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RECEIVED 1999

Date: February 26, 1999
Refer to: EM/ER:99-024

Dr. Robert S. Dinwiddie
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: REQUEST FOR SUPPLEMENTAL INFORMATION CONCERNING THE WORK PLAN FOR MORTANDAD CANYON, LOS ALAMOS NATIONAL LABORATORY, NM 0890010515

Dear Stu:

Enclosed is the Los Alamos National Laboratory's response to the New Mexico Environment Department Hazardous and Radioactive Materials Bureau's Request for Supplemental Information for the Mortandad Canyon Work Plan (LA-UR-97-3291). In addition, an update to the Reference Set for the Canyons Focus Area is enclosed.

Should you have any questions, please feel free to contact Dave Broxton at (505) 667-2492 or Joe Mose at (505) 667-5808.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/JT/gt

5573

Enclosures: 1) Request for Supplemental Information for Mortandad Canyon
2) Update to Reference Set for Canyons

Cy (w/ enc. 1):
D. Broxton, EES-1, MS M992
M. Buksa, EM/ER, MS M992
P. Longmire, CST-7, MS J534
A. Pratt, EES-13, MS M992
S. Reneau, EES-1, MS D462
J. Mose, DOE-LAAO, MS A316
R. Ryti, Neptune
M. Tardiff, Neptune
T. Taylor, DOE-LAAO, MS A316
J. Keiling, NMED-HRMB
EM/ER (CT# C632), MS M992
RPF, MS M707

Cy (w/o enc.):
M. Kirsch, EM/ER, M992
D. McInroy, EM/ER, MS M992
EM/ER File, MS M992
Tracker RM 604, MS M992

Response to Request for Supplemental Information for Work Plan for Mortandad Canyon, Los Alamos National Laboratory, NM (0890010515)

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 letter. Los Alamos National Laboratory's (LANL's) responses follow each NMED comment.

GENERAL COMMENTS

NMED Comment

1. *RPMP has concerns that the number and location of the proposed wells may be inadequate to discern the lateral and vertical extent of saturation in the alluvial, intermediate, and regional aquifers. For example, based on discussions with staff from LANL and the DOE-Oversight Bureau, RPMP recommends installation of an additional alluvial well and consider the placement of a well to the Cerro Toledo, in Tensight Canyon, to address potential impacts to the subsurface from historic TA-35 releases. In addition, the current and proposed gaging stations may not be adequately located to determine water balance and other recharge issues.*

LANL Response

1. Two wells penetrating the Cerro Toledo interval in the Ten Site Canyon area are proposed in the work plan. These wells are TSCO-6A in lower Ten Site Canyon and R-14 on the mesa top north of Ten Site Canyon. In addition to existing borehole 35-2028, these wells should provide adequate characterization of potential groundwater occurrences in the Cerro Toledo interval. Movement of R-14 to the floor on Ten Site Canyon can be discussed at a future NMED/GIT meeting, if necessary. Regarding the adequacy of gaging stations, see the response to comment 19.

Action in Document

1. None

NMED Comment

2. *LANL should identify the specific wells to be sampled, provide sampling protocols, and provide the rationale for the approach and strategy to sampling. For example, see* § 7.1 Introduction, page 7-3, Table 7.1-2, Initial Estimates of Sample Collection and Analyses. *LANL should note that many of the wells installed in the Mortandad Canyon Watershed and used for environmental surveillance were not installed and completed according to RCRA guidance. The wells not installed and constructed following RCRA guidance should be evaluated and replaced/reconditioned to meet RCRA guidance criteria.*

LANL Response

2. This work plan commits to sample only the eight new alluvial wells, two new Bandelier Tuff wells, and three new regional aquifer wells. Specific wells to be sampled, their sampling frequency, and analytical

suites are identified (see Tables 7.3.3-1, 7.3.3-2, 7.3.4-1, and 7.3.4-2). All of the new wells proposed in the work plan will be installed and constructed following RCRA guidance. Discussion for the rationale for the sampling approach begins on p. 7-69. As stated on p. 7-68, Levels of Contamination, third paragraph, existing wells including MCO-13, MT-1, MT-2, MT-3, MT-4, and some MCWB wells may be considered for supplemental water quality sampling. However, sampling these additional wells is not crucial to achieving the data quality objectives of this work plan, and their inclusion in future sampling events will not be undertaken without regulator approval.

In response to the second part of the comment dealing with surveillance wells, LANL recognizes that many of the older surveillance wells were not constructed according to RCRA standards. However, all surveillance wells installed since 1989 meet RCRA guidance design criteria. These wells include MCO-4A, MCO-4B, MCO-6A, MCO-6B, MCO-7A, and all 24 of the MCWB series "water balance" wells. Before the 1998 field season, the Environmental Surveillance Program decided to sample the RCRA designed wells, where located near the older wells. At a few locations, the older wells provide the only coverage, such as at MCO-3, or the RCRA-designed wells are dry and cannot be sampled. Combined with the addition of a few water balance wells, the new proposed ER wells should replace the few remaining old surveillance wells used for long-term monitoring. In 1999, the Surveillance Program will conduct a field inspection of wells in the Canyon to identify any sites with suspect well head integrity. For severe situations, some wells could be plugged and abandoned, such as was performed with well MCO-4 in 1998.

Action in Document

2. None

NMED Comment

3. *RPMP will require that LANL sampling acquire a "snap shot" of the surface water, alluvial, intermediate and regional aquifer groundwater zones. Sporadic sampling of the surface water and ground water wells is inappropriate for understanding the hydrogeologic system. Sample collection should be designed to acquire water samples from a canyon within a short period of time. LANL should also time sampling with storm-water, spring snow-melt, etc. to address effects on water quality and aquifer hydraulic response in Effluent, Tensight, and Mortandad Canyons*

LANL Response

3. LANL agrees that a "snapshot" sampling of surface water and groundwater will provide a more internally consistent data set for understanding the hydrologic system.

Action in Document

3. The response will be modified to read "The schedule for collecting existing groundwater and surface water monitoring samples will be coordinated to provide a "snapshot" in time. New wells installed will be sampled upon completion, and then twice again as part of a coordinated snapshot sampling effort. The snapshot sampling efforts will be scheduled to coincide with periods of low-flow and high-flow surface water flow."

NMED Comment

4. *LANL should discuss or reference protocols for sealing discrete zones of ground water (contaminated or not) if encountered while drilling the boreholes in Mortandad Canyon.*

LANL Response

4. Discrete groundwater zones will be sealed by placement of bentonite seals at the bottom of the casing string landed within the perching layers. The bentonite grout will be injected into the annular space around the bottom of the casing using a mechanical grout injection system. A smaller-diameter casing will be tripped inside the sealed casing string to advance the borehole. Water levels will be monitored inside the borehole to ensure that the bentonite seals perform as planned.

