barium, beryllium, and manganese. However, as barium, beryllium, and manganese were not listed as constituents of potential concern (COPCs) at the sites evaluated in this investigation, the construction worker must be evaluated at least qualitatively. Modify the risk assessments at Solid Waste Management Units (SWMUs) 05-003, 05-004, 05-005(b), and 05-006(c) to include evaluation of a construction worker receptor.*

LANL Response

1. The Laboratory respectfully disagrees that industrial land use requires a construction work receptor to be included in risk assessments where intrusive activities may occur. The construction worker scenario need not be evaluated unless current or reasonably foreseeable future land use involves site development and construction. As described in section 2.1.3 of the investigation report, Technical Area 05 (TA-05) serves as an undeveloped security buffer area adjacent to active Laboratory operations. The Laboratory has no plans to develop TA-05 in the reasonably foreseeable future.

   As noted in NMED's June 2012 risk assessment guidance (NMED 2012, 219971, p. 19), the industrial scenario includes exposure to shallow subsurface soils (i.e., depths of 0 to 1 ft below ground surface [bgs]) during moderate digging associated with routine maintenance and groundskeeping activities. This scenario is appropriate for activities that are likely to occur at the sites in Lower Mortandad/Cedro Canyons Aggregate Area (e.g., maintenance of stormwater best management practices). Therefore, the industrial scenario accounts for shallow intrusive activities that might occur at these sites, and evaluation of the construction worker scenario is not necessary.

   No revision to the report is necessary.

NMED Comment

2. *The January 2010 Lower Mortandad/Cedro Canyons Aggregate Area Investigation Work Plan (IWP) indicates that sediment samples would "…be collected from areas of sediment accumulation that include sediment determined to be representative of the historical period of Laboratory operations.*

The locations will be selected by the field geologist based on geomorphic relationships in areas likely to have been affected by discharges from laboratory operations."

The January 22, 2011 NMED approval with modifications of the IWP required the Permittees to include a geomorphic characterization report as an appendix in the IR. The purpose of the characterization report was to provide information on how representative sediment sampling locations were actually selected.

*Section B-9.0 (*Deviations from the Work Plan*) of the IR indicates "Preparation of a geomorphic characterization report is beyond the scope of investigation activities previously and currently conducted for aggregate area investigations. Therefore, the geomorphic characterization report was not prepared and is not presented as an appendix to this investigation report."*

*Sediment samples were collected at SWMU 05-004 (seven samples) and SWMU 05-005(b) (four samples). However, IR Appendix B (*Field Methods*) provides no information concerning how the field geologist determined that a chosen sediment sample location was "…determined to be representative of the historical period of Laboratory operations." and was "…based on geomorphic relationships in areas likely to have been affected by discharges from laboratory operations."*

In the response to this comment, provide a discussion that explains how the sediment sampling locations were chosen in the field, including how the determination was made that a given sample location was representative of geomorphic conditions most likely to have been affected by laboratory operations.

LANL Response

2. Before sediment samples were collected, the field geologist identified sediment accumulation areas within the drainage channel most likely to have received runoff from the sites being investigated. As a result, sediment samples were collected from areas of sediment accumulation that would be representative of historical Laboratory operations. When applicable, sampling locations were biased to areas with the greatest thickness of fine-grained sediments. In addition, sampling was restricted to the drainage channel and all surface samples were collected from 0 to 1 ft bgs.

   In the drainage channels downgradient of SWMUs 05-004 and 05-005(b), the sediment cover was thin, and the sediment/tuff interface was typically a foot or less below the ground surface. The shallow depth of sediment accumulation above the tuff indicated the sediment deposits were relatively recent and therefore were representative of geomorphic conditions most likely to have affected by discharges from Laboratory operations at these sites.

   This discussion has been added to section B-5.4 in Appendix B.

NMED Comment

3. The vapor intrusion pathway was not evaluated in the risk assessments at Lower Mortandad/ Cedro Canyons Aggregate Area. As shown on Figure I-3.1-1 (Conceptual Site Model), volatilization and subsequent inhalation of contaminants is shown to be a potentially complete pathway. Volatile organic compounds (VOCs) were detected at three of the four sites evaluated in the investigation report and evaluation of this pathway must be included in the risk assessments conducted at Lower Mortandad/Cedro Canyons Aggregate Area. Update the risk assessments to include evaluation of the vapor intrusion pathway.

