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HSWA LANL 6/12/98

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

December 10, 1998

Mr.Theodore Taylor, Project Manager
Los Alamos Area Office
Department of Energy
528 35th Street, MS A316
Los Alamos, New Mexico 87544

Dr.John C. Browne, Director
Los Alamos National Laboratory
P. O. Box 1663, MS A100
Los Alamos, New Mexico 87545

RE: Request for Supplemental Information: Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory, dated May 1998

Dear Mr. Taylor and Dr. Browne:

The RCRA Permits Management Program (RPMP) of the New Mexico Environment Department has reviewed the Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory (LA-UR-98-1822), dated May 1998, and requests supplemental information detailed in the attachment.

LANL must respond to the request for supplemental information within thirty (30) days of the receipt of this letter. If LANL does not submit a complete response to this request within thirty (30) calendar days, LANL should be advised that a Notice of Deficiency will be issued.

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Should you have any questions regarding this letter, please contact me or Mr. John Kieling, HRMB's LANL Facility Manager, at (505) 827-1558 ext. 1012.

Sincerely,

Robert S. (Stu) Dinwiddie, Ph.D., Manager
RCRA Permits Management Program
Hazardous and Radioactive Materials Bureau

RSD:bt

cc: J. Canepa, LANL EM/ER, MS M992
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File: Reading and HSWA LANL G/P/98
Track: LANL, 12/10/98, na, DOE/LANL, HRMB/Dinwiddie, RE, File

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ATTACHMENT

Request for Supplemental Information from Los Alamos National Laboratory on the Screening Level Ecological Risk Assessment Approach for the Environmental Restoration Project at Los Alamos National Laboratory, dated May 1998

General Comments

1. The Screening Level Ecological Risk Assessment Approach (the "Approach") is incomplete because it lacks a method for evaluating non-radiological risks to aquatic receptors.

   The process for selecting screening aquatic receptors should consider potential contaminant transport to downstream aquatic habitats and address the food chain transfer of bioaccumulative and biomagnifying constituents. The toxicity reference values for the four receptors selected (algae, daphnids, snails, and fish) are media concentration-specific (i.e., would not account for bioaccumulation) and should probably be used as the Ambient Water Quality Criteria or their equivalent. Receptors that feed on fish and aquatic invertebrates, which could be used to assess bioaccumulative contaminants, are not addressed.

   Therefore, LANL should revise the functional food web to include both fish and invertebrate eating representatives for both birds and mammals and develop the method to evaluate ecological risks to aquatic biota.

2. LANL should revise the method to model the external radiation dose to both terrestrial and aquatic receptors. The facility should work with the Administrative Authority (AA) to develop an adequate approach.

3. The Approach has not proposed toxicity reference values (TRVs) for selected ecological receptors; therefore, the approval of TRVs cannot be addressed at this time. LANL must obtain AA approval for both contaminant TRVs and biotransfer factors prior to their use.

4. It is unclear how the ecological screening level (ESL) method will address ecological risk associated with potential exposure to multiple contaminants and how this method will be used to make risk management decision. From a risk management perspective, it may be appropriate to allow a Solid Waste Management Unit (SWMU) or an Area of Concern (AOC) to proceed to no further action based upon individual chemical/radionuclide comparisons to a hazard quotient of 0.1 to 0.3 or a hazard index of 1. Please present an

approach to address multiple contaminants.

5. The Approach does not address how contaminant transfer through trophic levels (i.e., biomagnification) will be accounted for. For instance, no application of food chain multipliers has been proposed. One approach to address a contaminant transfer through trophic levels could be to use an approach equivalent to the food chain multiplier approach utilized in the Great Lakes Water Quality Initiative (GLWQI) to derive aquatic transfer factors. The GLWQI approach for addressing biomagnification may also be considered in the terrestrial food web when deriving dose to the top level predators.