Action in Document

4. The text in the LANL response to comment 4 will be added to Section 7.3.4.1.5.

NMED Comment

5. *Before LANL limits analytical suites, sample numbers, the scope of work, etc., LANL must provide rationale to RPMP and acquire prior approval before limiting the suite of analytes, sample number, etc..*

LANL Response

5. LANL will provide the rationale to NMED before limiting the analytical suite and sampling stations.

Action in Document

5. LANL will add language to Sections 7.2, Sediment Sampling and Analysis Plan, and 7.3, Surface Water and Groundwater Sampling and Analysis Plan, stating that LANL will work closely with NMED to finalize sampling locations and analytical suites.

NMED Comment [bold]

6. *LANL should include a section concerning investigation derived waste (IDW) characterization and disposal.*

LANL Response

6. The characterization and disposal of investigation derived waste (IDW) is done on a fieldwork-specific basis and follows the ER Project Consistency Team policy, Memorandum PCT-95-025, "Management of Investigation Derived Waste" (Environmental Restoration Project 1995, 51962). In addition, before performing specific fieldwork that generates waste, a Waste Characterization Strategy Form is completed and submitted to LANL's Solid Waste Operations Group (EM-SWO) for approval. This form describes the specific activity that generates the waste, acceptable knowledge, waste description, waste characterization, and waste disposal strategy.

Action in Document

6. The LANL response to comment 6 will be added to the work plan as a section following Section 7.5.3.3.

NMED Comment

7. *LANL should review effluent discharge and precipitation amounts (1951-current) and compare to groundwater levels, sediment, soil, surface and groundwater concentrations to better understand the hydrogeologic system response to effluent releases, precipitation, etc..*

LANL Response

7. These activities are planned as part of the modeling efforts described in Section 7.3.4.4. Clarification will be added to Section 7.3.4.4 to better describe these activities.

Action in Document

7. LANL will add the following text after the first sentence, second paragraph of Section 7.3.4.4, p. 7-100:

   "More specifically, the response of the hydrogeologic system to the hydrologic cycle and effluent releases will be addressed in at least two phases. The first phase will consist of a water-balance study that will include records of historical discharges and precipitation. The second phase will be simulation of the system by a groundwater flow and transport code, such as FEHM. This may be followed by a third phase, in which results of this process modeling will be checked by comparing them with those of an integrated, probabilistic, mass-transfer-simulation code, such as RIP.

NMED Comment

8. *Risk assessments need to consider future impacts to receptors (e.g., contaminant migration to municipal production wells, land transfers to the county or pueblo, etc.) as well as present-day scenarios.*

LANL Response

8. LANL agrees that the final risk assessments for the Canyons should include all relevant exposure pathways. However, the screening-level risk assessments may not consider water-related exposure pathways based on availability of water data. For example, sediment sample collection and analysis may be complete before a representative sampling of groundwater is complete. A preliminary (or screening-level) risk assessment of the sediment sample data would be justified and would be intended to provide information on the imminent risk associated with potential exposure to this media. Thus, LANL will clarify the pathways included in screening-level and baseline risk assessments associated with Canyons investigations.

Action in Document

8. LANL will add the words "present day" before each mention of human health and ecological risk in the Executive Summary. At the bottom of p. ES-4, LANL will mention the strategy of producing media-based or multiple media reports that address current day risk (for reasonable current day scenarios)

and indicate that subsequent reports will consider potential future use scenarios and discuss the potential impacts of future contaminant transport.

NMED Comment

9. *LANL should replace all terminology of "Background Screening Value" with "Background Value" as this is the RPMP-LANL accepted terminology. For example, see § 3.4.4.2.1, Table 3.4.4-5, pages 3-49 and 3-50.*

LANL Response

9. LANL agrees with NMED's statement regarding nomenclature for "background screening values."

Action in Document

9. LANL will replace this terminology with "background value" in appropriate sections of the Mortandad Canyon Work Plan.

NMED Comment

10. *In light of the recent findings (HE detections) at R-25 (suggesting an interconnection between surface water or alluvial groundwater with the regional aquifer) LANL and DOE should reconsider exposure pathways and data quality objectives/requirements to ensure that data needs are met for this work plan.*

LANL Response

10. The conceptual model for the Mortandad Canyon system shall be continuously revised to incorporate new data and information obtained from the regional aquifer (R) characterization wells. If evaluation of the conceptual model requires modification of the proposed sampling, NMED approval of the changes will be sought prior to implementation of the changes.

Action in Document

10. The following sentence will be added to the end of Section 4.2.2, Groundwater Transport and Resultant Exposures: "Updates to the conceptual model are documented in the Annual Hydrogeologic Workplan Reports."

NMED Comment

11. *LANL should clarify that lithologies, staining, moisture, etc. will be targeted for sampling when drilling, where possible, instead of discrete intervals*

LANL Response

11. LANL agrees with this comment and will modify the work plan as described below.

Action in Document

11. Another bullet will be added to Section 7.3.4.2.5 stating that "Samples of core and cuttings will be selected for geochemical analysis based on the changes in lithology, alteration features, moisture

content, and field screening results. Samples will be collected from representative lithologies at regular intervals in the absence of other criteria for sample selection."

SPECIFIC COMMENTS

NMED Comment

12. § 2.4.6 Technical Area 50, Table 2.4.6-1, page 2-20

Please indicate the reasons for unknown gross alpha/beta, cesium-137 and strontium-89/90 values in the table. These constituents were part of the routine reporting prior to the unknown values and were undoubtedly released during the unknown time frames and should be included in the table.

LANL Response

12. LANL and SAIC personnel conducted an archival search on radiochemical and chemical data associated with TA-50 discharges during preparation of the Mortandad Canyon Work Plan. Before 1973, liquid radioactive (actinide-fission product) waste was treated at TA-21. TA-55 became operational in 1973 and started processing plutonium for the Laboratory (p. 2-25 of the Mortandad Canyon Work Plan). Accordingly, some of the data for Am-241 and Cs-137 are not reported for TA-50 prior to 1973 (Table 2.4.6-1).

    Discharge data for several radionuclides (gross alpha, gross beta/gross gamma, Sr-89, Sr-90, and tritium) missing from Table 2.4.6-1 are being further investigated by TA-50 staff and ER Project personnel.

Action in Document

12. A footnote will be added to Table 2.4.6-1, p. 2-20, summarizing the response given above. Also, the source cited in the footnote at the bottom of Table 2.4.6-1 will be corrected to read "LANL 1992, 7672."

NMED Comment

13. § 3.3.4 Data Requirements, page 3-15

In order to resolve uncertainties in the conceptual model, the distribution of contaminants (extent) within the Mortandad hydrogeologic system is required. The work plan should address the nature, rate and extent of any contamination present. LANL should include "distribution of contamination" as a data requirement.

LANL Response

13. LANL agrees that distribution of contaminants should be identified as a data requirement in Section 3.3.4.

    The sampling and analysis plans for sediments, surface water, and groundwater are designed to provide information to help define the nature and extent of contaminants in Mortandad Canyon. Chemical results obtained from sampling sediments, core material, and characterization wells will be

used to quantify the nature and extent of contaminants in surface and subsurface environments. Hydrologic data and information also will contribute to understanding the nature and extent of contaminants within the Mortandad canyon system.

Action in Document

13. Nature and extent of contaminant distributions will be added to the Data Requirements on pp. 3-15 and 3-16, Section 3.3.4.

