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July 28, 1997

Mr. G. Thomas Todd, Area Manager
Department of Energy - Los Alamos Area Office
528 35th Street, Mail Stop A316
Los Alamos, New Mexico 87544

Dr. Sigfried Hecker, Director
Los Alamos National Laboratory
P.O. Box 1663, Mail Stop A 100
Los Alamos, NM 87545

RE: Comments on the Draft Ecological Risk Assessment Methodology for Los Alamos National Laboratory, Dated March 14, 1997

Dear Mr. Todd and Mr. Hecker:

The Hazardous and Radioactive Materials Bureau (HRMB) of the New Mexico Environmental Department (NMED) has reviewed the March 14, 1997 Draft Ecological Risk Assessment Methodology for Los Alamos National Laboratory. HRMB appreciates the opportunity to review this document and provides comments (see attachment).

Should you have any questions regarding the comments, please feel free to contact either Mr. John Kieling or Ms. Barbara Toth of my staff at (505)827-1558.

Sinderely,

Robert "Stu" Dinwiddie, RCRA Permits Program Manager
Hazardous and Radioactive Materials Bureau

RSD/bt

Attachment

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ATTACHMENT
Comments on the
Draft Ecological Risk Assessment Methodology for Los Alamos National Laboratory
Dated March 14, 1997

General Comments

1. The primary goal of the administrative authority is to reduce site risk to the environment. One of the goals of the ecological risk screening process should be to aid in the prioritization of remediation/cleanup efforts by identifying potential release sites (PRSs) that are contributing the highest risk level in an ecological evaluation unit (EEU).

Action: The proposed methodology should clearly direct the risk manager when the selection of site specific remediation efforts should be conducted and/or further evaluation is not necessary.

2. This methodology document is missing a clear distinction between the screening level and baseline ecological risk assessments.

Action: The screening level risk assessment should answer at a minimum the following questions: 1) has the nature, extent, and magnitude of the site/EEU contamination been characterized (e.g., has site-related contamination been identified); 2) are habitats and ecological receptors present at the site currently and/or are expected to occur in the future; 3) do contaminant fate and transport mechanisms occur at or from the site/EEU; and 4) do concentrations of contaminants exceed ecological benchmark values or may they exceed these benchmark values in the future.

Please revise the whole document to substitute "ecological risk assessment" for "ecological screening process", where appropriate.

3. An "ecologically-based decision logic/tree" that would correspond to the Decision Framework for the ER Project (see IWP, Revision 5, November 1995) needs to be developed. This should include a screening level ecological risk assessment process, as a component, to determine site specific strategies to reduce risk.

The decision logic should describe the criteria that lead to a petition for No Further Action (NFA), further site/EEU investigations (e.g., baseline ecological risk assessment process), or implementation of risk mitigation measures (e.g., source removal, site stabilization, release prevention).

4. The data base from which the contaminants of potential ecological concern (COPECs) are selected has not been approved and is not complete. There is no indication here as to whether samples from an appropriate depth were collected, appropriate detection limits were used, samples were discrete or composite, etc. Without proper quality control, it appears that

the initial list of COPECs has a high probability of not only being incomplete, but inaccurate.

Action: LANL should discuss the criteria it will use to determine data usability for ecological screening and risk assessment purposes. Data to be used in the screening and risk assessment must be approved under the Quality Assurance Project Plan (QAPP) and meet Data Quality Objectives (DQOs). Documentation of this must be presented before the screening level risk assessment process can move forward (see Specific Comment number 13).

5. Although the purpose of the EEU approach is to assess potential cumulative impacts to the ecological receptors within an EEU it is not clear how this goal will be accomplished. Also, if it is true that EEUs are ecological units defined on the basis of habitat type (compare with page 2, last para, 1st sentence) it is not clear why ecologically-defined boundaries separate mesa tops from the adjacent canyons. LANL has proposed to assess the ecological risk posed by PRSs located on the mesa tops separately from the canyons and riparian areas. In addition, LANL proposes to conduct cumulative assessments and to address associated contaminant environmental transport issues from mesa top PRSs under the auspices of the Canyons Field Unit sometime in the future.

The slicing of habitats into canyon bottoms and mesa tops is not ecologically defensible. Organisms will use both habitats for normal life functions, moving freely from canyon bottom to mesa top to feed, drink, and defend territory. These contiguous sections of suitable habitat are important linkages for dispersal of organisms within a habitat patch and to other similar habitat patches. In addition, contaminant transport processes (e.g., stormwater or snowmelt induced erosion, interflow or groundwater migration pathways) link the mesa top PRSs/EEUs with the canyon systems.

Action: It is recommended that ecological risks posed by the mesa top PRSs/EEUs not be separated from the canyon systems. Cumulative impacts and the impacts to downstream aquatic and terrestrial receptors due to contaminant migration from the source term within mesa top PRSs to the canyon systems must be addressed or a plan must be developed to address potential impacts.

6. It is unclear whether or not the list of COPECs will be generated for both the terrestrial and aquatic receptors.

Action: The mesa top sites where contaminant transport cannot be ruled out for the canyons (e.g., through surface water runoff) have to consider potential impact to terrestrial as well as downstream aquatic receptors, including those in the Rio Grande River and Cochiti Reservoir. The list of contaminants of potential ecological concern (COPECs) for the ecological risk screening must be based on all data available in the Facility for Information Management and

Display (FIMAD) for all PRSs included in an EEU, and should consider both terrestrial and aquatic receptors.