6. It is unclear, whether LANL will apply BAF_{beef} transfer factors to both mammals and birds. Please explain how the food chain transfer of contaminants (both chemical and radiological) to higher trophic level species (e.g prey -to-predator) will be addressed.

7. LANL should propose the approach to address potential risks from integrated internal and external radiation exposure.

Specific Comments

Executive Summary

8. Page iii, last paragraph, third sentence (and page 5, last paragraph, fourth sentence): "Possible recommendations include ecological NFA, voluntary corrective action (VCA), voluntary corrective measure (VCM), and corrective measures study/corrective measure implementation (CMS/CMI), any of which will be incorporated into an integrated risk management decision to include human health risk evaluations, ground and surface water issues, and other applicable regulations."

Comment: This statement identifies possible outcomes or risk management options that might result from the screening assessment. However, LANL has failed to mention immediate action such as stabilization measures and interim actions. Also, please substitute "*regulations*" for "*concerns*" or "*regulations and concerns*".

Section 2.0 Ecological Screening Process

9. Page 2, third paragraph, first bullet refers to detection limits: method detection limits (MDLs), practical quantitation limits (PQLs), and estimated quantitation

limits (EQLs).

Comment: Definitions should be provided for MDL, PQL, or EQL as these terms are interpreted differently in different laboratories.

10. Page 2, fourth paragraph.

Comment: There is no mention here of how it is ensured that the minimum required samples have been collected to make any decision based on comparison to agency approved levels. Please discuss the sampling methodology, including if discrete samples are collected, the depth at which they are collected, and the method used to evaluate fate and transport of contaminants.

Also, LANL should consider moving information provided on the bottom of this page concerning the sampling methodology up before the comparison to agency approved levels.

11. Page 2, fourth paragraph, first sentence et sequitur: "AA-approved standards exist for surface water in the form of Water Quality Control Commission (WQCC) wildlife and livestock watering standards."

Comment: a) Because AA only determines applicability and relevance of standards please revise "AA-approved" to read "New Mexico State"
B) LANL should clarify if wildlife and livestock watering standards apply to this process.

12. Page 2, fifth paragraph, fourth sentence: "After the scoping evaluation, if the ecological risk assessment team determines that the PRS or PRS aggregate poses no threat to the environment because there are no ecological receptors and/or there are no pathways to receptors, a recommendation for ecological NFA is made."

Comment: The determination of NFA based on the idea that there are no ecological receptors present is confusing. One reason no receptors may be present is that contamination may have wiped out their food base. If so, this would not be appropriate rationale for NFA.

LANL should provide an example of how the concept of stating no ecological receptors are present will be used to determine NFA.

13. Page 3, first paragraph, first full sentence: "If existing data may not represent the highest contaminant levels, the benefits of collecting additional data should be evaluated against the bias in the current sample maximum values."

Comment: If the existing data set allows for a meaningful 95% upper confidence limit of the arithmetic mean media concentration (95% UCL) to be calculated, LANL may consider substituting the 95% UCL value for the maximum media concentration. (No response required)

14. Page 3, seventh paragraph, first sentence: "The BCF is most commonly calculated as the steady-state or equilibrium-state ratio of the concentration of a potential toxicant in water to the concentration of the constituent in an organism's fresh tissue."

Comment: This statement appears to be reversed. LANL should review and revise this sentence to read: "The BCF is most commonly calculated as the steady-state or equilibrium-state ratio of <u>the concentration of the constituent in an organism's fresh tissue to the concentration of a potential toxicant in water."</u>

15. Page 3, last paragraph, first sentence: "Although the EPA has no guidance defining critical values for bioaccumulation estimators, NMED/HRMB specifies bioaccumulators as contaminants with a bioconcentration/bioaccumulation factor (BCF/BAF) greater than or equal to 40, or an organic constituent with the logarithm of the octanol/water partitioning coefficient (log K_{ow}) greater than or equal to 4 ... ."