NMED Comment

14. § 3.4.4.2.1 Active Channels, Figure 3.4.4-3, page 3-22

Please include in Figure 3.4.4-3 the physical measurements (e.g., 0.5-1 mm, 1-2 mm, etc.) for the size-fraction of Granules, V. Coarse, Coarse, etc.

LANL Response

14. The figure in Section 3.4.4.2.1 will be modified to include the particle sizes for each class:

granules (2.36–3.96 mm); V. coarse sand (1.17–2.36 mm); coarse sand (0.589–1.17 mm); medium sand (0.295–0.589 mm); fine sand (0.147–0.295 mm); V. fine sand (0.074–0.147 mm); silt and clay (<0.074 mm)

Action in Document

14. LANL will replace original figure in Section 3.4.4.2.1, p. 3-22, with revised figure.

NMED Comment

15. § 3.4.4.2.1 Active Channels, Published Does Estimates for Exposure to Sediments, page 3-34

"Because water in the canyon is not used for drinking, irrigation, cattle grazing, or gardens, the drinking water, meat ingestion, and fruit and vegetable ingestion pathways are not considered"

The water in the canyon may not directly be used for drinking, irrigation, cattle grazing, or gardens; however, Native Americans harvest plants, wildlife, material for pottery, etc., therefore ground water and surface water should be considered as exposure pathways. In addition, the current land-use scenario may not include irrigation, cattle grazing or gardening but future scenarios (e.g., land transfers) can not preclude these uses for the water found in Mortandad Canyon.

LANL Response

15. The text in question discusses a previously published report on the potential risks associated with exposure to contaminated media in Mortandad Canyon. This statement does not reflect which exposure pathways LANL plans to consider for assessments of current day or future risk scenarios. For discussion of exposure pathways, we refer the reader to Chapter 6 of the Canyons Core Document (LANL 1997, 55622). In general, LANL will address ingestion of surface water and alluvial groundwater where appropriate.

Action in Document

15. LANL will remove the words "Because water in the canyon is not used for drinking," from the last sentence of paragraph 3 on p. 3-34.

NMED Comment

16. § 3.5.3.3 Borehole MCC-8.2, page 3-66

"Activities of ^{241}Am greater than 0.001 pCi/g are observed from the surface to a depth of about 165 ft (50.3 m) within the Otowi Member, but activities are very low and are within background fallout values."

Please clarify if fallout values of ^{241}Am would be expected at a depth of 165 feet or if the text should read "below detection limits" instead of "within background fallout values."

LANL Response

16. LANL agrees that the text should be clarified. The text will be revised as stated below.

Action in Document

16. The sentence will be revised to read "^{241}Am activities range from nondetection to 0.6 pCi/g in samples collected from the surface to a depth of about 165 ft (50.3 m) within the Otowi Member" (Stoker et al, 1991, 7530).

NMED Comment

17. § 3.7.2.3 Recent Alluvial Groundwater Level Observations, page 3-96

"Historically, groundwater has not been found in the alluvium east of the MCO-8.2 area."

The second paragraph of this section indicates that historically no ground water has been observed east of MC0-8.2. According to Appendix D, Table D-5 (page D-33), indicates water was recorded in MCO-13 by DOE-OB staff in 1996 and 1997. Please clarify the discrepancy

LANL Response

17. LANL agrees with this comment and will modify the work plan.

Action in Document

17. The sentence will be modified as follows: "Historically, MCO-13 has been dry. However, NMED DOE OB detected groundwater in this well in both 1996 and 1997 (Table D-5)."

NMED Comment

18. § 3.7.4 Regional Aquifer, page 3-118, third paragraph

"The routine sampling and analyses of TW-8 in 1994..."

This paragraph indicates that an "anomalous" activity of 0.188 pCi/l ^{239,240}Pu obtained 1994 from TW-8 was not consistent with the previous years sampling. Please indicate if sampling of TW-8 occurred at a similar time during both years, whether amounts of precipitation, runoff, effluent discharge, purge time/volumes were similar, pump location relative to the top of the regional aquifer, etc. were consistent. Although, the "anomalous" Pu activity measured in TW-8 may not represent the conditions at the regional aquifer, evidence presented does not preclude pulses of contamination migrating through the groundwater system following high precipitation events, large volumes of discharge, runoff, etc.. Also, if leakage around the annulus of TW-8 was the source for the tritium in the regional aquifer, it seems the detection of tritium and other radiological contaminants would be more consistent from year-to-year as the effluent discharge from TA-50 is somewhat consistent.

LANL Response

18. LANL is considering multiple working hypotheses to account for the observations of contaminants in TW-8. The discussion on p. 3-118 considers the possibility that some contaminants detections in the past may be the result of annular leakage at TW-8. However, recharge of the regional aquifer by shallow groundwaters systems is not ruled out. The regional well installed as part of the implementation of the work plan should resolve this issue. In response to specific items in the comment above, the date of sampling of TW-8 varies each year, depending on the sampling schedule. LANL agrees that analytical results are influenced by a number of factors, including sampling techniques, well discharge rates, well-water purge time, turbidity of the groundwater sample (nonfiltered water samples for the Environmental Surveillance Program are analyzed for radionuclides and metals), pump location, and analytical methods.

    The annual precipitation at Los Alamos for 1994 was 20.08 inches and for 1995 was 17.92 inches; the variations probably did affect short-term distributions of Pu-239 and -240 in TW-8. However, amounts of daily precipitation can vary, especially in June through August, due to the frequency and intensity of thunder storm events. According to Table 2.4.6-1, p. 2-20, in the Mortandad Canyon Work Plan, TA-50 effluent discharges for 1994 and 1995 were 20,841,691 and 17,600,000 liters, respectively. Volumes of effluent discharged from TA-50 generally decrease over the years (Table 2.4.6-1).

    LANL agrees that steady-state leakage down the well annulus of TW-8 should produce relatively consistent concentrations of tritium and other contaminants.

Action in Document

18. A statement will be added to the end of the discussion on p. 3-118 to state that multiple hypotheses are being considered to account for the contaminants periodically detected by the Environmental Surveillance Program in TW-8. These hypotheses include leakage of contaminants down the annulus of TW-8 and recharge of the regional aquifer by shallow groundwater. Installation of regional wells as outlined in Chapter 7 should resolve these issues.

NMED Comment

19. § 3.8 Geochemistry of Surface Water and Groundwater in Mortandad Canyon, page 3-120, third paragraph in section

    "(GS-2 was operated for brief periods only, and gaging stations installed in 1995 and 1996 in lower Mortandad Canyon have not recorded flows as of May 1997, see section 3.6)"

During a site visit, the gaging station E202 (mislabeled as E222 on Plate) appears to be routinely by passed by surface water flow, as evidenced by significant head cutting into the northern side of the channel, within 10 meters of the gaging station and therefore is not likely to have recorded any flow since installation. RPMP will require that LANL inspect all current gaging stations in order to determine effectiveness and to assess the need for relocating the current gaging stations.

