

Permit

June 20, 1997

MEMORANDUM

SUBJECT: Review of *Ecotoxicological Risk Screening Methodology for Los Alamos National Laboratory*

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TO: David Neleigh, Chief
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THRU: William Gallagher, Chief
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I have reviewed the document entitled *Ecological Risk Assessment Methodology for Los Alamos National Laboratory*. The method proposed should be revised to address the following concerns.

- 1) General Comment: There are many fundamental premises stated in this document with which EPA does not agree. Examples begin on page 3. The primary goal of the agency is to reduce site risk to the environment. The procedure emphasized in this document prioritizes a method to identify the sites which present the least risk so that they may be eliminated from the system by a NFA decision. The proposed methodology can and has been used such that sites that may present risk are put on stand-by while other sites which might pass through the NFA process are given priority. The methodology proposed to deal with sites which do not immediately meet NFA requirements will fall into a loop of endless research which will end in either NFA or more study is needed with no clear remediation goals.
- 2) General Comment: Throughout this document procedures are based on decisions which have not been approved. For example, background concentrations have not been approved, the list of COPEC's has not been approved, etc. Also, the determination of extent of contamination for many sites has not been completed and for many sites where samples have been collected they have not approved as meeting data quality objectives.



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- 3) Issue: (Page 3; Problem Summary) It is implied that some PRSs do not have significant exposure pathways. This may be true, however, the term significant is not defined.
- 4) Action: Any exposure pathways which are considered to be incomplete or not significant must be clearly documented and future land use must be considered. The term non-significant exposure pathway should be defined in this document.
- 5) Issue: (Page 4; Specific) Evaluation of whether or not complete exposure pathways exist should be conducted prior to a screening risk assessment.

Action: Reverse the order of two bullets in this section.

- 6) Issue: (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.

- 7) Issue: (Page 4; Spatial) It is unclear how a soil depth of 5 feet enters into the study boundary data quality objective. How does this account for fate and transport?

Action: Rewrite and expand upon this statement in the DQO's. Spatial study boundaries must take fate and transport of contaminants into consideration.

- 8) Issue: (Page 4; Temporal) It is unclear how temporal study boundaries if they are only based on current conditions. What is temporal about that?

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

- 9) Issue: (Page 5; Task 1) The data base from which the selection of chemicals of concern 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 chemicals of concern has a high probability of not only being incomplete, but inaccurate.

Action: Data to be used in the risk assessment must be approved under the QAP and meet DQO's. Documentation of this must be presented before the risk assessment process can move forward.

- 10) Issue: (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.

- 11) Issue: (Page 8) It says 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 risk assessment process.

Action: Characterize all sites by watershed and have data validated and approved prior to selecting chemicals of concern.

- 12) Issue: (Page 8; Para 5) Number 1 under assumptions used to delineate EEUs makes no sense. Human health risk assessment procedures do not use different size exposure units for industrial, residential, etc. scenarios and EEUs may be tailored to ecosystems or communities, but not to individual receptors.

Action: This statement is unclear and should either be reworded or 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.

- 13) Issue: (Page 10; top) It states that critical ecosystem functions will be the foundation for selecting relevant endpoints and receptors.

Action: Logic for selecting receptors in later sections of this document as it relates to critical functions should be presented.

- 14) Issue: (Page 12; top) There is no procedure presented on how fate and transport of contaminants from mesa tops into canyons will be addressed.

Action: It is recommended that watershed boundaries be used to group ecozones and evaluate fate and transport across ecozone boundaries.

- 15) Issue: (Page 12; para 2) Paved roads were listed as areas with negligible habitat. Roads may cut across habitats which support significant 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.

- 16) Issue: (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.

- 17) Issue: (Page 16; Figure 6) The terrestrial conceptual model is incomplete. All primary release mechanisms for terrestrial 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. detritivores, omnivores, insectivores, amphibians, reptiles).

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

- 18) Issue: (Page 17; Figure 7) The aquatic conceptual model is incomplete.

Action: See comment 17.

- 19) Issue: (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.

- 20) Issue: (Page 18; bottom) It is unclear why only death, reproduction and behavioral changes are included as assessment endpoints. The most sensitive endpoint available 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 risk assessment.

- 21) Issue: (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.

- 22) Issue: (Page 19; Table 4) Amphiphians are not represented, are they not present in any of the habitat food webs presented? I thought endanger salamanders were present at LANL. It is true that due to a paucity of toxicity data, amphibians will most likely need to be dealt with as an uncertainty, however they should not be left out of potential receptors for LANL.

Action: If amphibians are present in the ecosystems presented, they should be included in the ecological risk assessment even if they have to been dealt with as an uncertainty.