Comment: The use of a BCF/BAF value of 40 as a cut-off for inorganic contaminants is usually considered a conservative screen for aquatic receptors. However, in terrestrial systems, this value may be excessively high. A more appropriate BCF/BAF value for terrestrial systems may be one (1) or less, depending on chemical toxicity.

LANL should review and revise the above quoted sentence to read: "Although the EPA has no guidance defining critical values for bioaccumulation estimators, NMED/HRMB specifies bioaccumulators as <u>inorganic chemicals</u> with a bioconcentration/bioaccumulation factor (BCF/BAF) greater than or equal to <u>forty (40)</u>, or <u>in the absence of empirical BCF/BAF</u>, an organic constituent with the logarithm of the octanol/water partitioning coefficient (log K_{ow}) greater than or

equal to <u>four (4)</u> ... ."

Also, LANL should acknowledge that no inorganic contaminants will be dropped or eliminated from risk evaluation based on comparison to a BCF/BAF.

16. Page 3, last paragraph, third sentence defines "persistent bioaccumulators".

Comment: LANL should either reference this definition or identify it as an operational definition.

17. Page 5, second paragraph, fourth sentence (and pages 20-22, Figure 3-6, and Table 3-2): "In addition four aquatic receptors have been selected for screening, algae, daphnids (Crustacea), snails (Gastropoda), and a generic bony fish." The receptors for the aquatic food web do not appear to be adequate for protection of the environment.

Comment: Please replace the aquatic receptors listed with Federal or State Water Quality Criteria. Also, add both fish and invertebrate eating representatives for both birds and mammals to the food web.

18. Page 6, Figure 2.1, Process flow for ecological screening assessment.

Comment: This process should also consider comparison of constituent environmental medium concentrations with existing (and AA-approved) applicable national and/or state numeric standards and criteria (such as the AWQC or New Mexico surface water standards). This comparison may be especially meaningful for the aquatic habitat screening assessment.

Section 3.1.2 Climate

19. Page 10. This section discusses some important meteorological factors or stressors. However, no LANL-specific meteorological information is presented.

Comment: LANL should revise this section to include, at a minimum, the following information:
1) temperature ranges and annual average;
2) precipitation ranges and annual average east to west on the Laboratory;
3) evapotranspiration rate; and
4) prevailing wind direction and its average speed.

Section 3.1.3 Geology

20. Page 10. This section is missing a discussion of soils.

Comment: LANL should review and revise this section to include information and data characterizing soil types throughout the Laboratory area and their properties. A map of soils on the Pajarito Plateau, such as that developed by Nyhan and co-workers (Nyhan et al., 1978, 5702), would also be helpful. LANL should include a description of soil types and their properties throughout the Laboratory.

21. Page 10, third paragraph.

Comment: LANL shall review and revise this paragraph to acknowledge the potential presence of the following:
1) permeable units in the canyon floors that outcrop below saturated alluvium. These units may contribute recharge to deeper ground water zones and form a source for springs and seeps in the area; and
2) faults, cooling joints, and fractures throughout the Pajarito Plateau.

Section 3.1.5 Biology

22. Page 12, third paragraph, last sentence: " Roughly twenty species are designated as either threatened and endangered species or "species of special concern" by the federal and/or state government." It appears that threatened and endangered species and "species of special concern" have not been defined since only a rough estimate of the number of these species present has been provided.

Comment: LANL should provide a complete list of the threatened and endangered species and species of special concern.

23. Page 13, Table 3-1, Areal extent of land cover types at the Los Alamos National Laboratory.

Comment: LANL should revise this table to include wetlands/riparian cover. LANL should submit criteria for field verification of vegetative types (i.e., Mixed conifer versus Ponderosa pine). Also, LANL should verify and potentially modify numerical values representing contribution of mixed conifer forests and ponderosa pine forests.

