START

Incoming:9205501

0023413

United States
Environmental Protection
Agency

Region 10
Hanford Project Office
712 Swift Boulevard, Suite 5
Richland WA 99352

EPA

June 8, 1992

SEP 1992
RECEIVED
EDMC

Steven H. Wisness
Tri-Party Agreement Manager
Department of Energy
Richland Operations Office
P.O. Box 550
Richland, WA 99352

Re: Hanford Site Soil Background Report Review

Dear Mr. Wisness:

The U.S. Environmental Protection Agency (EPA) and its contractors have completed the review of the Hanford Site Soil Background report (DOE/RL-92-94). Enclosed are the comments reflecting that review. Enclosed is a Wordperfect 5.1 diskette for your convenience.

The review of the report was based on the content and objectives outlined in the Site-Wide Background Soil Sampling Plan (WHC-SD-EN-AP-052, dated June 1991). Much of the work described in the plan has yet to be completed. Specifically, the refinement of the conceptual model and the recommendations for Hanford Site soil background values have yet to be completed. These are key elements of the report and are only mentioned in Chapter 5. The review of the document therefore is considered preliminary until all data is included.

The EPA believes that the report meets the intent of the Hanford Federal Facility Agreement and Consent Order Milestone (Tri-Party Agreement) M-28-03 however the milestone will not be considered complete until the remainder of the data and conclusions are incorporated into the document. At that time EPA will again review the document and determine if the milestone has been fulfilled. We anticipate a full review cycle on the final document.

RECEIVED
JUN 18 1992
T.R. VENEZIANO

9 2 1 2 6 5 1 1 8 5 3

If you have any questions or concerns regarding these comments, please contact me at (509) 376-4919.

Sincerely,

Pamela S. Innis

Pamela S. Innis
Unit Manager

Enclosure

cc: D.R. Jensen, Ecology
D.C. Nylander, Ecology
~~T.B. Veneziano~~, WHC
K. M. Thompson, DOE
Administrative Record

9 2 1 2 6 6 1 1 8 5 4

The Environmental Protection Agency, (EPA) reviewed the Hanford Site Soil Background report (DOE/RL-92-24). The report was prepared by the U.S. Department of Energy (DOE) and is dated April 1992. The report format, content, and investigative strategy were reviewed for compliance with the Site-Wide Background Soil Sampling Plan (WHC-SD-EN, AP-052 dated June 1991). The comments presented below are based on a comprehensive technical review of the report and supporting appendices. General comments are presented first, followed by specific comments.

GENERAL COMMENTS

The terms "surface soil/sampling", "subsurface soil/sampling", and "vadose zone soil/sampling" are used interchangeably throughout the text. This can be confusing to the reader. A distinction should be made. The sampling sites are exposed and could be considered "surface" sites however the term is more often viewed as referring to the land surface level not exposed faces.

The report does not explain whether surface soil samples are collected and analyzed for inorganic constituents. However, the terms "surface sampling strategy" and "compositional integrity of surface samples" appears in the report. Separate site background data for surface soils should be collected.

Vadose zone soil samples are collected from exposed vertical surfaces of excavation pits, manmade pits, exposed hillsides, river overbank deposits, trenches, and burial grounds. Since these exposed surfaces may have been subjected to contamination from external influences such as precipitation, runoff, fallout, dust, and erosion, it remains questionable whether the data obtained from these samples provide accurate background information. The report should document the "appropriate procedures" and "quality control" used for representative samples from these locations.

Field duplicate samples are not collected and analyzed to evaluate the homogeneity of the medium sampled in a particular location or the precision in sampling.

Systematic random samples are collected from limited depths. The report should clarify how the samples collected from these depths represent the entire depth of the Hanford formation at these respective locations. The depth of the vadose zone varies from 30 feet to 200 feet at various waste management units.

The usefulness of judgment samples is not clearly explained. It would be appropriate to determine separate background levels for strategically distinct units or subunits (end members) or a single average for Hanford formation with appropriate inclusion of end member samples.