LANL Response

3. Section I-4.3 explained that the vapor-intrusion pathway was not evaluated (quantitatively) because structures and buildings have been removed, and no buildings will be constructed in the future at TA-05. In addition, volatile organic compounds (VOCs) were generally not used at the TA-05 sites, only a few VOCs were detected at the sites with concentrations near or below the estimated quantitation limits, and the detections were sporadic in nature. Given these conditions, a VOC plume is not present at any of these sites that would impact the vapor-intrusion pathway, and no complete pathway for exposure exists. However, the conceptual site model mistakenly indicated the vapor-intrusion pathway is complete (although with very low impact). Instead of modifying the vapor-intrusion pathway in Figure I-3.1-1, evaluation of this pathway was conducted for each site and is described below.

   SWMU 05-003 is a former underground calibration facility (structures 05-20 and 05-21) located at the west end of TA-05. The calibration facility consisted of an aboveground shed (structure 05-20) and a calibration chamber (structure 05-21). The belowground chamber was used to calibrate neutron detector systems for experiments at TA-49. In accordance with the approved investigation work plan (LANL 2010, 108281; NMED 2010, 108451), samples collected at SWMU 05-003 were not analyzed for organic chemicals because such chemicals were not used at this site. Therefore, the vapor-intrusion pathway at SWMU 05-003 is not applicable and was not evaluated at this site.

   SWMU 05-004 is a former septic tank (former structure 05-13), associated drainlines, and outfall that were located at the west end of TA-05 near the edge of Mortandad Canyon. The tank received industrial waste from a laboratory (former building 05-1), but the types of materials used in former building 05-1 are not known. VOCs were detected at location 05-613786, which is below the inlet to the tank, at location 05-613790, which is beneath the tank, and in the drainage downgradient of the outfall on the canyon slope. Naphthalene and 2-methylnaphthalene were detected at location 05-613788, which is at the inlet line near former building 05-1. However, this location is where the entire list of polycyclic aromatic hydrocarbons (PAHs) was detected. As noted in the investigation report, PAHs were not detected below the locations of the former drainlines and septic tank or in the drainage. Therefore, PAHs were not discharged from the building to the septic system. An engineering drawing (LASL 1947, 206411) indicates the access road to building 05-1 was gravel-surfaced with one coat of hot oil penetration, the most likely source of the PAHs detected next to former building 05-1. Because the PAHs are not associated with SWMU 05-004, naphthalene and 2-methylnaphthalene were not evaluated under the vapor-intrusion pathway. The former underground calibration facility (SWMU 05-003) was located near the edge of Mortandad Canyon to the west of the SWMU 05-004 drainline. As a result, the vapor-intrusion pathway could potentially be complete only in this area. Therefore, the vapor-intrusion pathway was evaluated for the locations at the edge of the mesa top where VOCs were detected at SWMU 05-004 (locations 05-613786 and 05-613790).

   SWMU 05-005(b) is an area of potentially contaminated soil associated with a former outfall that was located at the edge of Mortandad Canyon. The outfall served building 05-5 (a shop and darkroom) that supported TA-05 firing-site activities, including a shop work and processing photographs of experiments conducted at the firing sites. Only two VOCs were detected in one sample each at or near the canyon bottom. Therefore, no complete pathway exists for vapor intrusion at SWMU 05-005(b), and it was not evaluated for this site.

   SWMU 05-006(c) is an area of potentially contaminated soil associated with the location of former building 05-5, a shop and darkroom. The structure was originally used to support firing-site activities, including processing photographs of experiments conducted at the TA-05 firing sites. Future construction at this site is not anticipated in the foreseeable future, and only five VOCs were detected.

However, because a former building was located at this site, the vapor-intrusion pathway was evaluated for all VOCs detected.

The vapor-intrusion pathway has been added to the risk assessments in Appendix I for SWMU 05-004 (limited to locations on the mesa top) and SWMU 05-006(c). Text discussing SWMUs 05-003 and 05-005(b) has been added to section I-4.1 to explain why the vapor-intrusion pathway is not evaluated at these sites. Text in sections I-4.1, I-4.2.1, I-4.2.2, I-4.2.3, I-4.2.4, I-4.3, I-4.4-2, and I-4.4.4 and Tables I-4.2-7, I-4.2-26, and I-4.2-27 have been revised to include changes resulting from the evaluation of the vapor-intrusion pathway.