Section 3.1.6 Wetlands

24. Page 14, last paragraph, seventh sentence lists some wetland areas on the Laboratory.

Comment: LANL should indicate the approximate size of those wetlands and show approximate locations on the site map.

Section 3.3 Exposure Pathways

25. Page 18, third paragraph identifies potential exposure pathways for contaminated surface soils, sediments, surface water, shallow ground water and air.

Comment: The list of exposure pathways associated with surface water and sediment appears to be incomplete. LANL shall address the potential for deep-rooted plants and burrowing animals to become exposed to contaminated subsurface soils. Also, please include root uptake from sediment and respiration gills to the bulleted list of exposure pathways.

Section 4.1 Scoping Evaluation

26. Page 24, second paragraph identifies the goals of the scoping evaluation.

Comment: LANL should review and revise this paragraph to include the evaluation of contaminant environmental transport.

Section 4.1.3 Scoping Checklist

27. Page 25, first paragraph, first bullet: "... confirm that ecological receptors can be affected by a release ..."

Comment: LANL should clarify if it really plans to confirm that ecological receptors can be affected by a release through the use of the scoping checklist or that LANL will determine if complete exposure pathways may exist at a site.

Section 4.1.3.2 Checklist Step 2: Site Visit

28. Page 26, first paragraph, second sentence: "A secondary objective is to evaluate whether site data provide information to determine the nature, rate, and extent of contamination."

Comment: LANL should revise this sentence to read: "A secondary objective is to evaluate whether site data provide adequate information to determine the nature, rate, and extent of contamination."

29. Page 26, fifth paragraph, second sentence: "Specifically, do existing data provide information on the nature, rate, and extent of contamination?"

Comment: LANL should revise this sentence to read: "Specifically, do existing data provide adequate information on the nature, rate, and extent of contamination?"

Section 4.2.1 Hazard Quotient and Hazard Index Calculations

30. Page 27, first paragraph, last sentence: "Effects on organisms may be measured as reproductive, or measures of morbidity and mortality."

Comment: LANL should review and revise this statement to read: "Effects of ecological concern include adverse effects on reproduction, growth, and survivorship (i.e., mortality)."

31. Page 27, first paragraph, second sentence and the numerator of Equation 4.1, presenting the hazard quotient calculation, refer to "dose exposure" as the contaminant intake measure.

Comment: To describe a contaminant intake level LANL may want to substitute "dose exposure" for "exposure dose" or just "dose" or "exposure" throughout the document.

32. Page 28, second paragraph, last sentence states that those chemicals that contribute more than 0.1 to an hazard index that exceeds 1 are considered COPECs.

Comment: Please explain why a chemical contributing more than 0.1 to a hazard index of less than 1 will be considered a chemical of potential ecological concern (COPEC).

Section 4.2.2 ESRVs for Nonradiological and Radiological Contaminants

33. Page 28, third paragraph, second sentence states that ecotoxicity screening reference values must be experimentally derived and based upon determination of the toxicological kinetics for specific organisms under experimental conditions of uptake.

Comment: Please explain how ecotoxicity data will be extrapolated from one species to another.

34. Page 28, third paragraph defines ecotoxicity screening reference values (TRVs).

Comment: LANL should review and revise this paragraph to assure that the TRVs will be derived for each ecologically significant exposure pathway or route and will preferentially be based on chronic mortality, reproduction, and growth studies.

35. Page 28, Table 4-1 presents several categories of information to be supplied to support ESRVs for screening receptors.

Comment: Please explain if and how other toxicity criteria, such as a lowest-observed-adverse-effect level(LOAEL), will be used to derive an ESRV estimate.

Section 4.2.3.1 Terrestrial Receptors

36. Page 29, fourth paragraph, last sentence identifies Baes et al. (1984) as the literature source for the plant tissue bioconcentration factors for inorganic contaminants.

Comment: Many BCFs for plants are derived on a dry weight basis and an appropriate dry-weight to wet-weight correction may need to be made, depending on the units for herbivore ingestion rates used. Empirical data should be used where available. Also, please include units on all variables and state whether BCFs/biotransfer factors are based on a wet-weight or dry-weight.