9 2 1 2 6 5 1 1 8 5 5

Certain sampling activity objectives stated in Section 2.1 of Appendix A are not addressed. These include (1) the factors that affect the chemical composition of the Hanford site soils, (2) how these factors influence the compositions obtained by regulatory protocols, and (3) the type of compositional variability that exists.

Analytical results for soil sample leachates are reported in milligrams per liter (mg/L). However, the usefulness of such results for background conditions is limited. Background soil data should be reported on a dry-weight basis in milligrams per kilogram (mg/kg) or micrograms per kilogram (μg/kg) for comparison with site soil contamination.

The soil report contains excessive statistical analyses which do not aid the reader's understanding of the site background soils. There is also some confusion between "background" and "threshold" values and concentration units are omitted.

The preliminary results seem to support the conceptual model however, the deviation of sodium from the expected result will need further explanation.

Specific comments follow.

9212611856

SPECIFIC COMMENTS

1. **EXECUTIVE SUMMARY, p. iii**

   Comment - Line 34 uses the term "dangerous waste". The usage is inappropriate since this may be misconstrued to reference the Dangerous Waste regulations (WAC 173-303).

2. **EXECUTIVE SUMMARY, p. iii, second paragraph**

   Comment - The text states, "the compositions of the entire vadose zone appear to be dominated by . . . two ubiquitous constituents in the soils . . . thus these two end members . . . strongly influenced by . . . minor end members." The two ubiquitous constituents and the two end members should be identified.

   This paragraph is confusing and should be rewritten to clarify its meaning.

3. **SECTION 1.0, p. 1-1**

   Comment - In reviewing this report and the study plan for the background study (WHC-MR-0246), an explanation of why the study excludes a definition of the background levels of radionuclides was not found. Radionuclides were apparently

excluded from the study because an adequate data base and a statistical analysis of the data already exists for the Hanford Site. If this is true, it should be so noted in the introduction and appropriate references should be provided. If this is not true, please explain how the background levels of radionuclides will be established.

4. **SECTION 1.0, p. 1-1**

Comment - The definition of natural background in the Definition of Terms is not consistent with the definition of natural background noted in paragraph 2 of Section 1.0. The definition of natural background in the Definition of Terms includes low concentrations of anthropogenic organic compounds such as PCB's, while the definition in Section 1 does not. These definitions should be consistent.

5. **SECTION 1.0, p. 1-2, second paragraph**

Comment - Section 1.0 discusses the waste management unit (WMU) background, a single Hanford site background, and the area background. The paragraph should clearly explain why a single Hanford site background concept is used in this study, or a reference should be cited to clarify this decision.

6. **SECTION 1.0, p. 1-2, lines 11-13**

Comment - This sentence implies that natural background for soils will be established with data from analyses of the unconfined aquifer. The last sentence should include a reference for groundwater background or be reworded to specify only the soil media.

7. **SECTION 1.1, p. 1-2**

Comment - As noted in the last paragraph, the sodium values do not appear to represent a single statistical population. After the obvious outliers were deleted, the sodium values shown in Figure 40 on page F-40 appear to represent two distinct populations. This appears to violate the conceptual model of a single site-wide background population. The statement is made that "this is consistent with the variability in the natural repositories of sodium in the soils (e.g., minerals) and its geochemical behavior." This is an ambiguous statement and is unsupported by further discussion (see comment on Appendix D, Section 2.7, p. 2-7). A better explanation of the divergence of the sodium data from the conceptual model is warranted.

8. **SECTION 1.3, p. 1-4**

Comment - A brief description of the background conceptual model should be provided or a reference should be cited so that the reader can obtain this information.

In the second paragraph, the text states that the entire vadose zone of the Hanford site can be represented by two end member compositions. The two end member compositions should be specified or a reference should be cited for this information.

9. **SECTION 1.3, p. 1-4, lines 46-47**

Comment - It is noted here and elsewhere in the report that the composition of the soil is defined by differing proportions of two end member sediment types and that the composition of any sediment sample should fall somewhere between the composition of the two end members. This part of the conceptual model could be tested by obtaining information from the literature or by analyzing representative samples of the end members and comparing the results to confirm that the majority of soil samples tested fall within the range of the end-member compositions.