LANL Response

19. Surface-water sampling and analysis are proposed only for GS-1 and GS-1.3 (Section 7.3.4.1.1, p. 7-67); thus the adequacy of other gages is not pertinent to this work plan. Use of stream gaging stations only in the upper part of Mortandad Canyon is appropriate because surface flow occurs only in that part of the canyon, except for low-frequency, large-volume stream events. The surveillance group monitors other stream gages in the canyon, and results from these stations will be incorporated into our investigations as appropriate.

    NMED comments concerning conditions at the cited gaging have been forwarded to ESH-18 for their information.

Action in Document

19. None

NMED Comment

20. *§ 3.8.7 Data Requirements for Understanding the Geochemistry of Surface Water and Groundwater, page 3-139 and 3-140*

    Bullets 1, 2 and 3 should state "will" instead of "should" or "is needed" when discussing the data requirements for sample collection, sorption experiments, and geochemical modeling. This is a work plan, not a proposal. In addition, LANL should add determination of hydraulic properties of weathered tuff (page 3-110, last paragraph) as well as other activities that are required to adequately understand the hydrogeologic system.

LANL Response

20. In Bullet 1 in Section 3.8.7, the word "should" will be replaced with "will." In Bullet 2 in Section 3.8.7, the sentence will be modified to read ". . . will be preformed, as needed to support modeling, on different aquifer material. . . ." In Bullet 3 in Section 3.8.7, the words "is needed" will be replaced with "will be performed." Data needs for hydraulic data are identified in Section 3.7.5 on p. 3-119. A list of proposed hydraulic tests is given in Table 7.3.4-15 on p. 7-100. Although not specifically identified, weathered Bandelier Tuff is one of many lithologies that will be considered for testing if appropriate core samples can be obtained.

Action in Document

20. Bullets 1, 2, and 3 on pp. 3-139 and 3-140 will be modified as described above.

NMED Comment

21. § 4.1.1 Purpose, Page 4-1, 4th paragraph

"The conceptual model description helps define the investigations (including field measurement activities) and the interpretation and analysis of both new and existing data that are needed to refine risk assessments".

Because HRMB/NMED is unaware of any risk assessment being completed for the canyon setting, LANL should consider revising this statement to read: "The conceptual model description helps define the investigations (including field measurement activities) as well as the interpretation and analysis of both new and existing data that are needed to perform risk assessments".

LANL Response

21. LANL agrees with NMED's comment regarding the conceptual model for the Mortandad Canyon system.

Action in Document

21. The sentence in Section 4.1.1, Purpose, of the Mortandad Canyon Work Plan will be revised to read as follows:

"The conceptual model description helps define the investigations (including field measurement activities) as well as the interpretation and analysis of both new and existing data that are needed to perform risk assessments."

NMED Comment

22. § 4.1.1 Relationship of the Conceptual Model to Impact Assessment, Page 4-2, 1st paragraph

"The exposure pathways are part of the human health risk assessment model and ecological risk assessment model described in Chapter 6 of the core document (LANL 1997, 55622)".

The cited document does not contain any methodology to evaluate ecological risks. Thus, LANL should revise the work plan to include either the correct reference or the proposed approach to evaluate ecological risks.

LANL Response

22. LANL agrees with this comment and will revise the text to clarify what is contained in the Canyons Core Document.

Action in Document

22. LANL will remove the words "and ecological risk" from the cited sentence and add the following text after the cited sentence: "Exposure pathways to ecological receptors are based on current LANL-specific guidance on screening-level ecological risk assessments (Kelly et al. 1998, 57916)."

NMED Comment

23. § 4.1.1 Relationship of the Conceptual Model to Impact Assessment, Page 4-2, 3rd paragraph

This paragraph identifies the potential human exposure scenarios for the Mortandad Canyon. The exposure scenarios listed here differ from those presented in Chapter 6 of the core document. Please provide the rationale for these differences.

LANL Response

23. Chapter 6 of the *Core Document for Canyons Investigations* ("the core document") (LANL 1997, 55622) proposes risk assessments that include sediments, surface water, groundwater, and air particulates. These media were proposed to be evaluated in nine exposure scenarios over three land uses. The continued Laboratory land use includes a construction worker scenario and an on-site worker scenario. The recreational land use has both a trail user scenario and a camper scenario. The American Indian land use consists of scenarios for residential use, ranching, hunting, traditional uses, and use of the Rio Grande and Cochiti Lake.

    The assessment proposed for this phase of the Mortandad Canyon investigation uses scenarios for a trail user, a resource user (incorporating aspects of a ranching or hunting scenario), a construction worker, and a resident. These scenarios are considered to be inclusive of realistic present-day potential exposure activities in lower Los Alamos Canyon. The bases of primary and secondary exposures are the concentrations of contaminants in sediments.

    Development of an American Indian land use scenario is proposed in the core document. The intent of that land use scenario is to uniquely define the parameters of exposure pathways that reflect the activities of the local American Indian populations. However, the American Indian scenario is not sufficiently developed to be applied at this time. An approximation of the American Indian scenario can be achieved by combining the results for the residential scenario with the resource user scenario.

    Approaching risk characterization in this manner supports site management decisions about present-day potential risks and the possible need for remediation of sediments. This is a deterministic approach that uses the contaminant concentration data to make individual contaminant assessments. Where contaminants are collocated, integrated potential exposures will be estimated. Performing stochastic uncertainty and sensitivity analyses is deferred to later reports when sufficient data are available to evaluate the surface water and groundwater exposure pathways.

Action in Document

23. This text will be modified to agree with the information presented in the reach reports.

NMED Comment

24. § 4.1.1 Relationship of the Conceptual Model to Impact Assessment, Page 4-2, 3rd paragraph, 5th and 6th bullets

"The potential human exposure scenarios for the Mortandad Canyon system include the following: ...habitation by the local biological community, which considers whether complete exposure pathways exist; and use of the Rio Grande, including integrity of the biological community."

These two bullets do not appear to be directly attributed to human exposure scenarios but they are relevant to ecological receptor exposure. LANL should review and revise these two bullets for their relevancy to human exposure scenarios.

LANL Response

24. This text will be deleted because it is not relevant to human exposure pathways.

Action in Document

24. Bullets 5 and 6 on p. 4-2 will be deleted.

NMED Comment

25. § 4.1.3 Development of the Mortandad Canyon Conceptual Model, Page 4-3, Figure 4.1.3-1

Figure 4.1.3-1 shows the elements of the Mortandad Canyon system conceptual model. This model identifies, people, animals, and plants as receptors potentially affected by contaminated media but it does not predict exposure pathways to those receptors. For clarity and to better understand any relationship between contaminated media and potential exposure of those receptors, it would be helpful to construct an additional (complementary) model diagram or diagrams presenting contaminated media, contaminant release and transport mechanisms, and exposure scenarios/pathways to both human and ecological receptors.

LANL should develop the Mortandad Canyon conceptual model and its diagram(s) to include the relationships between contaminated media, contaminant release and transport mechanisms, and exposure scenarios and pathways to both human and ecological receptors. Also, LANL should provide the rationale for addressing or not addressing those components of the model during the Mortandad Canyon investigations.