7. The screening process is intended to: 1) screen COPECs to determine which ones need to be carried further into the baseline risk assessment phase; and/or 2) to provide a mechanism to propose NFA for PRSs/EEUs that are obviously not of potential ecological concern (i.e., no excessive risks occur now and are not anticipated to occur in the future). A PRS which cannot be proposed for NFA after this phase (e.g., a risk screening phase shows a Hazard Index greater than one and/or the contaminant fate and transport is of concern or bioaccumulation/biomagnification of COPECs is of concern) does not automatically require corrective action (e.g., clean-up) but may require more analysis (e.g., a baseline risk assessment should be conducted).

Action: Defining the exposure units should be one of the first steps in the ecological screening assessment. The definition of the EEU should be as simple as possible. Nature and extent of contamination should be determined for each PRS/EEU. Conservative assumptions should be used for screening phase purposes. This will maximize exposure parameters such as: 1) the highest measured or predicted contaminant concentration at an EEU should be used to represent the exposure point concentration to biota. These screening concentrations should not be used, however, as clean-up goals since they may be more conservative than necessary; 2) acceptable screening procedures should be developed to address contaminants bioaccumulation and biomagnification as well as contaminant migration; 3) the receptor should be assumed to reside 100 % of time in the contaminated area (Area Use Factor of 100 %); 4) bioavailability of the contaminant is assumed to be 100 %; 5) the most sensitive life stage of the receptor is assumed for the exposure assessment; 6) minimum body weight to maximum ingestion rate should be assumed; 7) to account for multiple exposure pathways it should be assumed that 100 % of diet consists of the most contaminated dietary component.

A PRS/EEU conceptual model should be developed as part of the baseline risk assessment process. Exposure parameters may be adjusted within this process, but not in the screening phase.

8. LANL proposes to use acute toxicity reference values (acute TRVs) based on LD_{50} rather than chronic TRVs (based on no-observed-adverse-effect levels (NOAELs)) for areas in "heavily disturbed" industrial settings. LANL also proposes an alternate acute/chronic TRVs land boundary within the EEU boundary between grassy (acute TRVs land) and woody (chronic TRVs land) vegetative cover. The all-inclusive boundaries for Acute Exposure Areas (AEAs) are not ecologically defensible because they do not consider chronic effects that may result from contaminant migration (runoff) from these AEAs downstream into other habitats. Also, hawks, owls, coyotes, and bats will forage near buildings and acute TRVs may not be adequately

protective.

Action: LANL's approach to address "heavily disturbed" industrial settings should be refined to include only paved areas and buildings (see also Specific Comment number 18). If there is habitat available for wildlife and/or there is potential for the contaminant migration, then LANL should use chronic TRVs.

9. Assessment endpoints may need to be developed for each EEU separately. Consideration should be given to ecological relevance in the food web in the choice of receptors, i.e., earthworm - American robin - Cooper's hawk. Furthermore, appropriate assessment endpoints must be selected to evaluate potential impacts to these receptors, i.e., in assessing robins that prey on potentially contaminated worms, reproductive success becomes an assessment endpoint in addition to the dietary exposure of hawks. Also, for practical reasons, such as availability of exposure parameters information, American robin should be used as the surrogate species for the Western bluebird.

10. Ecological toxicity benchmark values or toxicity reference values (TRVs) should be developed for each ecologically significant exposure pathway/route and they should:

1) utilize the most sensitive species;
2) be derived from chronic mortality, reproduction, and growth studies;
3) be based on the lowest NOAELs.

In the absence of a literature NOAEL for a chemical, the NOAEL can be estimated for use in generating the screening reference value by applying an uncertainty factor of 10 for the lowest available lowest-observed-adverse-effect level (LOAEL) or 100 for the lowest available acute toxicity value [such as dose or concentration levels causing 50 percent mortality to a test population (LD_{50} and LC_{50}) or effective concentration causing 50 percent mortality or some equivalent effects (EC_{50})]. If toxicity values are not available for the habitat of interest (e.g., aquatic or terrestrial), toxicity values derived from other habitat studies should not be used, and the chemical should be retained for further evaluation in the ecological baseline risk assessment. In subsequent phases of the ecological baseline risk assessment, the above conservative assumptions can be examined and adjusted to better reflect site and receptor-specific conditions.

11. LANL should develop and propose ecological risk screening procedure or methodology for radioactive constituents of potential ecological concern. Both the IAEA (1992) methodology and the screening method presented by B. Amiro (*1997. Radiological Dose Conversion Factors for Generic Non-human Biota Used for Screening Potential Ecological Impacts)* can be considered for potential applications. However, some modifications may be necessary to B. Amiro screening method, such as using the weighting factor of 20 to account for increased biological effectiveness of alpha particles. The proposed applications should be consulted with

NMED and EPA prior to their implementation (see also Specific Comment number 47).

12. When assessing the appropriate food chain pathways, conservative assumptions should be applied in the ecological screening process.

13. The formula for converting benchmark dose to a TRV for mammals and birds is not appropriate for the ecological screening procedure. It may, however, be appropriate for the baseline ecological risk assessment.

Action: Screening reference values should be estimated from literature toxicity values without adjusting for scaling factors. All literature sources should be properly referenced (see also Specific Comment number 48).