10. **SECTION 2.2, p. 2-1**

Comment - This section should describe validation procedures used to qualify the analytical data. The description of the qualifiers used in Appendix C should also be provided here.

11. **SECTION 2.1, p. 2-1, lines 11 and 12**

Comment - The sentence notes that the Hanford site is located in the Pasco Basin which is a structural element of the Columbia Plateau and references Figure 2-1. Figure 2-1 shows neither the Pasco Basin nor the Columbia Plateau.

Either change Figure 2.1 or replace it with a figure that displays the referenced information.

12. **SECTION 2.1, p. 2-1, line 18**

Comment - The Ellensburg Formation also includes epiclastic sediments.

13. **SECTION 2.1, p. 2-1, line 25 and 26**

Comment - The sentence is grammatically incorrect. It may be appropriately written as "The Ringold Formation, which directly overlies the basalt, consists of moderately

9 2 1 2 6 5 1 1 8 5 8

consolidated fluvial-lacustrine sediment and is the principle member for the unconfined aquifers at the Hanford Site".

14. SECTION 2.1, p. 2-3, lines 18-20

Comment - This sentence implies that plant and animal activity are the sole cause of soil horizons.

15. SECTION 2.1, p. 2-3, lines 37-38 and 44-45

Comment - It is noted that subordinate members of the vadose zone are included in the data evaluation process. The EPA believes these subordinate members should be represented by the judgement samples discussed in Appendix A, yet no evaluation of the judgement samples nor discussion of these subordinate members is found in either Chapter 5 or Appendix D.

Compare the results of judgement samples to the general population and discuss the results.

16. SECTION 2.1, p. 2-3, lines 47-51

Comment - The site-wide soil background exclusively focussed on sampling the Hanford formation sediments. Underlying the 200-West area, the Ringold Formation comprises a large portion of the unsaturated zone, and this portion of the Ringold Formation meets the definition of soil used in this report. How will soil samples taken from the Ringold Formation be compared to background?

Chapter 1 or 2 should address whether the Ringold Formation will be compared to the site-wide background developed for the Hanford formation or to a particular end member or subordinate member of the Hanford formation, or if a separate 200-West Ringold Formation background will be developed.

17. SECTION 2.1, p. 2-4, lines 47-49

Comment - It is unclear as to what is meant by the phrase "these soils support plant growth (DOE 1988) that is largely restricted to the upper few inches of the vadose zone." If this statement refers to rooting depth, it should be noted that "big sage" is a common plant type on the Hanford reservation and commonly has a rooting depth of about 3 meters. Please explain or clarify this sentence.

9 2 1 2 5 1 1 8 5 9

18. **SECTION 2.3, p. 2-3, line 17**

Comment - This section states that maximum claimed detection limits are included in Appendix C, but this information is not included in the appendix. This omission should be corrected.

19. **SECTION 2.3, p. 2-3, line 21**

Comment - This section states that the matrix effects for soil samples will be estimated during the statistical analysis. The text should provide details of this statistical estimation.

20. **SECTION 3.1.2, p. 3-2**

Comment - This section does not reflect the EPA policy that detected organic chemicals automatically represent contamination. The sole exceptions to this policy, humic compounds and similar materials, are not detected in routine assays from the Hanford site.

21. **SECTION 3.2, p. 3-3 and 3-4**

Comment - It is noted that soil samples were collected from Savage Island and near the Yakima Barricade yet no information on these sites is presented in Appendix A or Appendix B.

Describe the number and depth of samples collected in these bore holes and note which formation these samples represent, Hanford, Ringold, or alluvium.

22. **SECTION 3.2, p. 3-4, lines 41-42**

Comment - Rational for the exclusion of carbonate analysis should be given.

23. **TABLE 3-1, p.T3-1, line 19**

Comment - This table lists method 200.7 CLP-M for analysis of titanium and zirconium; this method is not approved for analysis of these two compounds. The correct methods should have been used for these analyses. Method 300 for inorganic, nonmetallic analyses and method 7481 for molybdenum analysis should be included in the footnote for this table.