37. Page 29, fifth paragraph discusses the calculation of biotransfer factors for organic chemicals based upon their respective octanol-water partition coefficients.

Comment: LANL should acknowledge that this calculation is applicable only to those situations where no empirical biotransfer factors are available in literature. If empirical biotransfer factors are available and applicable, they should preferentially be used.

For nickel, cadmium, selenium, zinc, and arsenic, biotransfer factor values can be derived from uptake slope factors provided in the following document:

U.S.EPA. 1992. *Technical Support Document for the Land Application of Sewage Sludge*. Volumes I and

II. EPA 822/R-93-001a. Office of Water. Washington, DC.

Uptake slopes provided in U.S.EPA (1992) are the ratio of the COPEC concentration in dry weight plant tissue to the mass of COPEC applied per hectare soil. These uptake slopes were multiplied by 2×10^9 g/hectare soil to convert to biotransfer factor values. The conversion factor was derived using the U.S.EPA (1992) assumed soil bulk density of 1.33 g/cm^3, and incorporation depth of 15 cm.

For the remaining metals (excluding mercury), biotransfer factor values may be obtained from Baes et al., (1984).

Uptake via air to leaf transfer of volatiles should either be quantatively assessed or qualitatively described as an uncertainty. K_{ow} values used in the regression equation should be provided along with references.

38. Page 30, second paragraph, third sentence: "Conceptually speaking, therefore, any of the organic constituent that is adsorbed to inorganic and organic soil particulates is unavailable for plant uptake because it is not in the water fraction (interstitial water) of soil."

Comment: Although some organic constituents may strongly bind to soil particulate, that results in their low bioavailability, other chemicals may be less strongly adsorbed and, therefore, can be taken up by plants.

LANL should revise this sentence to read: " ... therefore, any of the organic constituent that is adsorbed to inorganic and organic soil particulates <u>may be</u> unavailable for plant uptake because it is not in the water fraction (interstitial water) of soil."

39. Page 30 et sequitur. Information is not provided on whether BCF and BAF values are dry-weight or wet-weight based.

Comment: Please define whether the BCF or BAF in each equation is based on a dry weight or wet weight.

40. Page 30, fifth paragraph, first sentence: "The organic constituent BCF model for soil-dwelling invertebrates (BCF_{inv}) was adopted from Connel and Markwell's (1990) interpretation of earthworm bioconcentration studies, and is presented in Equation 4.6 below."

Comment: Empirical information for organic constituents should also be used when available. Please change the text to indicate that empirical BCFs rather than K_{ow}-calculated BCFs will be used where possible.

41. Page 30, Equation 4.6 is the model adopted to estimate BCF_{inv} for organic constituents.

Comment: LANL should identify how the lipid fraction of the organism and the fraction of organic matter in soil will be determined.

42. Page 31, Equation 4.7 presents the regression relationship describing the concentration of the organic constituents in soil water.

Comment: Please explain how this model will be used.

43. Page 31, Equation 4.8 and text below it which discusses the exposure model used for vertebrates.

Comment: There is no information presented on the calculation of contaminant concentrations in omnivores, invertivores, or piscivores. This equation seems to imply that biomagnification does not occur and that it does not matter what an organism at trophic level 3 eats; its concentration will be entirely dependent upon the amount of fat content and a relationship developed for a herbivore (cow). However, contaminant transfer to upper trophic levels is also dependent on transfer to their food source and magnification potentially occurring within that food source. LANL also states that everything needs to be converted over to a dry-weight and yet Table 4-2 provides most information on wet weight-basis.

Also, LANL describes BAF_i as the "bioaccumulation factor for chemical constituent *x* in soil to diet item *i*".