14. A general concern is that a portion of an EEU may contribute chronic impacts to a specific receptor that may not necessarily result in measurable or predictable impacts (e.g., death) but may compromise the organism's ability to evade capture by a predator. This could result in preferential feeding in this area by predators, resulting in a "suitable" habitat appearing vacant and open for colonization by other animals. This could result in a cycle creating an ecological sink for some organisms (prey species) and excessive exposure for others (predators). Indicate how LANL proposes to address this issue.

Specific Comments

I. Introduction

1) Page 2, 4th para, 2nd bullet. Although this bullet indicates that the cumulative effects from multiple sites must be assessed the cumulative effects have not been addressed by this methodology. LANL proposes to conduct cumulative assessments and address associated contaminant environmental transport issues from mesa top PRSs under the auspices of the Canyons Field Unit sometime in the future.

Action: Please develop and propose the method to evaluate cumulative risks.

2) Page 3, 2nd para. The approach to address "high background variability and disturbance" is unclear.

Action: Please define "high background variability and disturbance" and explain how this issue will be addressed. Provide an example clarifying how it is possible that a baseline ecological risk assessment will be consistent with the screening approach. Define both concepts (i.e., baseline

vs screening level ecological risk assessment) and use examples to support the above statement and distinction.

II. Decision Framework

3) Page 3, 5th para. "Some of the PRSs presently do not have concentrations of contaminants of potential ecological concern (COPECs) in soil that are above ambient concentrations (e.g., they do not differ from background) or do not have significant or complete exposure pathways to receptors, while other PRSs (either singly or in combination) may contribute to unacceptable ecological risk." It appears that LANL ignores potential future effects of environmental fate and transport processes on some PRSs. In addition, the difference between ambient and background contaminant concentrations is not clear from this sentence.

Action: LANL should address the environmental fate and transport mechanisms that may affect current PRS conditions. Please include the following definitions:

1) ambient and background concentrations of COPECs;
2) "significant" exposure pathway and a description of the process used to determine whether or not an exposure pathway is significant;
3) how one can determine that an exposure pathway is or is not significant without a quantitative evaluation; and
4) unacceptable ecological risk.

4) Page 4; Specific Evaluation of whether or not complete exposure pathways exist should be conducted prior to a screening risk assessment.

Action: Please reverse the order of two bullets in this section.

5) Page 4; Protection Criteria Risk management decisions about what constitutes protection of the environment are made in this section.

Action: Negotiations with the risk manager should be held to decide whether protection at the individual or population level is appropriate and to define what is meant by protection at the population level.

6) Page 4; Spatial It is unclear how a soil depth of 5 feet enters into the study boundary data quality objective. Does it mean that sites with soils contaminated at depths greater than 5 feet will not be evaluated for potential ecological impacts? Indicate how fate and transport of contaminants are accounted for ?

Action: Please rewrite and expand upon this statement in the DQO's. Spatial study boundaries

must take fate and transport of contaminants into consideration. Please revise this approach since soil contamination at depths greater than 5 feet can be of concern for certain ecological receptors, such as deep rooted plants, or for certain exposure scenarios (e.g., possible current or future excavations of soils, leaching to groundwater and discharging as springs or seeps).

7) Page 4; Temporal It is unclear how temporal study boundaries will act as protection criteria if they are only based on current conditions. What is temporal about that?

Action: Please evaluate fate and transport of contaminants to determine temporal boundaries.

III. Methodology

8) Page 5, 2nd para. Last sentence states that if the preliminary screening process for an EEU identifies PRSs within the EEU that do not contribute to ecological risk and do not need to be addressed further, this information may be combined with information from the human health risk assessment to propose the PRS for No Further Action .

Action: It is recommended that "terrestrial and aquatic" will be added before "... ecological risk ..." to read : "If the preliminary screening process for an EEU identifies PRSs within the EEU that do not contribute to terrestrial and aquatic ecological risk and do not need to be addressed further, this information may be combined with information from the human health risk assessment to propose the PRS for No Further Action (NFA)."

9) Page 5, 4th para. Screening process should be considered as a part of Section III "Methodology" and should closely follow the method described in Appendix III (the draft EPA Region 6 Screening of Chemicals of Potential Concern for Ecological Risk Assessment) (see also General Comment number 7).

Action: Any deviation from this method must be justified and the NMED concurrence must be obtained prior to implementing the modified screening level assessment method. As stated in the EPA Region 6 Ecological Screening draft document, the purpose of the screening procedure is to determine if there is a need to go forward with an ecological risk assessment and, therefore, to focus the ecological risk assessment by identifying those chemicals/radionuclides most likely to present a risk to ecological receptors exposed to them in abiotic media within specific habitats. As a result, the screening values generated by this procedure are obviously conservative and results are not to be used to define clean-up levels.

10) Page 5, Task 1. 1st bullet: "Contaminants that are known to have been used or known to be present at the site".

Action: Please revise this statement to identify the source of this knowledge and methods or procedures used to determine the presence of contaminants at the site.

11) Page 5, Task 1. 3rd bullet: "Contaminant identified as of concern during the human health assessment".

Action: Since this criterion is irrelevant to ecological receptors it should not be used in the screening process of contaminants of potential ecological concern. Therefore, it is recommended that the 3rd bullet be dropped.

12) Page 5, Task 1. 4th bullet: "Other factors, such as toxicity, persistence, exposure potential, bioavailability, and potential for food chain transfer". In fact, each of these factors constitutes an important criterion in the screening process of the COPECs. The toxicity criterion will, however, be used in the ecological screening process to develop a contaminant-specific ecological toxicity reference value (TRV) for the comparison with a maximum contaminant concentration in the environmental medium of ecological concern.