9 2 1 2 6 5 1 1 8 6 0

24. **SECTION 4.0, p. 4-1, line 19**

This section states, "The CLP (leachate) analysis of these samples is the basis for determining background threshold levels." The CLP (leachate) procedures are not routine CLP analytical services and are not referenced in Table 3-1. This method should be identified in the table.

The rationale for analyzing the sample leachate for determining background threshold levels is not provided and should be.

25. **SECTION 4.1, p. 4-1, first paragraph**

This section states that since bias is involved in the collection of judgment sample data, these data cannot be used in the statistical calculations of threshold contamination. The procedure and potential bias should be identified to determine any possible use of these data. It is not clear how biased data establishes the completeness of this sampling program. This section also states that the judgment data are used for identification of "subordinate end members." Subordinate end members should be defined.

26. **SECTION 4.1, p. 4-1, second paragraph**

This paragraph discusses quality assurance and quality control (QA/QC) sample data sets. There is no discussion on the collection and analysis of field duplicate samples to measure either the homogeneity of the medium sampled in a particular location or the precision in sampling. Similarly, there is no discussion on the sample collection and analysis for field blanks to determine if certain field sampling or cleaning procedures might result in cross contamination of site samples.

27. **SECTION 4.2, p. 4-2, line 28**

This section states that "constituents that do not exceed threshold levels by statistically significant amounts can be dropped from further consideration . . . " The acceptable statistical limit above threshold levels should be stated.

28. **SECTION 4.3.2, p. 4-4, lines 7 and 8**

<u>Comment</u> – It is stated that "the ensemble of sampling locations covers the Hanford site both horizontally and vertically through the stratigraphic section" shown in Figure 4-1. As noted in comments to Section 2.1, it appears

9 2 1 2 5 5 1 1 8 5 1

that the Ringold Formation was not sampled. It is therefore recommend that line 7 be changed from "Hanford Site" to "Hanford formation."

29. SECTION 4.5, p. 4-5, and Table 4-2, p. T4-2

Comment - "Thresholds" should be defined. The referenced Table 4-2 (which is not numbered) is difficult to decipher and should be reformatted. In addition, there is no explanation in the text for use of the Weibull distribution. Readily available reference books note that this distribution is most used by engineers and toxicologists for analysis of life data (survival times). It is useful to vary shapes by varying its two parameters (called α and β in one reference and κ and ρ in the other) from the exponential distribution to the extreme value distribution. Since Table 4-2 refers only to η and β, it is unclear which shape variant is used. The text should clarify which shape variant is used.

30. SECTION 4.11, p. 4-7

Comment - The text in Chapter 3 implies that no organic analyses, other than field determinations, were run on samples from the inorganic sites yet it is indicated that no detectable organics were found at these sites. A clarification should be made in Chapter 3.

31. TABLE T4-1, p. T4-1

Comment - This table identifies sample numbers B014K4 and B014K5 as outliers. These two samples are field duplicates with high levels of alkalinity. The quality control criteria for identification of these samples as outliers should be stated. It should also be clarified whether the outliers listed in this table were used in identification of any other analytes.

32. CHAPTER 4, Figure 4-1, p. F4-1

Comment - The stratigraphic units sampled by the Savage Island and Yakima Barricade bore holes, and by site 14 are not shown on Figure 4-1.

33. CHAPTER 4, Figure 4-2, pp. F4-2.1 through 2.13

Comment - Fifteen sampling sites are plotted on the scattergrams. We assume that these represent sites #1-14. Does site 15 represent the Yakima Barricade or Savage Island

9 2 1 2 6 5 1 1 8 6 2

bore hole? Identify site 15 and explain why the data from the other site is missing.

Also, no units are given for these figures.

34. **CHAPTER 4, Figure 4-3, pp. F4-3.1 and F4-3.2**

Comment - No units are given for the figures.

35. **CHAPTER 4, Figure 4-4, p. F4-4**

Comment - No units are given for the figures.