This description does not discern BAF from BCF. LANL should present information on calculation of contaminant tissue concentrations in individual omnivore, invertivore, and piscivore receptors. It would be more clear if the data are presented and calculations are done on a wet-weight basis

Please revise the BAF description to differentiate, between bioaccumulation and bioconcentration factors

(i.e., BAFs and BCFs), since both terms are used in the subject document.

44. Pages 32 and 33, Table 4-2 lists an inhalation rate as one of the parameters required for inclusion in Equation 4.10 (page 34).

Comment: Please state the purpose of providing inhalation rate and a body weight in Table 4-2 or remove them.

45. Page 33, last paragraph discusses the composition of herbivore, omnivore, and carnivore receptors diets.

Comment: When organisms have omnivorous diets, the suggestion of dividing the diet equally between food items (components) appears to be appropriate for calculating contaminant tissue concentration. However, dietary composition is very site-specific (e.g., a racoon living along a stream may have a diet consisting primarily of crayfish while one living near a garbage dump may eat little to no invertebrates). Therefore, it may be better to bracket the amount of food types eaten rather than specifying an even distribution when estimating dose to a receptor. When estimating dose to a receptor, it is suggested that LANL should run the model assuming both exclusive diets and equally divided diets. For example, if an omnivorous mammal eats both plants and invertebrates, LANL will estimate risk based on a 100% plant diet, a 100% invertebrate diet, and a 50% plant-50% invertebrate diet.

46. Page 34, first paragraph, last two sentences discuss bioaccumulation factors from food-to-muscle (BAF_{fm}) and identify Baes et al. (1984) as the literature source for inorganic contaminants BAF_{fm}.

Comment: LANL should explain the specific application of the transfer factors derived from Baes et al. (1984) and discuss how LANL plans to address contaminant food chain transfer in the case of omnivore and carnivore dietary exposures. This is especially important for estimating exposure to bioaccumulative and biomagnifying contaminants.

47. Page 34, Equation 4.9 is the model based on Travis and Arms (1988) to estimate the BAFs for organic constituents.

Comment: Please explain why this equation differs from that provided in Travis and Arms (1988).

48. Page 34, last paragraph, sixth sentence refers to models for estimating exposure to or uptake of contaminants by plants and invertebrates and states that for those receptors, the ESL simply corresponds to the ESRV (NOAEL).

Comment: LANL should clarify this statement and address the role of biotransfer factors in those models.

49. Page 34, Equation 4.11 presents the ecotoxicity screening level (ESL) calculation for terrestrial vertebrate receptors.

Comment: Due to a disagreement with how dose is calculated (see comments number 43 and 46) this Equation also appears to be incorrect. Please resolve comments 43 and 46 and modify the Equation, as necessary and include a legend. Also, it is suggested that ESLs be calculated using both NOAEL- and LOAEL-based concentrations.

50. Page 35, first paragraph, last sentence states that a soil-borne chemical constituent with a concentration greater than that of the ESL may be considered a COPEC.

Comment: Because the concept of the ESL does not address exposure to multiple contaminants LANL should explain the approach to select COPECs for sites contaminated with multiple chemicals/radionuclides.

Section 4.2.4.2 Estimating Radiological Dose

51. Page 35, fifth paragraph, fourth sentence refers to the radionuclides of interest.

Comment: It is unclear how those radionuclides have been determined to be of "interest." If the suite of "radionuclides of interest" at LANL consists of only those listed in Tables 4-8 through 4-12, this list is likely incomplete. LANL should explain why only some radionuclides are discussed in the subject document and state that individual, site-specific ecological screening level risk assessments will address all relevant radionuclides and their daughter products.

52. Page 35, fifth paragraph, last sentence cites Amiro (1997) and Baker and Soldat (1992).

Comment: Please explain why these authors, especially Amiro, are cited when the dose conversion factors listed in the cited documents do not appear to be used.