LANL Response

25. LANL agrees that this work plan does not directly provide a diagram that shows exposure pathways to human and ecological receptors. However, such a diagram was included by reference to Chapter 6 of the Canyons Core Document (LANL 1997, 55622). As this conceptual exposure diagram represents a critical part of the data assessment and evaluation strategy, LANL will include such a diagram directly in Chapter 4 of this work plan. We will also clarify the exposure pathways evaluated in current day exposure scenarios and those that will be evaluated with certain future use scenarios.

Action in Document

25. LANL will add one new diagram, based on Figure 6-2 of the Canyons Core Document, that clearly shows the exposure pathways.

NMED Comment

26. § 4.1.3 Development of the Mortandad Canyon Conceptual Model, Page 4-3, Figure 4.1.3-1

Figure 4.1.3-1 illustrates airborne resuspension as a mechanism of contaminant transport from sources such as "worldwide fallout, stack emission and deposition, and "active channel sediments".

However, other and potentially ***critical*** *contaminant sources such as contaminated soils on mesa tops and the canyon slopes have been left out of the canyon investigation and are not considered to affect airborne resuspension.*

LANL should review and revise the current Mortandad Canyon conceptual model and its diagram to include contaminated soils on mesa tops and the canyon slopes as critical sources for the airborne resuspension transport mechanism.

LANL Response

26. Figure 4.1.3-1, p. 4-3, will be revised to indicate the possibility of direct airborne resuspension of contaminated soils at PRSs.

    Item L1 in Table 4.2-1, p. 4-11, will be revised to read "Entrainment is limited to contaminants in surface sediments in the canyons and surface soils at PRSs."

    Item L3 in Table 4.2-1, p. 4-11, will be revised to read "Entrainment, dispersal, and deposition are affected by sediment and soil properties, surface roughness, vegetative cover, and terrain."

    The second sentence in the first paragraph of Section 4.2.4, p. 4-17, will be revised to read "Resuspension of sediment and soils by wind is considered to be one of the predominant pathways for radiological exposure to *humans* because dust can be easily lifted high enough to be inhaled by *humans* (see Chapter 6 of the core document [LANL 1997, 55622] for a discussion of exposure pathways and scenarios)."

Action in Document

26. LANL will make the revisions as indicated in the response.

NMED Comment

27. § 4.2 Contaminant Transport Conceptual Model, Page 4-4, second paragraph

This paragraph implies that the major elements of the conceptual model are: surface water and sediment transport, ground water transport, biological/food chain transport, and atmospheric transport. Although soil transport has not been listed here, Table 4.2-1 (pages 4-5 through 4-11) discusses the erosion and transport of soil and sediments as a part of surface water and sediment transport. It is recommended that LANL should consider soil erosion and transport from mesa tops and down the canyon slopes as one of the major contaminant transport mechanism or pathways for the canyon system. LANL should revise the conceptual model to include soil transport from mesa tops and the canyon slopes as the mechanism for contaminants transport in the Mortandad Canyon.

LANL Response

27. The phrase "soil transport" was not used here because once soil particles have been eroded and transported by surface water, they are considered to be "sediments" in the context of this work plan. To clarify the distinction between soils and sediments and the role of eroded soils in the conceptual model, the following sentence will be added to the first paragraph of Section 4.2.1, p. 4-4, after the sixth sentence. "Some contaminants that are associated with soil particles at PRSs may also be eroded by surface water and subsequently transported as sediments."

Action in Document

27. LANL will add the sentence as indicated in the response.

NMED Comment

28. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-4, 4th paragraph

"Sequential precipitation runoff and other surface flow events have transported a small portion of these contaminants off-site (see Section 3.4)."

This statement is rather a speculation than defensible technical documentation. LANL should provide numerical values (and their ranges, if applicable) in support of statements such as "a small portion" (or e.g., "low levels" on page 4-10, element G7) to allow readers for their own interpretation and, therefore, reducing or eliminating subjectivity of the evidence.

LANL Response

28. LANL agrees with this comment.

Action in Document

28. The sentence will be revised to read "Available data indicate that sequential precipitation runoff and other surface flow events have transported some contaminants off-site, although concentrations in sampled off-site sediments are extremely low (10^{-15} Ci/g) (Gallaher et al. 1997, 59165)."

NMED Comment

29. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-5, Table 4.2-1

Table 4.2-1 identifies and discusses elements of the conceptual model for Mortandad Canyon. Element B in this table, erosion and transport of soils and sediments, discusses sediment traps as the transport medium for contaminants downstream in Mortandad Canyon. However, there is no mention about the sediment traps acting as a secondary source term, promoting percolation and infiltration of contaminants into the underlying ground water system in the canyon.

This work plan should include the approach to evaluate performance of sediment traps in the canyon system, intended to reduce the rate of contaminant transport downstream and off-site, as well as their impact on quality of the underlying ground water.

LANL Response

29. LANL agrees to identify in Table 4.2-1 the sediment traps as a potential secondary source of contamination. The sediment characterization associated with downstream areas (Chapter 7) will provide information about the effectiveness of the sediment traps to reduce the rate of contaminant transport downstream and off-site.

Action in Document

29. LANL will add the following sentence to Concepts/Hypotheses, B-4: "The sediment traps contain ponded water during some storm run-off events, which may provide a source of recharge to alluvial groundwater."

NMED Comment

30. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-10, element I1, Table 4.2-1

Element I1 states that an animal can ingest contaminants by consuming water from the active channel or from water ponded for limited periods at locations such as the sediment traps. Other sources or points of animal exposure to contaminants, which are not mentioned here, are contaminated springs and seeps. LANL should include springs and seeps, if they are present in the canyon system, as the potential sources/points of exposure.

LANL Response

30. LANL is not aware of any springs or seeps within Mortandad Canyon that may provide potential sources/points of exposure. In the future, if springs or seeps are identified in the Mortandad Canyon system, these exposure pathways will be considered in the risk assessments.

Action in Document

30. None

NMED Comment

31. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-11, element I7, Table 4.2-1

"Behavior can decrease the degree of exposure to environmental contaminants because food or water might not be obtained from a single site or behavior might cause wildlife to be exposed to multiple, antagonistic contaminants."

The concept of multiple contaminants interactions is incomplete as discussed here. Antagonism is only one of many types of possible interactions between contaminants in which people and other animals are exposed. Therefore, other types of interactions such as synergistic, additive, or potentiation must also be acknowledged. LANL should review and revise this statement to read: "Behavior can decrease the degree of exposure to environmental contaminants because food or water might not be obtained from a single site or behavior might cause wildlife to be exposed to multiple contaminants and these exposures might result in antagonistic, synergistic, additive or other interactions between contaminants." Also, please provide a few examples.

LANL Response

31. LANL agrees with adding "synergistic or other" to the list of potential effects of multiple contaminants on animal behavior. LANL will provide examples by citing references in primary toxicological literature.

Action in Document

31. LANL will make the revisions as indicated in the response and will add references Axelsen et al, 1997; Logan and Wilson, 1995; and Thompson, 1996 as examples. (abstracts are included in the attachment at the end of this document).