NMED Comment

4. *Recent research provides evidence that hexavalent chromium is carcinogenic by a mutagenic mode of action via ingestion. The New Jersey Department of Environmental Protection (NJDEP) released a publication entitled Derivation of Ingestion-Based Soil Remediation Criterion for Cr^{+6} Based on the NTP Chronic Bioassay Data for Sodium Dichromate Dihydrate (April 8, 2009) which presents cancer potency values derived from a two-year dose-response study conducted by the National Toxicology Program (2008). NJDEP derived an oral cancer potency value of 0.5 milligrams per kilogram per day (mg/kg-day) for hexavalent chromium. Based on this information, the risk-based human health screening levels would be lower than the screening levels presented and utilized in the human health risk assessments in this investigation report. The 2012 NMED Soil Screening Levels (SSLs) as well as the US EPA's (2011) Regional Screening Levels also include screening levels for hexavalent chromium in soil and tap water utilizing the NJDEP updated oral cancer slope factor of 0.5 mg/kg-day and age-adjustment calculations for exposure to mutagenic constituents. Modify the human health risk assessments to utilize the updated soil and tap water screening levels for hexavalent chromium and the oral cancer slope factor of 0.5 mg/kg-day.*

LANL Response

4. The Laboratory applied the soil screening levels (SSLs) available from NMED (2009, 108070) at the time the report was written in October 2011. Subsequent changes to the chromium(VI) SSLs in February 2012 are not applicable to this report. Previous changes to SSLs have not been applied retroactively to reports submitted before NMED published revisions.

   The chromium evaluated in the investigation report is total chromium, and the chromium(VI) SSL was used to provide a conservative screen for risk. Note that hexavalent chromium is not suspected of being present, as indicated in the approved investigation work plan (LANL 2010, 108281; NMED 2010, 108451). A more representative screen is to compare the total chromium data with the chromium(III) SSL from 2009 because this form of chromium is present in soil and tuff at these sites. Therefore, Tables I-4.2-12, I-4.2-16, I-4.2-20, and I-4.2-24 have been revised to compare the total chromium exposure point concentration with the chromium(III) SSL for each scenario.

SPECIFIC COMMENTS

NMED Comment

5. Figure I-3.1-1 Conceptual Site Model for Lower Mortandad/Cedro Canyons Aggregate Area, page I-31:

The exposure pathways presented on the conceptual site model are designated as 'very low', 'low', 'moderate', or 'not applicable'. Based on these designations, it is not clear from the figure which pathways were determined to be complete and whether they were evaluated in the risk assessments. Modify Figure I-3.1-1 to indicate whether the pathways are designated as complete or incomplete, and if they are evaluated (quantitatively and/or qualitatively) in the risk assessments.

LANL Response

5. A note has been added to Figure I-3.1-1 for the VL, L, and M designations to indicate the pathway is potentially complete and is evaluated in the risk assessments, while NA indicates the pathway is incomplete and is not evaluated in the risk assessments. All potentially complete pathways were evaluated quantitatively in the risk assessments.

NMED Comment

6. Section I-5.4.4 Comparison with Background Concentrations, page I-19:

Several inorganics were eliminated as constituents of potential ecological concern (COPECs) based on a comparison of exposure point concentrations (EPCs) with background concentrations, as shown on Tables I-5.4-1, I-5.4-2, and I-5.4-3. This is not an appropriate screening tool to be used to eliminate COPECs from further evaluation in the ecological risk assessments for the following reasons:

a. Site-to-background comparisons were already conducted in the nature and extent of contamination investigations and resulted in the lists of COPCs to be retained for analysis in the risk assessments;

b. It is not appropriate to compare 95% upper confidence limits (UCLs) with individual background concentration terms. In cases where statistical tests concluded that site concentrations of COPCs were elevated compared to background, EPCs based on 95% UCLs would be greater than 95% UCLs that could be calculated for the background data set. Therefore, it is incorrect to assume that exposure to EPCs (based on 95% UCLs) for inorganic COPCs would be the same as exposure to background levels.

c. Chromium was eliminated as a COPEC at SWMU 05-006(c) despite having an EPC greater than the range of background concentrations. Thus, the EPC versus background comparison appears to be incomplete;

d. Refinement of inorganic COPECs should include application of area use factors and use of soil screening levels based on lowest observed adverse effects levels (LOAELs).

Remove the discussion comparing EPCs with background concentrations from the ecological risk assessments at SWMUs 05-004, 05-005(b), and 05-006(c). Retain all inorganics that were eliminated as COPECs based on a comparison of EPCs with background concentrations. Modify the ecological

risk assessments to utilize the accepted methods for refining COPECs, such as the application of area use factors and use of ecological screening levels based on LOAELs.