53. Page 37, first paragraph, fifth sentence: "For radionuclides with multiple beta decay levels in a radionuclide, the energy per disintegration is calculated as the sum of the MeV per disintegration for that radionuclide."

Comment: LANL should review and revise this sentence to read: "For radionuclides with multiple beta decay levels in a radionuclide, the energy per disintegration is calculated as the sum of the average energy in MeV per disintegration for that radionuclide."

54. Page 37, third paragraph, last sentence states that the assumption of a sphere of a density of 1 g/cm is conservative, as it overestimates the actual energy absorption.

Comment: Please explain where in this document LANL applies a sphere geometry for gamma emitters.

55. Page 40, Table 4-6 shows the summation of energy deposition in tissues.

Comment: LANL should mention that the summation of energy deposition in tissues is a combination of all particle or radiation interactions.

56. Page 40, Table 4-7 presents the fractions of radionuclides in tissue resulting from ingestion.

Comment: Please explain why the table lists the fraction of americium reaching blood as derived from a study of uptake in tumbleweed.

57. Page 40, Equation 4.13 is the model used to estimate the internal absorbed dose for animals.

Comment: This equation incorporates a term listed as "pCi/(g of food)", however, no definition is provided.

LANL should define all exposure factors in this equation and discuss how their values will be obtained or measured. In addition, LANL should present the approach to estimate internal exposure dose through food chain transport (e.g., by using food chain multipliers, if warranted).

58. Page 41, Equation 4.13.

Comment: This equation is confusing and its relation to the preceding equation (equation 4.13 on page 40) is

unclear.

Please explain why Fa is being multiplied by rad/day (i.e., the internal absorbed radiation dose by animals) and 20, in each of the components of this equation and assign it a unique equation number.

59. Page 41, paragraph under Table 4-8, third sentence states that for tritium, the concentration in the blood and tissues is nearly in equilibrium, whereas for actinides only a small fraction of concentration in the blood is absorbed into tissues.

Comment: Please provide a reference for this statement and possibly, a numerical value for the fraction of each actinide's concentration in the blood that is absorbed into other tissues.

60. Page 42, first paragraph, first full sentence states that for the purposes of radiological screening, the soil-to-plant transfer factor is extracted from the default values for the RESRAD computer code to retain consistency with human health dose assessment.

Comment: This statement is unnecessary and confusing. LANL should assure that soil-to-plant transfer factors used to model ecological receptors internal dose are relevant to the mode of ecological receptors exposure. This appears to be more important than its consistency with human health dose assessment.

Therefore, LANL should revise this sentence to indicate whether the soil-to-plant transfer factors used are representative of radionuclides transfer to vegetative (aboveground) parts of plants or reproductive and storage parts or both.

61. Page 42, Table 4-9 presents soil-to-plant transfer factors for radionuclides.

Comments: Soil-to-plant transfer factors for americium and uranium are lower than those derived for vegetative parts by Baes et al. (1984), but within the same order of magnitude. However, for strontium, the soil-to-plant transfer factor value differs by a factor of 10. Please provide the rationale for using these (lower) values.

62. Page 42, paragraph under Table 4-9, second sentence states that LANL will apply the default bioconcentration factor of 1 for terrestrial invertebrates.

Comment: LANL should revise this sentence to acknowledge that the default bioconcentration factor of 1 will be used only if no empirical or **similar** value is available in published literature.

63. Page 43, subsection entitled "External Dose to Terrestrial Animals or Plants Living in or Burrowing in Soil".

Comment: It is unclear why LANL uses dose estimation coefficients for water and extrapolates them to soil. If using one medium coefficient to extrapolate to the next, one cannot multiply by a correction factor for density only. External dose due to media interactions is dependent on the type of radiation and its energy. Use of mass attenuation coefficients for gamma radiation and stopping power for beta radiation, which are density dependent, are necessary in this case. Therefore, extrapolated values in Table 4-11 are incorrect and LANL should revise them for technical accuracy.