NMED Comment

32. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-11, element K2, Table 4.2-1

"Disturbance of the soil surface by vertebrates also affects the rates of erosion processes."

Vertebrates have the ability to disturb both surface and subsurface soils. Also trees' and shrubs' root systems have the ability to penetrate into the deep subsurface disturbing the integrity of consolidated material and this action may bring contaminant to the surface. LANL should revise this concept/hypothesis to include the ability of vertebrates to disturb integrity of subsurface soils that might promote erosion.

LANL Response

32. LANL concurs with this suggested change.

Action in Document

32. The text for K2 will be modified to read "Disturbance of the soil surface and near subsurface by vertebrates. . . ."

NMED Comment

33. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-11, element L4, Table 4.2-1

"Therefore, even if all such radioactive contaminants were attributable to Mortandad Canyon deposits, from a regulatory standpoint there is no significant risk on the mesa tops."

The technical basis or evidence in support of the statement that "from a regulatory standpoint there is no significant risk on the mesa tops" is unclear. Without this evidence, the statement appears to be premature and potentially misleading. LANL should delete the statement.

LANL Response

33. LANL agrees with this comment and will delete the last sentence in item L4, Table 4.2-1, p. 4-11.

Action in Document

33. LANL will make the revision as indicated in the response.

NMED Comment

34. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-11, element M1, Table 4.2-1

"Gaseous contaminants are not believed to occur in Mortandad Canyon at any significant levels."

This statement appears to be speculative and arbitrary and unsupported by any technically based evidence. As such, the sentence should be deleted unless the evidence in its support is provided.

LANL Response

34. LANL agrees with this comment.

Action in Document

34. LANL will delete the sentence.

NMED Comment

35. § 4.2.1 Surface Water and Sediment Transport and Resultant Exposures, Page 4-12, 2nd paragraph

This paragraph lists several human exposure pathways potentially associated with contaminated sediment. The list is, however, incomplete and it should include all relevant human exposure pathways considered by American Indian land use scenarios in the core document. Among those additional sediment-associated human exposure pathways should be inhalation of contaminated smoke particles from the burning of contaminated wood for heating, cooking, ceremonial uses as well as inhalation of volatile organic compounds and tritium, and dermal exposure to high energy beta-emitting radionuclides in sediments. Therefore, LANL should review and revise Section 4.2.1 to include all relevant human exposure scenarios and pathways consistent with those accepted by the core document.

LANL Response

35. LANL agrees with this comment. The risk scenarios are briefly described in the response to comment 23.

Action in Document

35. LANL will delete the paragraph on page 4-12 that begins "Contaminants that are associated with sediment . . ." and includes 6 bullets.

NMED Comment

36. § 4.2.2 Ground Water Transport and Resultant Exposures, Page 4-13, 3rd paragraph

"Currently the alluvial ground water is not consumed by humans, but soil moisture does support vegetation that is used as forage by animals and for fuel and ritual or medicinal purposes by American Indians from San Ildefonso Pueblo."

If springs or seeps originating from the alluvial ground water are present or discovered in the canyon system and their water is occasionally consumed by people, the statement that "currently the alluvial ground water is not consumed by humans" may potentially be misleading. LANL should revise this sentence to read: "No springs nor seeps are known to be fed by the alluvial ground water and no humans use this water for drinking, but soil moisture does support vegetation that is used as forage by animals and for fuel and ritual or medicinal purposes by American Indians from San Ildefonso Pueblo."

LANL Response

36. LANL agrees to the proposed change.

Action in Document

36. LANL will revise the sentence to read "No springs nor seeps are known to be fed by the alluvial groundwater and no humans use this water for drinking. However, soil moisture does support vegetation that is used as forage by animals and for fuel and ritual or medicinal purposes by American Indians from San Ildefonso Pueblo."

NMED Comment

37. § 4.2.2 Ground Water Transport and Resultant Exposures, Page 4-16, 5th paragraph

"This mechanism requires further investigation to determine how far the vapor-aqueous-phase transport of tritiated water may extend or to determine at which point it no longer needs to be considered a significant risk potential."

Risks can only be evaluated after the nature, rate, and extent of contamination have been determined. It is, therefore, inappropriate to state that either the extent of contamination or the significance of risk should be determined. LANL should revise the sentence to read: "This mechanism requires further investigation to determine how far the vapor-/aqueous-phase transport of tritiated water may extend."

LANL Response

37. LANL agrees to the proposed change.

Action in Document

37. LANL will revise the sentence to read, "This mechanism requires further investigation to determine how far the vapor/aqueous-phase transport of tritiated water may extend."

NMED Comment

38. § 4.2.3 Biological Transport and Resultant Exposures, Page 4-17, 2nd paragraph

"The dropping of leaves and other dead or dying plant tissues also returns contaminants to the ground where they are subject to erosion or dissolution."

Contaminated plants or their parts may act as a secondary source of contamination. Possible contaminant release mechanisms would include erosion of accumulated plant material and dispersion

rather than dissolution. LANL should revise the sentence to read: "The dropping of leaves and other dead or dying plant tissues also returns contaminants to the ground where they are subject to erosion or dispersion."

LANL Response

38. LANL agrees to the proposed change.

Action in Document

38. LANL will revise the sentence to read "Dropping leaves and other dead or dying plant tissues also return contaminants to the ground where they are subject to erosion or dispersion."

NMED Comment

39. § 4.3 Refinement of the Conceptual Model, Page 4-18, 3rd paragraph, 4th bullet

"Actual data to document possible exposure of canyon occupant by resuspension."

If contaminated sediment resuspension is of concern, please say so, otherwise remove this bullet.

LANL Response

39. LANL agrees with NMED's comment.

Action in Document

39. LANL will delete the fourth bullet, "Actual data to document possible exposure of canyon occupant by resuspension."

NMED Comment

40. § 7.1.5 Overview of Information to be Collected, page 7-5, Bullets

"Identification of contaminant concentrations and distributions in (1) sediments, (2) surface water, (3) groundwater, and (4) the biological environment in the Mortandad Canyon system within and outside the Laboratory Boundaries"

Bullet 1: Please include in the text "(1) sediments and other soils".

"Identification of contaminant transport pathways and improvement in understanding transport mechanisms and the ability to predict the potential for movement of present day contaminants to off-site areas"

Bullet 3: Please indicate the activities identified in this work plan and other work plans that will be used to determine transport mechanisms.

LANL Response

40. LANL agrees with NMED's comment.

Action in Document

40. LANL will revise Bullet 1 to include "sediments and associated soils" in the text.

    LANL will revise Bullet 3 to include in the text, "Identification of contaminant transport pathways and improvement in understanding transport mechanisms, including sediment and water sampling accompanied by chemical and physical analyses described in Section 7.2.6, Sediment Sample Collection and Analysis, and in Section 7.3.4, Surface Water and Groundwater Characterization, and the ability to predict the potential for movement of present-day contaminants to off-site areas."

    Groundwater and surface water sampling, geochemical and hydrological modeling, sediment-contaminant distributions, colloid characterization, and selective extractions of sediment samples are activities that will help in determining transport mechanisms within the Mortandad Canyon system. These activities are described in Chapter 7 of the Mortandad Canyon Work Plan.