LANL Response

6. The comparison of exposure point concentrations (EPCs) with background concentrations is relevant in the context of uncertainty associated with potential risks and exposures to chemicals of potential ecological concern (COPECs). If, as defined, the upper confidence limit (UCL) is intended to represent the average concentration of a contaminant that a receptor is exposed to at the site, then an average concentration that is indistinguishable from what occurs naturally does not result in an increased potential exposure or risk to what the receptor is exposed to naturally. Because the risk is not increased by the EPC over what may be expected from naturally occurring concentrations, the risk is overestimated, and the uncertainty associated with this overestimation should be eliminated from the risk estimate. In addition, if the EPC is the maximum detected concentration or maximum detection limit for that inorganic chemical from 0 to 5 ft bgs, then a comparison with background is appropriate.

    a. Although site-to-background comparisons were conducted to identify chemicals of potential concern (COPCs), a reevaluation of COPC concentrations relative to background at the risk assessment stage is warranted because the concentrations used at this point are depth-dependent. In the initial comparison to background, all sampling results regardless of depth are used for each medium. However, in the case of ecological risk, only data from 0 to 5 ft bgs for all media are included. This approach may result in a subset of data being used to assess risk and warrants a reevaluation of concentrations to background, especially if the maximum detected concentration or the maximum detection limit is used as the EPC. This is the case for several COPECs at each site in the Lower Mortandad/Cedro Canyons Aggregate Area. Therefore, Tables I-5.4-1, I-5.4-2, and I-5.4-3 and the text in section I-5.4.4 have been revised accordingly.

    b. The 95% UCLs are not being compared with individual background concentration terms. Rather the comparison, or more appropriately the evaluation, is done between the EPCs (some of which are UCLs) and measured concentrations that represent naturally occurring levels of the inorganic chemical in the environmental media sampled. Furthermore, statistical tests conclude that a site data set for a COPC is different from the background data set in some way, not that it is elevated compared with background. Often this difference is a matter of the median between the site and background data sets being different rather than the data sets themselves being different. Therefore, EPCs based on 95% UCLs would not necessarily be greater than 95% UCLs calculated for the background data set, and it is incorrect to assume that exposure represented by 95% UCLs for inorganic COPECs would be different on average than exposure to naturally occurring levels.

    For example, chromium is a COPEC at SWMU 05-005(b) with an EPC (95% UCL) of 12.77 mg/kg. The ESLs for the earthworm and plant are 2.3 mg/kg and 2.4 mg/kg, respectively, which results in hazard quotients (HQs) of 5.5 and 5.3. Chromium background concentrations range from 0.25 mg/kg to 36.5 mg/kg for soil, sediment, and tuff combined. This results in chromium HQs ranging from 0.1 to 15.9 for these two receptors based on naturally occurring chromium concentrations: the earthworm and plant HQs for the maximum Qbt 2,3,4 background concentration (13 mg/kg) are 5.7. It is clear that the risks (HQs) from the 95% UCL are the same as the HQs from background concentrations (i.e., the risks are not increased above those that are present from naturally occurring concentrations). The 95% UCL represents the mean exposure at the site despite some concentrations being above background for a given medium. This mean exposure is used as the basis for whether potential risk exists at the site. It makes no difference whether the concentration divided by the ESL is a 95% UCL or a single concentration, the HQ is

the same and, therefore, the associated risk is the same. If the mean exposure does not add additional risks to what could in theory result from naturally occurring concentrations, then it should not be included in the overall analysis. The uncertainty analysis is designed to illustrate whether the "risks" estimated based on conservative screening values reflects potential impacts to receptors. Because the chromium HQs in this case do not reflect potential impacts to receptor, potential risk from chromium should not be included as part of the overall risk for this site.

c. Chromium was retained as a COPEC at SWMU 05-006(c) and evaluated accordingly.

d. Inorganic COPECs retained following the comparison to background were evaluated using the area use factors and lowest observed adverse effects levels (LOAELs) ESLs. The text in sections I-5.4.7, I-5.4.8, and I-5.5.1 was updated to include these evaluations. Tables I.5.4-8, I-5.4-9, and I-5.4-10 were also revised.

The discussions and tables comparing EPCs with background concentrations have been revised in Appendix I. Some inorganic chemicals were eliminated as COPECs based on this comparison because the concentrations are either the maximum detected concentration or maximum detection limit for the 0- to 5-ft-depth interval.