36. **SECTION 5.0, p. 5-1, first paragraph**

Comment - The text concludes that the site-wide approach is technically preferable to the unit-based approach for establishment of soil background. This conclusion should be explained.

37. **SECTION 5.2, p. 5-1**

Comment - This section addresses site-wide background threshold values for six representative inorganic analytes for vadose zone soils. However, there is no discussion of threshold values for these six representative inorganic analytes for surface soil samples.

Also, the text in this section states, "These soil compositions represent the range of lateral and vertical variability of soil types in the Hanford formation and younger soils." No supporting data related to this variability are discussed, but should be.

38. **Appendix A, Section 2.1, page 2-1**

Comment - In the second paragraph, the text does not state the objective of the Hanford site-wide soil background sampling and analysis effort for the surface soils. This omission should be corrected.

39. **APPENDIX A, Section 2.2, p. 2.2, lines 23-24**

Comment - The Pleistocene floods that deposited the Hanford formation are noted to have occurred between 16,000 and 12,000 years ago. In Section 2.1, the floods are noted to have occurred between about 1 million and 6,000 years before

9 2 1 2 6 5 1 8 6 3

present. The estimate in Section 2.1 may be closer to the truth.

40. APPENDIX A, Section 2.3, p. 2-4

The text in lines 27, 28, and 42 regarding the surface sampling strategy should be clarified.

41. APPENDIX A, Section 2.4, p. 2-5

Comment - The discussion of the composition integrity of surface samples focuses only on the representativeness of the whole rock sample. In the arid environment of the Hanford site the rocks and minerals probably have not been subjected to extensive mineral weathering in the period of time that most of the surface samples have been exposed and the samples should accurately represent the primary mineralogy of the formation. However, the CLP extraction methods used for the analyses of inorganic composition of the soil do not measure the primary mineralogic composition of the soil sample, but rather measure the more chemically mobile fraction of the soil, such as ions dissolved in interstitial soil water, exchangeable ions, and precipitates on the soil surface. This relatively mobile fraction of the soil may indeed have been altered by years or 10's of years of exposure to the soil surface and leaching by precipitation.

As noted in a comment to WHC-MR-0246, the chemical composition of the soil that is extractable can vary significantly depending on the depth of the soil, with soil within 1-2 meters of the surface being leached of soluble ions and soil below that depth being enriched with deposited ions. Soils below the root zone at a depth of 10-20 ft may be less affected by the near-surface leaching and deposition of soluble minerals.

The process of leaching of near-surface soils and redeposition at greater depth is not included in the conceptual model nor in the discussion of the representativeness of near-surface sampling.

The section title is "Compositional Integrity of Surface Soils", but the discussion cover subsurface soils. This discrepancy should be resolved.

42. APPENDIX A, Section 2.5, p. 2-5, line 28

Comment - The four tentatively recognized subdivisions for the stratigraphy of the Hanford formation should be specified.

9 2 1 2 6 5 1 1 8 6 4

43. **APPENDIX B, Section 1.1.1, p. 1-2**

Comment - The height of the exposed vertical section of the hill should be provided as should the rationale for the assumption that three sample locations represented the full height of exposure. In the previous section (Section 1.1), sampling intervals are spaced at approximately 3-foot vertical intervals from a random starting point. This discrepancy should be addressed.

44. **APPENDIX B, Section 1.1.2, p. 1-2**

Comment - The depth of exposed hillside, the elevations (depths) at which the systematic samples are collected from the four locations, and the stratigraphic details should be provided to allow evaluation of the representative sample collection. The rationale for the collection of multiple samples from the uppermost location, about 1 foot below the top of the exposure, should be stated.

45. **APPENDIX B, Section 1.1.3, p. 1-3**

Comment - Two separate sampling events are conducted at Site 3 from 12-foot-high and 25-foot-high exposures. The significant difference between these two exposures is not explained elsewhere. The sampling depths for systematic and judgment samples are not specified for these two sampling events.