Action: It is unnecessary to specify toxicity as a criterion used in the development of the list of contaminants of potential ecological concern (COPEC) because it rather serves as a decision criterion at the later stages in the screening process. In addition, LANL should provide with a precise definition of each of the four criteria listed in the 4th bullet (i.e., environmental persistence of a constituent, exposure potential, bioavailability, and potential for food chain transfer) as well as with description of how each of them will be used in the process of developing the list of COPECs (for example, potential for food chain transfer can be defined by constituent's bioconcentration factor (BCF) - bioaccumulation factor (BAF) - biomagnification and/or K_{ow} value; then, for instance, all constituents having BCFs/BAFs exceeding 40 and/or log K_{ow} above 4 will be included into the list of COPECs).

13) Page 6, Figure 1. The Data Quality Objective (DQO) and Data Quality Assessment (DQA) process is missing at the top of the flow chart.

Action: The entire ecological risk assessment process depends on the adequacy of the data, both in presenting the highest contamination and in data quality. DQO and DQA boxes should be inserted prior to developing a list of COPEC's.

14) Page 8, 1st para. The COPECs selected were augmented with other chemicals which are known to be of environmental concern. If all chemicals known to be of environmental concern were added to this list it would be at least ten times its present length. Obviously there is some detail missing of how this augmented list of chemicals was generated. It does suggest that LANL expects these contaminants to be of concern at the site. If these contaminants are

expected to be present, it seems reasonable that several others may also be of concern. This re-emphasizes the fact that site characterization must be completed and data must be approved prior to entering into the ecological screening assessment process.

Action: Please revise this paragraph for clarity and provide a step by step process for the development of the COPECs list. Characterize all sites by watershed. Address data validation processes and obtain approval prior to selecting chemicals of concern.

15) Page 8, 2nd para. The 3rd sentence stating that additional chemicals can be added for EEUs where there are reasons for doing so does not carry any specific information.

Action: This sentence should either be deleted or revised to provide a clear criterion or criteria for adding additional chemicals/radionuclides to the list of COPECs for an EEU.

16) Page 8, 2nd para, sentences 4th through 6th. It is unclear whether or not the list of COPECs will be generated for both the terrestrial and aquatic receptors.

Action: The mesa top sites where contaminant transport cannot be ruled out for the canyons (e.g., through surface water runoff) have to consider potential impact to terrestrial as well as downstream aquatic receptors. In addition, ecological screening process for the mesa top PRSs/EEUs should consider the contaminant transport from the source term to the down-gradient canyons at the time of the mesa top screening (see General Comment number 5) and it is unacceptable to delay the COPECs environmental fate and transport evaluation to later and undefined date. Therefore, this paragraph must be revised to address the above concerns.

17) Page 8, 2nd para. Last sentence: "Water quality standards and other criteria such as ..."

Action: Please add "sediment guidance values and" in front of "... other criteria..." to read: "Water quality standards, sediment guidance values and other criteria such as ... "..

18) Page 8, 4th para. Last sentence states that the sites that are located within highly disturbed areas are evaluated against acute Toxicity Reference Values (TRVs) rather than chronic TRVs because of the lower potential for consistent biotic usage.

Action: Because more conservative chronic toxicity reference values must be used in the ecological screening process to ensure protection of the environment, this sentence should be revised to read: "Sites that are located within highly disturbed areas are evaluated against chronic Toxicity Reference Values (TRVs) during the ecological screening. However, both the chronic and acute TRVs can be considered for sites located within highly disturbed areas, when a baseline risk assessment is warranted. Determination of sites/EEUs as an acute exposure areas

during the ecological screening process may apply only to those sites/EEUs where no environmental fate and transport mechanisms exist or will not exist in the future (e.g., a PRS located in a basement of building, under pavement, in process line, or tank)" (see also General Comment number 8).

19) Page 8, Task 2, Assumption 1. Reference to human health risk assessment is irrelevant and confusing here. Human health risk assessment procedures do not assume different size exposure units for industrial, residential, or other scenarios. EEUs may be tailored to ecosystems or communities but not to individual receptors.

Action: This statement is unclear and as such should be deleted. EEUs should be delineated by changes in food webs. If changes in food webs are associated with changes in habitat the habitat delineation is appropriate. In areas which have SWMUs which cross habitat/food web boundaries, COPECs should be assessed for impact to both habitats/food webs.

20) Page 8, Task 2, Assumption 2, last para on page 8 and 1st para on page 10. Risk management criteria should not be a factor in the delineation of EEUs. The top paragraph on page 10 states that critical ecosystem functions will be the foundation for selecting relevant endpoints and receptors.

Action: Please define factors listed as (1) and (2). Please, delete factor (3). Please define the following: 1) ER project protection goals, 2) endpoints, 3) decision criteria, 4) predominant plant and animal interactions critical to maintenance of community or ecosystem function, and 5) critical functions. Logic for selecting receptors in later sections of this document as it relates to critical functions should be presented.

21) Page 10, Task 2, Assumption 3, 3rd para. Please, define spatial information type (3) "existing land use categories" and explain how this information will be used in the process of an ecological exposure unit delineation.

22) Page 10, Task 2, Assumption 4, 4th para. Please, delete word "initially" from this one-sentence paragraph.