64. Page 43, paragraph under Table 4-11, sentences fourth and fifth discuss the half-lives of uranium progeny.

Comment: Some of uranium progeny are short-lived. Uranium is in equilibrium with the first three of its decay products in a relatively short (less than a year) period of time, and these decay products should be considered as a part of the ecological dose assessment.

Although information in Table 4-11 indicates that the subject decay products have been considered, the text does not support this. Therefore, LANL should review and revise the text to identify which uranium decay products will be considered for the uranium isotopes.

65. Page 43, subsection entitled "External Dose Terrestrial Animals and Plants Living on or above Soil".

Comment: Use of immersion dose coefficients for water for extrapolation to soil is inappropriate. See specific comment number 63.

66. Page 44, first paragraph describing the approach using the inverse square relationship to estimate external radiation dose to plants and animals.

Comment: The inverse square relationship is appropriate for planar sources if the planar source approximates a point source. The latter, however, is not the case for distances from 0.5 and 2.0 meters for an infinitely contaminated plane. Therefore, LANL should consider the application of an other geometry correction (e.g., Microshield, a copyrighted software from Groves Engineering, Rockville, MD, 1992), to estimate external radiation dose to ecological receptors.

67. Page 44, first paragraph, third sentence refers to Equation 4.15 on page 41 which is used to estimate dose at 0.5 and 2.0 meters under assumption of the inverse relationship between radiation dose and distance.

Comment: Equation 4.15 on page 41 does not refer to inverse square relationships. Therefore, LANL should revise this sentence for technical accuracy.

68. Page 44, subsection entitled "Calculating External Doses to Aquatic Organisms."

Comment: LANL should use the water immersion coefficients from Eckerman and Rydman (1993) to estimate external dose to aquatic organisms. If sediment dose is to be estimated by using the soil dose estimate coefficients derived from aquatic coefficients, as for terrestrial plants, then this method would be innapropriate. Please see specific comment number 63.

In addition, LANL should address the assessment of external dose for aquatic organisms that live both in the sediment and water, perhaps by using similar approach to that presented in Baker and Soldat (1992).

Section 4.2.4.3 Calculating Ecological Screening Levels for Radionuclides

69. Page 44, fourth paragraph defines the ESLs as "environmental levels that lead to a calculated dose equal to the dose limit [HQ = 1]".

Comment: This definition appears to be appropriate for those sites where ecological receptors are potentially exposed to a single radionuclide only. However, it does not apply to simultaneous exposures to multiple radionuclides (i.e., cumulative exposure). Therefore, it is critical that LANL proposes an approach to addressing cumulative exposures to radionuclides.

70. Page 44, fourth paragraph states: "The ESLs ... are obtained by back-calculating the media concentration from the dose limit value through the dose calculations given above."

Comment: This statement is unclear and LANL should review and revise it to ensure that total radiation dose (i.e., a sum of both internal and external radiation doses) is considered in the ESLs calculation and provide a simple example of an ESL calculation. In addition, LANL should address the approach to model radiation dose to ecological receptors of the different trophic levels.

Appendix B: Ecological Scoping Checklist, Parts A, B, and C.

71. Pages B-2 and B-5: run-off score.

Comment: The basis of the runoff score and a reference for the proposed method is not provided. Please define and state the purpose of the runoff score along with an appropriate reference. Also define how one assesses whether aquatic receptors could be affected if erosion is a transport pathway.

72. Page B-3: Site Visit Documentation. Field verification of site-specific information for fate and transport modeling appears to be weak.

Comment: Please consider verifying fate and transport parameters (e.g., types of vegetation, watersheds, slopes, soil types) as part of the site visit documentation.

73. Page B-4: Site Visit Documentation(cont.).

Comment: The stopping of the site visit checklist based on the absence of receptors without further explanation is inappropriate. In severely contaminated areas receptors may not be present due to the contamination. Please provide an example of what type of area would be considered to have no receptors present.