NMED Comment

41. § 7.2.2.1 Geomorphic and Radiological Survey Data Quality Objectives, page 7-7, last paragraph

"Radiation screening results and laboratory analyses will be examined to determine whether the original geomorphic units are appropriate to define the contaminant inventories and risks using average values for these units"

First, RPMP does not allow screening data to be directly used in the assessment of risk. Secondly, LANL should remove "...and risks using average values for these units" from this statement as it is not known if this approach is appropriate prior to data analysis.

LANL Response

41. The sentence will be modified to read "Radiation screening results and laboratory analyses will be examined to determine whether the original geomorphic units are appropriate to define contaminant distributions and inventories in each reach."

Action in Document

41. LANL will modify the sentence as indicated in the response.

NMED Comment

42. § 7.2.2.1 Geomorphic and Radiological Survey Data Quality Objectives, page 7-8

"Limited sampling of older sediments may be conducted to test the validity of criteria for distinguishing post-1942 sediment and to gauge the importance of the other potential contaminant pathways"

Please identify the criteria used to determine the "limited sampling" and confidence level that the "limited sampling" will achieve in order to test the validity of the post-1942 sediment identification.

LANL Response

42. The following new sentence will be added at the end of the bullet: "The potential need, number, and location of such samples in inferred pre-1943 deposits will be dependant on the specific conditions occurring in each reach and will be based on professional judgment. For example, in reaches where geomorphic characteristics and/or field radiological measurements provide high confidence in the extent of contaminated post-1942 sediment, little or no exploratory sampling to determine the boundaries of pre-1943 sediment may be required. In contrast, in reaches with subtle geomorphic changes and low levels of radiological contaminants, extensive exploratory sampling of pre-1943 sediment may be judged necessary to determine the extent of contamination."

Action in Document

42. LANL will add the new sentence as indicated in the response.

NMED Comment

43. § 7.2.3 Technical Approach for Sediment Investigation, page 7-11, first paragraph

"Supplemental measurements such as field radiological data and the sizes of sediment deposits, may be made in intervening areas to improve confidence in extrapolation between reaches"

RPMP believes that supplemental measurements of the intervening areas are needed to improve confidence and reduce uncertainty in transport models and any risk assessments conducted for Mortandad Canyon.

LANL Response

43. LANL believes that it is premature to state a need for supplemental measurements between reaches until results of the reach investigations have been evaluated in the context of transport models, risk assessment, and potential remedial actions. For example, even if such supplemental measurements are thought to be required, it is possible that they would be made only between key reaches and not between all reaches.

The following new sentence will be added at the end of the paragraph to clarify this issue: "Possible decisions to obtain such supplemental measurements between specific reaches will be made following evaluation of data from the reaches and identification of significant uncertainties. It is expected that no data will be required for areas where levels of contamination in bordering sampled reaches are below levels that may warrant remediation or other institutional actions. In contrast, if data from the sampled reaches indicate the need for remedial action, it is expected that data on levels of contamination in the bordering unsampled areas will be required."

Action in Document

43. LANL will add the sentence as indicated in the response.

NMED Comment

44. § 7.2.6.3.2 Inorganic Chemicals and Radionuclides, page 7-38

"Radionuclides with half-lives less than 365 days are not considered to be COPCs."

LANL should provide the rationale for this statement. The radionuclides with short half-lives (less than 365 days) should be considered as COPCs. The daughter products may have longer half-lives and if these radionuclides are currently being discharged in the TA-50 effluent they are present and will add to any calculated present risk scenario.

LANL Response

44. The following additional explanatory text will be added to the work plan.

Action in Document

44. LANL will add the following text to the work plan:

"Radionuclide sample results will be reviewed against process knowledge of waste streams released into Mortandad Canyon. Radionuclides detected in environmental media samples and also expected to be present will be included as COPCs. Detected radionuclides from gamma spectroscopy also include short-lived daughter radionuclides of naturally occurring uranium and thorium isotopes. These uranium and thorium daughters are not identified as COPCs because radiological dose conversion factors for the parent radionuclides include the expected activity of these short-lived daughters. The list of detected radionuclides from gamma spectroscopy may also include other short-lived radionuclides (less than one year), which are not included as COPCs if they were not identified in the process knowledge of Mortandad Canyon waste streams. These short-lived radionuclide warrant exclusion as COPCs based on their rapid elimination from environmental media. For the specific case of a short-lived radionuclide decaying to a longer lived daughter, we would expect to find rapid attainment of secular equilibrium in this decay chain and therefore sampling should detect the presence of the long-lived daughter."

NMED Comment

45. § 7.2.7 Characterization of Potential Release Sites in Mortandad Canyon, pages 7-40 and 7-41

This section should include characterization of "Pratt Canyon", historic TA-35 discharges, possibly TA-48 issues, etc.

LANL Response

45. TA-35, including Pratt Canyon, is being characterized by the Remedial Actions Focus Area Team of the ER Project. This team shall continue to take the lead with their ER Project investigations at TA-35. The Canyons Focus Area Team, however, will communicate with the Remedial Actions Focus Area Team to develop and implement a comprehensive sampling program for TA-35 to ensure that Pratt Canyon is characterized using an approach that is consistent with Canyons Investigations.

Action in Document

45. None

NMED Comment

46. § 7.3.2.1 Surface Water and Alluvial Groundwater Data Quality Objectives, page 7-52

A thorough water balance study should be conducted on the Mortandad Canyon watershed so that a reasonable model may be developed.

LANL Response

46. A water-balance study is planned to supplement modeling of Mortandad Canyon (see response to comment 7).

Action in Document

46. None

NMED Comment

47. § 7.3.2.1 Surface Water and Alluvial Groundwater Data Quality Objectives, page 7-53

"Sampling of the upgradient alluvial well will be conducted semiannually"

RPMP will require quarterly sampling of the upgradient well for at least two (2) years so that seasonal variations can be more adequately understood.

LANL Response

47. The proposed sampling frequency is described in comment 3 of this document. Sampling will be consistent with the "snapshot" approach requested by NMED.

Action in Document

47. Chapter 7 of the work plan will be modified to reflect the "snapshot" approach and sample frequency described in comment 3.

NMED Comment

48. § 7.3.2.2 Bandelier Tuff and Regional Aquifer Groundwater Data Quality Objectives, page 7-55

"Continuous groundwater levels will be recorded for two years in wells containing pressure transducers."

Please indicate which wells will be equipped with pressure transducers.

LANL Response

48. Because of the uncertainties of finding groundwater present, the specific wells in which transducers will be installed have not yet been determined. Because of uncertainties in the hydrogeological system, LANL will thoroughly review the field data and then select the wells in which transducers will be installed.

Action in Document

48. None

NMED Comment

49. § 7.3.2.2 Bandelier Tuff and Regional Aquifer Groundwater Data Quality Objectives, page 7-55

"Data needed to evaluate potential impacts from contaminant transport within or outside the Laboratory boundary must provide adequate validation of models of aquifer distribution and transport properties to evaluate trends over time relative to present-day risks"

Please discuss the approach to model "validation" and define "adequate validation".