23) Page 10, Task 2, Assumption 5, 5th para. The 1st sentence states that the smallest unit for analysis of ecological risk is a continuous patch of habitat defined through analysis of satellite imagery.

Action: Please revise this sentence to read: "The smallest unit for both the screening and ecological risk analyses is a continuous patch of habitat defined through analysis of satellite imagery and validated by field survey/reconnaissance." Note, this sentence is true only under

the assumption that the mesa top PRSs/EEUs ARE NOT separated from the associated canyons.

24) Page 10, Task 2, Assumption 5 c., last para, 2nd sentence: "Additional ground-truthing of the vegetation coverage possible could be required for some assessments."

Action: Please replace "... could ..." with "would", since it is difficult to differentiate between mixed conifer, ponderosa/mixed conifer, and ponderosa pine based on satellite images only.

25) Page 12, Task 2, Assumption 6. As recommended earlier in this review document, the mesa top PRSs/EEUs cannot be screened out or evaluated separately from the associated canyons, especially if the mechanisms for the contaminant transport from the source term to downgradient canyon location exist now or may exist in the future.

Action: The whole assumption 6 (i.e., 6, 6.a., 6.b, and 6.c) should be deleted. It is recommended that watershed boundaries be used to group ecozones and evaluate fate and transport across ecozone boundaries.

26) Page 12, Task 2, Assumption 7, 2nd para. Paved roads were listed as areas with negligible habitat. However, roads may cut across habitats which support important ecosystems and actually figure into the assessment of complete exposure pathways. For example, reptiles often crawl onto roads to adsorb heat. Also, predators and scavengers often feed on prey injured or killed crossing a road.

Action: Do not ignore roads as portions of larger habitats. What is important here is an evaluation of the significance of complete exposure pathways. See also General Comment number 8 and Specific Comment number 18.

27) Page 12, Task 2, Assumption 7, 2nd para. The assumption is that the areas heavily disturbed by industrial operations will not be managed as wildlife habitat and that reduction of ambient contamination levels to meet chronic toxicological criteria would result in little or no benefit to the environment. The statement that reduction of ambient contamination levels to meet chronic toxicological criteria would result in little or no benefit to the environment is a speculation until this relationship is demonstrated to occur (i.e., it is evaluated and documented). If substantiated, this relationship could become a basis for risk management decisions related to those heavily disturbed areas. (see also General Comment number 8 and Specific Comment number 18).

Action: Please revise the assumption and the controversial statement.

28) Page 12, Task 2, Assumption 7, 2nd para 3rd sentence: "This is consistent with management guidance to apply less protective (acute) toxicity criteria to these areas."

Action: As stated earlier, risk management criteria should not be a factor in the delineation of EEUs. Therefore, the sentence should be removed from this paragraph (see also General Comment number 8 and Specific Comment number 18).

29) Page 12, Task 2, Assumption 7, 2nd para, 4th sentence: "Boundaries were drawn around major Technical Areas to identify areas that had virtually no wildlife habitat value (Figure 3)."

Action: Please define criteria for identifying the areas with "virtually no wildlife habitat value" and obtain the regulators concurrence for using them as such or delete this sentence.

30) Page 12, Task 2, Assumption 7, 2nd para, last sentence: "Locations of permanent buildings and paved roads also were used to identify other areas with habitat values that were assumed to be negligible."

Action: Since such assumption is unacceptable for the screening or risk assessment, the sentence should be deleted unless the evidence is provided (and documented) that animal feeding <u>does NOT</u> occur in these areas and it is unlikely to occur in the future and that these areas <u>are NOT</u> contaminant transport pathways currently and <u>will NOT</u> be such in the future.

31) Page 12, Task 2, Assumption 8, 3rd para, last sentence. Please add "and drainage pathways" after "... habitat patch ..." to read the sentence as follows: "These patches were identified by selecting any habitat patch and drainage pathways that overlapped the mapped boundary of a PRS in the FIMAD spatial database."

32) Page 12, Task 2, Assumption 9, 4th para, 1st sentence. Please add "and drainage pathways" after "... habitat patches .." to read the sentence as follows: "Exposure units should include habitat patches and drainage pathways that the receptor would reasonably be expected to use (Figure 4)."

33) Page 12, Task 2, Assumption 9, 4th para, last sentence. Please add the following at the end of this sentence: "and habitat linkages", to read the sentence as follows: "Probability of successful movement between habitat patches has been estimated as a declining function of distance and habitat linkages (...)."

34) Page 12, Task 4, 7th para. This section does not indicate by what means pathways that have potential for "significant" contaminant transport will be evaluated.

Action: Contaminant fate and transport mechanism that might exist at the site/EEU should be determined at the early stage of the screening assessment process. Pathways for contaminant migration from the source term are to be identified at the very early stage of the screening process (during problem formulation stage). Because an assessment of the fate and transport of contaminants from the source term is one of the fundamental issues and one of the very first steps of any contaminant screening process, the environmental fate and transport concept/model and its use in the screening assessment (including the list of all assumptions and input parameter values) must be described. The concept of "significant contaminant transport potential" should be defined and its possible applications characterized. Please indicate which transport models (i.e., Lane, BIOTRAN) have been evaluated, address their strengths and weaknesses, and how they will be used in the fate and transport assessment task.

35) Page 15; Figure 5. The generic terrestrial food web presented is not complete enough to evaluate potential impacts to the environment. For example, if a representative mammal carnivore was selected to infer protection of the carnivore box of the food web, results may not be protective of a carnivore bird.