- 23) Issue: (Page 21; Task 8) 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, what is the basis for assuming the final dose of the toxicant to the target organ is solely a function of metabolism of a compound and that the metabolism rate depends only on the metabolic rate of the animal which, in turn is a function of body size? Using your 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 your 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: There are two options here; 1) you can validate the assumptions of allometric scaling of each species for which the procedure is used to determine the TRV, or 2) Use the lowest available NOAEC in the literature for each Class/feeding guild being represented.

- 24) Issue: (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 (see action 2 in comment 23 above) is selected for the TRV. This statement is not true if the allometric scaling approach presented above is used. It is not appropriate to pick and choose which part of EPA Region 6 Guidance to use and which not to use.

Action: Either follow the EPA Region 6 approach of using the lowest available NOAEL for each Class/feeding guild or incorporate uncertainty factors into the NOAEL's derived using assumption verified allometric scaling methodology.

- 25) Issue: (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 should only be done if toxicokinetic and toxicodynamic information justifies this action.

- 26) Issue: (Page 22; Task 9) The compilation of site characterization 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: Expand this section to include methodology for evaluating that the appropriate information goes into the front end of the risk assessment.

- 27) Issue: (Page 22; last para) Kd values vary based on the organic carbon content of soil and pH, therefore this information should be supplied with any Kd values used.

Action: Provide the organic carbon content of soil used to derive Kd and the pH it is derived at.

- 28) Issue: (Page 24; Table 6) The Kd 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: Verify the valence state of chromium appropriate for this Table and add methyl mercury or explain why it is not added.

- 29) Issue: (Page 25; Table 7) It is unclear why PAH's and PCB's are not addressed in this Table, as they are COPECs.

Action: Present Kow's which will be used in the risk assessment methodology for all organic COPECs.

- 30) Issue: (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 vegetable.

Action: Explain the limitations of the soil to plant concentration factor presented and use them appropriately in the risk assessment.

- 31) Issue: (Page 26; bottom) It appears you are either trying to predict the concentration of a COPEC in a herbivore as opposed to a dose or are 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).

- 32) Issue: (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 can vary based on a wide range of conditions (e.g. temperatures, reproductive needs). Units also do not appear to matchup for calculations (i.e. dry weight versus wet weight basis).

Actions: 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 effect the proper calculation of risk should be presented. Also, a sample calculation should be presented.

- 33) Issue: (Pages 28 through 33) 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 many of them may change as sites are characterized and human exposure scenarios are modified requiring the ecological risk analysis to be redone.

Action: Delete this approach. Use maximum concentrations to calculate risk. Uncertainties from area use may be addressed in the risk characterization, however 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 and therefore, calculation of ecological risk using human SALs is a fruitless endeavor which should not be undertaken.

- 34) Issue: (Page 34; top) Factors listed as bullets on the top of this page may be qualitatively addressed in the uncertainty section of the screening assessment, however further refinement to the risk assessment should be addressed in a baseline assessment.

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

- 35) Issue: (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. It is interesting that the first bullet infers that when chemical site characterization data are lacking a risk assessment cannot be performed and yet you propose doing so using human health numbers.

Action: Data gaps are identified in the screening risk assessment process. Uncertainties

are described in the risk characterization of the screening risk assessment. This task has been completed before you start a baseline assessment. Delete this section.

- 36) Issue: (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 tissue concentrations. This recommendation makes sense as there are usually uncertainties associated with modeling from media to tissues. The remainder of the recommendations may belong in an environmental assessment or University research study, but appear to add no significant value to a risk assessment. For example, if you find a diversity index which is significantly different from a reference site or value, what concentration would you remediate to? What contaminants are causes the effect? Are the contaminants causing the effect? Also, these studies can be very expensive and time consuming and conclusions are effect specific (i.e. calculation of a diversity index only tells you if diversity appears to be effected not whether other endpoints are effected).

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 data), however any further studies which do not aid in defining site clean-up goals should be deleted.

- 37) Issue: (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 you tell me how you will determine the fate and transport mechanisms involved in evaluating the concentration of contaminants in nectar and where you can find the average body weight and consumption rates of a bee? It is also unclear why ants were selected as assessment receptors for detritivores when it is much easier to calculate dose to an earthworm, the earthworm dose appears to be higher than an ants by virtue of its high soil ingestion rate, and the earthworm would appear to figure more prominently in food chain transfer of contaminants.

Action: Receptors should be selected to represent each Class/feeding guild. How dose can be calculated should also figure into receptor selection. If data is available to calculate the dose for all the receptors chosen, methodology should be presented.

- 38) Issue: (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) include all TRVs to be used; 2) present measurement endpoints; 3) present site characterization; and 4) include all food webs and receptors to be assessed.