NMED Comment

7. Table I-5.4-4, PAUFs and AUFs for Ecological Receptors at SWMUs 05-004, 05-005(b), and 05-006(c), page I-67:

The population area use factors (PAUFs) shown on Table I-5.4-4 appear to be incorrect. The footnote explains that the PAUF is calculated as the area of the site divided by the population area. For example, the PAUF at SWMU 05-004 for the American Kestrel should be calculated as 0.003 hectares (ha)/4240 ha = 7E-7. However, a value of 6E-8 is listed in the table. Clarify how the PAUFs were calculated, and modify Table I-5.4-4 to display the correct PAUFs. Modify any subsequent calculations if necessary.

LANL Response

7. Table I-5.4-4 has been revised. The site areas as well as the population area use factors (PAUFs) and area use factors (AUFs) calculation results have been updated and corrected. The site areas, AUFs, and the AUF-adjusted Mexican spotted owl hazard indexes (HIs) in section I-5.4.5 have been revised, and the HQs and HIs in Tables I-5.4-5, I-5.4-6, and I-5.4-7 have been recalculated as appropriate.

NMED Comment

8. Section 6.4.2.4., Site Contamination, Soil and Rock Sampling, pages 37 through 43:

In the discussion for lead, the text states, "The preexcavated concentration of lead was 26,500 mg/kg from 0–1 foot (ft) below ground surface (bgs) at location 05-61380 (RE05-11-3393, excavated sample, Appendix F). Lead was detected at concentrations of 26.4 mg/kg and 60.1 mg/kg from 2–3 ft and 5–6 ft bgs, respectively.

Overall, lead concentrations decreased with depth at this location and decreased laterally in all four directions at the excavation." The analytical results show that there are increasing concentrations of lead with increasing depth at location 05-613800. In addition, there are increasing concentrations of lead with increasing depth at location 05-614431. Modify the discussion of lead to state that there

are increasing concentrations with increasing depth at locations 05-613800 and 05-614431. Provide a basis for the conclusion that the vertical extent of lead contamination is defined.

LANL Response

8. The statement quoted in the above comment refers to the 0 to 6 ft bgs profile of lead results for location 05-613800. Concentrations decreased overall with depth from 26,500 mg/kg at 0 to 1 ft (which was remediated) to 60.1 mg/kg at 5 to 6 ft bgs. The text in section 6.4.2.4 has been revised to read "Overall, lead concentrations decreased with depth at this location from 0–1 ft to 5–6 ft bgs, and the remaining concentrations are approximately an order of magnitude below the residential SSL (400 mg/kg). Lead concentrations decreased laterally in all four directions from the excavation."

   Location 05-614431 shows a slight increase (approximately 6 mg/kg) in lead concentrations with depth, but essentially no change (0.4 mg/kg) in concentrations from 2 to 3 ft to 5 to 6 ft bgs. The lead concentrations at depth at this location are slightly above (approximately 5 mg/kg) the maximum Qbt 2,3,4 background concentration (15.5 mg/kg) and are comparable with the lead concentrations detected at the other step-out locations (locations 05-614430 and 05-614432). Furthermore, all lead concentrations within and around the excavated area are an order of magnitude or more below the residential SSL (400 mg/kg), indicating cleanup levels were met and additional samples for extent is not warranted. The text in section 6.4.2.4 has been revised accordingly.

REFERENCES

LANL (Los Alamos National Laboratory), January 2010. "Investigation Work Plan for Lower Mortandad/Cedro Canyons Aggregate Area, Revision 1," Los Alamos National Laboratory document LA-UR-10-0048, Los Alamos, New Mexico. (LANL 2010, 108281)

LASL (Los Alamos Scientific Laboratory), October 29, 1947. "Site and Road Plan, Details, Relocate Assembly Bldg. from TA-18 to TA-5," Engineering Drawing ENG-C-1660, sheet number 1 of 2, Los Alamos, New Mexico. (LASL 1947, 206411)

NMED (New Mexico Environment Department), December 2009. "Technical Background Document for Development of Soil Screening Levels, Revision 5.0," with revised Table A-1, New Mexico Environment Department, Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2009, 108070)

NMED (New Mexico Environment Department), January 22, 2010. "Approval with Modifications, Investigation Work Plan for Lower Mortandad/Cedro Canyons Aggregate Area, Revision 1," New Mexico Environment Department letter to M.J. Graham (LANL) and G.J. Rael (DOE-LASO) from J.P. Bearzi (NMED-HWB), Santa Fe, New Mexico. (NMED 2010, 108451)

NMED (New Mexico Environment Department), February 2012 (updated June 2012). "Risk Assessment Guidance for Site Investigations and Remediation," Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, Santa Fe, New Mexico. (NMED 2012, 219971)