Action: Food webs should be presented down to the level of Class and feeding guild.

36) Pages 16 and 17, Figures 6 and 7. The terrestrial and aquatic conceptual models are incomplete. All primary release mechanisms for terrestrial and aquatic systems are not presented (e.g. leaching, degradation, volatilization). Receptors should be broken down to the Class/feeding guild level. Also, there are several groups of receptors missing (e.g. detrivores, omnivores, insectivores, amphibians, reptiles).

Action: If each of these conceptual models is supposed to be an example one of many complete exposure pathways, label them as such. If not, much more detail is needed in these conceptual models. Also, in either case, define receptors by animal Class along with the feeding guild.

37) Pages 16 and 17, Figures 6 and 7. The conceptual models are missing some exposure pathways/routes, including external exposure to penetrating radiation. Deposition is listed in both figures as exposure route, however, it is rather a mechanism of exposure. For plants, absorption through leaves could result from contaminant deposited on leaves surface (see Figure 6).

Action: It is recommended that the site/EEU conceptual model identifies all potential pathways and routes of exposure, including those eliminated from consideration because they are incomplete. Elimination of some pathways/routes should be justified and justification should be provided in the methodology document. In addition, it is suggested that "deposition" in Figure 6 be replaced by "absorption from deposition" or "leave absorption". Similarly, for aquatic

plants (see Figure 7), "absorption from deposition" or "direct contact" could replace "deposition". Since sediment uptake is rather impossible phenomenon for plants this should be replaced by "interstitial" or "pore water uptake from sediment" or just "uptake from sediment" (see Figure 7). In addition, the relationship between the receptor category and relevant exposure pathway/route should be shown in these figures.

38) Page 18, Table 3. Critical ecological attributes may be different based on animal Class (e.g. mammal versus bird herbivore).

Action: Expand Table to address feeding guild for each animal Class.

39) Page 18, Task 6. Selection of receptors and assessment endpoints.

Action: This task should include the development of the receptor and surrogate species lists, as well as the assessment and measurement endpoints. The lists should be consulted with NMED and EPA prior to their use in the screening or baseline risk assessment.

40) Page 18, Task 6, 2nd para, 3rd bullet. This bullet identifies protection of threatened and endangered species as one of the receptor selection criteria.

Action: Please add sensitive species to this bullet to read: "protective of Threatened, Endangered, and Sensitive Species ..."

41) Page 18, Task 6, 2nd para, 3rd bullet. This bullet should be deleted because receptors do not have to be abundant within their communities in order to be selected as target receptor species of ecological concern.

Action: Please delete this bullet.

42) Page 18, Task 6, bottom. It is unclear why only death, reproduction, and behavioral changes are included as assessment endpoints. The most sensitive endpoint should be selected. For example growth may be the most sensitive assessment endpoint.

Action: The most sensitive assessment endpoint for each Class/feeding guild should be used in the ecological screening or baseline risk assessment.

43) Page 19, Table 4. Not all Class/feeding guilds have potential receptors presented. For example, a herbivore bird is not presented.

Action: All Class/feeding guilds should be represented in this table. Please identify surrogate

species, revise receptors and assessment endpoints, and develop measurement endpoints. The choice of mites as the receptor for the invertebrate predator trophic group could be highly impractical and alternatives would include ants, yellow-jackets, dragonflies etc. Consideration should be given to ecological relevance in the choice of receptors, i.e., earthworm - American robin - Cooper's hawk. Furthermore, appropriate assessment endpoints must be selected to evaluate potential impacts to these receptors, i.e., in assessing robins that prey on potentially contaminated worms, reproductive success becomes an assessment endpoint in addition to the dietary exposure of hawks. Also, for practical reasons, such as availability of exposure parameters information, American robin should be as the surrogate species for Western bluebird.

44) Page 19; Table 4. Amphibians are not represented in this table. They are probably present in food webs at LANL. For example, the Jemez salamander has been found in mixed conifer habitats located at LANL.

Action: If amphibians are present in the ecosystems presented, they should be included in the ecological risk assessment. If amphibian toxicity data is limited, they may have to be dealt with as an uncertainty in the risk characterization section.

45) Page 21, Task 7. Toxicity values selection and documentation issues.

Action: Please provide properly referenced toxicological benchmark values for surrogate species, receptors, and assessment endpoints. Lists of ecological benchmark values should be consulted with NMED and EPA prior to their use in any assessment. The OAK Ridge (ORNL) Screening Benchmark data base such as Sample et al., 1996 should not be used as the first and/or sole source of benchmark values. However, the only problem with the ORNL data base is that the ecological benchmark values tabulated in these data base are also those indicative of the adverse effects (eg., EC_{20}) and that the ORNL data base may not acknowledge this fact. Therefore, LANL should focus benchmark values selection process on the primary literature sources (referenced also by the ORNL data base).

46) Page 21, Task 7, 2nd para, 1st bullet: Literature values.

Action: Primary literature searches should be used after all other possibilities (such as those listed as bullets following this one) are explored and found ineffective. Therefore, this bullet should become the last one (the 6th).