LANL Response

49. LANL will change the sentence as described below.

Action in Document

49. LANL will replace second sentence under "Interpretive Study" with the following text: "Before data can be used in groundwater-flow, contaminant-transport and risk-analysis models they must be checked for consistency with the conceptual hydrogeologic model." The same change will be made under "Interpretive Study" on p. 7-53.

NMED Comment

50. § 7.3.3 Technical Approach of for Surface Water and Groundwater Investigation, Table 7.3.3-1, page 7-59

Clarify if the designation of the replacement well for MCO-3 is MCO-3a or MCO-3 as indicated in the table.

LANL Response

50. The correct designation for the replacement well is MCO-3A.

Action in Document

50. LANL will change the replacement well for MCO-3 to MCO-3A in Table 7.3.3-1.

REFERENCES

The following list includes all of the references cited in the body of this document. The parenthetical information following each reference provides the author, publication date, and the ER identification (ER ID) number. This information is also included in the citations in the text and can be used to locate the documents.

ER ID numbers are assigned by the Laboartory's ER Project to track all material associated with Laboratory potential release sites. These numbers can be used to locate copies of the actual documents at the ER Project's Records-Processing Facility and, where applicable, within the ER Project reference library titled *Reference Set for Canyons.*

Copies of the reference library are maintained at the New Mexico Environment Department Hazardous and Radioactive Materials Bureau, the Department of Energy Los Alamos Area Office, and the ER Project Office. This library is a living document that was developed to ensure that the administrative authority (AA) has all the necessary material to review the decisions and actions proposed in the document. However, documents prefiously submitted to the AA are not included in the reference library.

Environmental Restoration Project, July 5, 1995. "Management of Investigation Derived Waste," Environmental Restoration Project Memorandum EM/ER:PCT-95-025, to ER Project Distribution from ER Project Consistency Team, Los Alamos National Laboratory, Los Alamos, New Mexico. (Environmental Restoration Project 1995, ER ID 51962)

Gallaher, B. M., D. W. Efurd, D. J. Rokop, T. M. Benjamin, and A. K. Stoker, September 1997. "Survey of Plutonium and Uranium Atom Ratios and Activity Levels in Mortandad Canyon," Los Alamos National Laboratory Report LA-13379-MS, Los Alamos, New Mexico. (Gallaher et al. 1997, ER ID 59165)

Kelly, E., G. Gonzales, L. Soholt, M. Hooten, and R. Ryti, May 1998. "Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory," Los Alamos National Laboratory Report LA-UR-98-1822, Los Alamos, New Mexico. (Kelly et al. 1998, ER ID 57916)

LANL (Los Alamos National Laboratory), April 1997. *Core Document for Canyons Investigations,* Los Alamos National Laboratory Report LA-UR-96-2083, Los Alamos, New Mexico. (LANL 1997, ER ID 55622)

Stoker, A. K., W. D. Purtymun, S. G. McLin, and M. N. Maes, May 1991. "Extent of Saturation in Mortandad Canyon," Los Alamos National Laboratory Report LA-UR-91-1660, Los Alamos, New Mexico. (Stoker et al. 1991, ER ID 7530)

ATTACHMENT

Abstracts for Citations for NMED Comment 31

Axelsen, J.A., Holst, N., Hamers, T. and Krogh, P.H., 1997. "Simulations of the Predator-Prey Interactions in a Two Species Ecotoxicological Test System," *Ecological Modelling,* Vol. 101, pp. 15-25.

KEYWORDS: ecotoxicology; theory; ecological risk analysis; predation

NOTES: A mathematical simulation model (Gutierrez type) has been developed to investigate the predator-prey interactions in a two species ecotoxicological test system. The test system consists of the predacious mite (Hypoaspis aculeifer Canestrini) and, as prey, the collembolan Folsomia fimetaria L. In a microcosm (5.5 cm high x 6.0 cm in diameter) with 30 g humidified soil. F. Fimetaria is provided with bakers yeast as food source. The model simulates (i) the population development of the test animals in synchronous cultures before the test, (ii) the selection of the test animals from the synchronous cultures and (iii) predator-prey interactions with and without the presence of dimethoate during the test and extraction periods. The driving variable is the temperature dependent food demands of the organisms. Both species were simulated with separate male and female populations, which were divided into a number of life stages. Thus the model handles very complicated predator- prey interactions taking the different interactions between different instars into consideration. The simulated test results were found to be very sensitive to changes in predator search rate, capture efficiency, habitat overlap, the amount of stored reserves of H. Aculeifer at test start and the survival and reproduction of F. Fimetaria, The simulations constitute the foundation for suggestions for further improvement of the test system.

Logan, D.T. and H.T. Wilson, 1995. "An Ecological Risk Assessment Method for Species Exposed to Contaminant Mixtures," *Environmental Toxicology and Chemistry,* Vol. 14, pp. 351-359.

KEYWORDS: ecological risk analysis; contaminant; ecotoxicology

NOTES: The method developed here provides a quantitative, objective measure of ecological risk for natural populations exposed to mixtures of chemical contaminants. It is founded on generally accepted risk assessment concepts: use of toxic units to assess the joint toxic effects of mixtures and expression of ecological risk as a relationship between toxicological end points and estimated environmental concentrations. Toxicological end points may be regulatory levels with zero variance and species-dependent concentrations with estimates of variance. Risk is the probability that a linear combination of toxic units exceeds 1, which expresses the probability that a measurement end point (e.g., 50% mortality in 96 h) will occur. Computations have three variations. One addresses concentration addition, in which chemicals act independently to produce similar biological effects. For noninteractive joint action with no addition, in which the biological response to the mixture is not significantly different from the response to the most toxic component, the method reduces to an analysis of extrapolation error. For other noninteractive joint action-antagonism, partial addition, and supra- addition - a correction factor similar to Konemann's mixture toxicity index is applied. An initial validation using published data indicated that increased in situ striped bass mortality was generally associated with elevated risk estimates. The method is applicable to many organisms and toxicant mixtures.

Thompson, H.M. "Interactions Between Pesticides," 1996. A Review of Reported Effects and Their Implications for Wildlife Risk Assessment," *Ecotoxicology*, Vol. 5, pp. 59-81.

KEYWORDS: pesticide; ecotoxicology; wildlife management; ecological risk analysis

NOTES: Reviews of pesticide usage survey data and vertebrate wildlife and honeybee poisoning incident schemes in the UK show that there is considerable potential for wildlife to be exposed to combinations of agricultural pesticides, According to the published literature the toxicity of many pesticide combinations is at least additive. In some cases pesticide mixtures, particularly those involving insecticides, have been shown to be synergistic, with reported increases in toxicity of up to 100-fold. However, these effects are species, time and dose dependent and are therefore difficult to predict routinely. It is suggested that risk assessments should routinely take additive toxicity into account and those based on synergism should be targeted at those mixtures for which a further defined increase in toxicity would result in a high-risk classification. In order to support this risk assessment approach there is a need to develop and validate a standard in vivo test in order to confirm the interaction in those cases where additive or synergistic toxicity results in a high-risk classification.