47) Page 21, Task 7, 4th paragraph. Last sentences of this paragraph state that if man is adequately protected, than other living things are also likely to be sufficiently protected. This is why LANL has chosen to not address radionuclides except in situations where no human health risk assessment has been performed. It appears that LANL has misinterpreted the first

sentence cited from the *IAEA (1992)* document, since the IAEA refers to the radiation dose that may be safe for biota if it is safe for human. For instance, irradiation at chronic dose rate of 1 mSv/day may be protective of plants and terrestrial and aquatic animals. In order to determine whether or not biota exposure will meet this (or other literature-based dose) dose rate level or exceed it, the radiation dose to biota has to be estimated on the site-specific basis.

Action: LANL should develop and present ecological risk screening procedure or methodology for radioactive constituents of potential ecological concern. Both the *IAEA (1992)* methodology and the screening method presented by B. Amiro in the 1997 paper titled *Radiological Dose Conversion Factors for Generic Non-human Biota Used for Screening Potential Ecological Impacts* can be considered for potential applications. However, some modifications may be necessary to B. Amiro screening method, such as using the weighting factor of 20 to account for increased biological effectiveness of alpha particles. The proposed applications should be consulted with NMED and EPA prior to their implementation.

48) Page 21, Task 8. Calculate Toxicity Reference Values (TRVs).

The formula for converting benchmark dose to a TRV for mammals and birds is not appropriate for the ecological screening procedure but may be applicable for the baseline risk assessment. LANL approach to inter-specific extrapolation in animals, relies on allometric scaling factors to extrapolate dose based solely on differences in body size. This approach, however, may be technically incorrect since a formula for converting dose given to one animal to a dose in a second animal assumes that this dose will result in the same effects. This approach is based on the assumption that the delivery of the final dose of the compound to the target organ is solely a function of metabolism of the compound and that the metabolism rate depends only on the metabolic rate of the animal which, in turn, is a function of body size. Moreover, the allometric scaling factors were developed from mammals data and, for instance, birds were shown to have a very different scaling function. Finally, it has recently been demonstrated, that the current allometric scaling model fails to correctly predict threshold doses with sufficient frequency to make the model itself suspect and may result in incorrect extrapolation.

The allometric scaling methodology presented in this document has many limiting assumptions for which documentation should be supplied before grossly applying this procedure to all organisms. For example, using LANL's numbers, Appendix VII shows an arsenic TRV of 0.03 mg/kg-day for the coyote using the allometric scaling. An actual measured benchmark in the literature for a dog is 0.31 mg/kg-day. Another example using LANL's mammalian lead benchmark to predict a TRV for a mammal not listed, but for which measured toxicity information exists indicates that the TRV for a sheep would be approximately 2 mg/kg-day, where as the measure NOEC is 0.005 mg/kg-day. These are just a couple of many examples of how, when allometric scaling methodology is used without validating the assumptions upon

which it is based, risk can be misrepresented by an order of magnitude or more.

Action: Screening reference values should be estimated from literature toxicity values without adjusting for scaling factors. All literature sources should be properly referenced (see also General Comment number 10 and Specific Comment number 45).

For the baseline risk assessment, LANL can validate the assumptions of allometric scaling of each species for which the procedure is used to determine the TRV.

49) Page 22, Task 8. The statement is made that EPA Region 6 has indicated that no uncertainty factor need be applied to a NOAEL within the same animal Class. This statement is only true if the lowest NOAEL available in the literature for each Class/feeding guild is selected for the TRV. This statement is not true if the allometric scaling approach presented above is used.

Action: Please either follow the EPA Region 6 approach of using the lowest available NOAEL for each Class/feeding guild or incorporate uncertainty factors into the NOAELs derived using allometric scaling methodology based on the validated assumptions.

50) Page 22; Task 8. It is stated that a standard uncertainty factor of 10 should be applied to TRV extrapolated across animal Classes.

Action: It should be noted here that extrapolation of TRVs across animal classes can only be done if toxicokinetic and toxicodynamic information justifies this action.

51) Page 22; Task 9. The compilation of site characterization data does not include any methodology for evaluating whether the appropriate samples were collected from an appropriate depth such that a meaningful ecological risk assessment can be conducted. Are composite samples evaluated the same as discrete samples? There is also no method presented for identifying data gaps.

Action: Please expand this section to include methodology (e.g., methodology for data useability evaluation for a screening/risk assessment) for evaluating that the appropriate information goes into the front end of the assessment.

52) Page 22, Task 10. Determination of biological concentration/accumulation factors.

Action: Please address the use of food chain multipliers for assessing the potential for biomagnification depending on the prey's trophic level.

53) Page 24, Table 6. Kd values vary based on the organic carbon content of soil and pH.

Action: LANL should demonstrate the appropriateness of the Kd values applied. This should include information on the organic carbon content of the soil and the soil pH found at LANL. This may or may not result in different Kd values for different EEUs. Table 6 should also include information on the organic content of soil used to derive Kd and the pH it is derived at.

54) Page 24, Table 6. The Kd value presented for chromium appears to be for Cr+6, not total chrome or chromium +3. Also, why is methyl mercury not addressed in this table?

Action: Please verify the valence state of chromium appropriate for this table and add methyl mercury or explain why it is not included.

55) Page 25, Table 7. High explosives.

Action: LANL may contact the Edgewood Research, Development and Engineering Center of the U.S. Army Biological and Chemical Defense Command for Log K_{ow}, toxicity information, and fate and transport models.

56) Page 25; Table 7. It is unclear why all organic COPECs (e.g., PAH's, PCB's, etc.) are not addressed in this Table.

Action: Present K_{ow}'s which will be used in the screening and risk assessment methodology for all organic COPECs.

57) Page 25, Table 8. It appears that these soil to plant concentration factors are based on root transfer to leafy vegetation. It may not be appropriate for a fruiting body or root vegetation.

Action: Please incorporate soil-to-plant concentration factors for plants' reproductive portions (Br) into this table. Explain the limitations of the soil to plant concentration factor presented and use them appropriately in the screening and risk assessment.

58) Page 26, bottom. It appears that LANL is either trying to predict the concentration of a COPEC in a herbivore as opposed to a dose or is using the Kitchings et al. and Whicker and Shultz studies to define BCFs and BAFs.

Action: This section needs to be re-written to define what is being done. Which ever method is chosen, the TRV must be in like units (i.e. dose or tissue concentration).

59) Page 27, bottom. The approach for calculating animal intake rates presented has many uncertainties associated with it. All assumptions associated with this approach are not documented. Field Metabolic Rate (FMR) can vary based on a wide range of conditions (e.g. temperatures, reproductive needs). Units also do not appear to correspond for calculations (i.e. dry weight versus wet weight basis).

Action: Ingestion rates from sources such as the Wildlife Exposure Factors Handbook should be used when available. Assumptions associated with the use of the FMR approach which may affect the proper calculation of risk estimates should be presented. Also, a sample calculation should be presented. Equations used to estimate FMR for mammals should be herbivore, non-herbivore, and rodent-specific. In addition, LANL should justify the use of the generic "all bird" FMR equation presented vs using passerine and non-passerine-specific formulas.

60) Pages 28 through 33 , Task 11. The method presented for assessing spatial distribution of COPECs is not acceptable for a screening assessment. It spatially weights exposures such that hot spots will be overlooked based on the area they occupy. A small area may not be a large part of an organisms home range, however it may be drawn to that area to feed on chronically effected prey, i.e. it may be an ecological sink. The approach also attempts to account for population risk twice, first by using TRVs from the Oak Ridge data base which are based on a 20% effect level and then by taking a spatial average based on home range. Also, human SALs should not be used in an ecological risk assessment as default values to substitute for data gaps.

Action: Please delete this approach. Use maximum concentrations found in EEUs to calculate risk estimates. Uncertainties from area use may be addressed in the uncertainty analysis within the risk characterization section. Area use of single species must be representative of other species in the Class/feeding guild which is to be protected. Sites cannot be closed until they are characterized.

61) Page 34, Task 12. Factors listed as bullets on the top of this page may be qualitatively addressed in the uncertainty analysis section of the screening assessment, however further refinement to the risk assessment should be addressed in a baseline assessment.

Action: Please change the statement preceding these bullets to "Uncertainties of the following assumptions will be discussed in the risk characterization portion of the risk assessment."

62) Page 34, Task 13. A screening risk assessment is conservative, not inadequate. Several bullets listed in this section can be dealt with using conservative assumptions or qualitatively (as uncertainties) in the uncertainty analysis section. The first bullet infers that when contaminant site characterization data are lacking a risk assessment cannot be performed (please refer to

Specific Comment number 60).

Action: Data gaps are identified in the screening assessment process. Uncertainties are described in the risk characterization section of the screening level risk assessment. This task has been completed before LANL starts a baseline assessment. Please delete this section.

63) Page 35; Task 15. This task appears to argue that the HQ approach is too conservative and centers too much on individuals rather than populations. It suggests a broader spectrum of indicators should be examined to determine environmental health. One recommendation is to evaluate receptor tissue concentrations. This recommendation makes sense as there are usually uncertainties associated with modeling concentrations from media to tissues. The remainder of the recommendations may belong in an environmental assessment or University research study, but appear to add no considerable value to a risk assessment. For example, if LANL finds a diversity index which is significantly different from a reference site or value, what concentration would LANL remediate to? What contaminants are causes of the effect? Are the contaminants, in fact, causing the effect? Also, these studies can be very expensive, time consuming and may be inconclusive and conclusions, if any, are effect specific (i.e. calculation of a diversity index only tells you if diversity appears to be affected not whether other endpoints are affected).

Action: The HQ method is what regulators use in risk assessment. Uncertainties in the HQ method can be addressed in the baseline risk assessment (e.g. collection of tissue samples and their analyses), however any further studies which do not aid in defining site clean-up goals should be deleted.

64) Appendix IV. It is implied that the assessment receptor will somehow be related to a measurement endpoint. It is unclear how dose will be calculated for the potential receptors which were selected or their measurement endpoint surrogates. Can LANL describe how it will determine the environmental fate and transport mechanisms involved in evaluating the concentration of contaminants in nectar and where it can find the average body weight and consumption rates of a bee?

Action: Receptors should be selected to represent each Class/feeding guild. How dose can be calculated should also figure into receptor selection. For example, the selection of ants as assessment receptors for detritivores may be inappropriate, when it is much easier to calculate dose to an earthworm. The earthworm dose may be higher than an ants by virtue of its high soil ingestion rate, and the earthworm would may be more prominent in food chain transfer of contaminants. If data is available to calculate the dose for all the receptors chosen, methodology should be presented.

65) Missing TRVs. There does not appear to be any detritivore or plant TRVs presented.

Also, no aquatic food webs of TRVs are presented in this document.

Action: Before an ecological risk assessment methodology for LANL is approved it must: 1) present site characterization data; 2) include all food webs and receptors to be assessed; 3) include all TRVs to be used; 4) present measurement endpoints.