46. **APPENDIX B, Section 1.1.5, p. 1-4**

Comment - The total depth of the pit exposure should be stated. The rationale for the collection of judgment samples at this site should be provided when all samples collected are fine grained.

47. **APPENDIX B, Section 1.1.6, p. 1-5**

Comment - No information on the collection of multiple samples or judgment samples is provided at Site 6, but should be. The total depth of the pit and the elevations at which the systematic samples are collected should be provided. This comment is applicable wherever appropriate in subsequent sections.

48. **APPENDIX B, Section 2.0, p. 2-1**

Headspace analysis is suggested to validate background conditions for volatile organic compounds (VOCs). The primary limitation of this technique is that unless the soil type, headspace volume, temperature, sample handling techniques, and storage time are held constant, relative

9 2 1 2 6 5 1 1 8 6 5

concentration levels between soil samples are not comparable. Analytical sensitivity, selectivity, and other considerations are required to determine the degree of analytical sophistication needed for a specific measurement. The reported headspace measurements are for total organic values, but will not provide data for detailed speciation. The intended use of headspace measurements is not clearly explained to allow evaluation of this technique for validating background conditions. Background soil samples should not be analyzed for VOCs since no VOCs are present.

49. APPENDIX C, General Comments

Extensive data is given for bore hole site 699-48-96, yet no reference is given for this site in Chapter 3 nor in Appendix A and B.

The data summary needs further explanation, including:

- Why these soil data are reported in units of mg/L.
- Why most "used" lead results are given as 5.85 mg/L. The plotted data, such as Figure 34 in Appendix D, are quite different.
- Why some sodium results (such as sample B014G1) are listed as rejected (qualified "R") but still given a numerical value in the "used" column.

50. Appendix C, Raw Data Soil Background Table

Comment - This table presents the maximum quoted detection limit, contract-required detection limit, achieved detection limit, and the used detection limit value. The text should define the maximum quoted detection limit and the achieved detection limit. The used detection limit value for aluminum, calcium, copper, iron, lead, and sodium are higher than the contract-required detection limit for these analytes. The text should describe how this raised detection limit will affect the data usability. The text also lists the contract-required detection limit for calcium at 5,000 mg/L. The contract-required detection limit is 5 mg/L. This error should be corrected.

Soil sample data should be reported on a dry-weight basis. Also, soil chemical data should be reported consistently for each type of analysis as either mg/kg or µg/kg as specified in the Site-Wide Background Soil Sampling Plan (WHC 1991). In this report, soil chemical data are reported in mg/L using leachate of soil samples, which deviates from the site-wide background soil sampling plan that does not

9 2 1 2 6 5 1 1 8 6 6

include any leachate analysis. This discrepancy should be addressed.

51. APPENDIX D, General Comment

The statistical results are not clearly justified, and this appendix seems to be based on a new methodology. The use of a new methodology should be justified, especially when accepted methods, such as the outlier analyses cited in Section 1.2, are available. Part of that justification includes referencing sources, which are almost totally absent here. Another crucial omission is the definition of terms, such as "factor analysis," and "variogram," and the parameters of the Weibull distribution cited in the comment on Section 4.5, page 4-5, and Table 4-2, page T4-2.

52. APPENDIX D, Section 1.0, p. 1-1 to 1-3

Comment - Several of the statistical analytical techniques described in this section, including variogram analysis and subordinate end member analysis, are not included in the data analyses presented in Section 2.0.

53. APPENDIX D, Section 2.1, p. 2-1, lines 16-18

Comment - The inorganic analyses of surface samples taken for the characterization of organics background are noted here, but are not included in the statistical analyses. How will these analyses be handled? Will they be included in the general systematic-random population or as judgment samples? In light of the comments on Appendix A, Section 2.4, it is suggested that these samples be handled as judgment samples for comparison with the general systematic-random population.

54. APPENDIX D, Section 2.2, p. 2-1

Comment - The column headings of the referenced Table 1 should be clearly defined. In addition, the report should consider whether the high data rejection rates, especially for antimony, would bias the results.

55. APPENDIX D, Section 2.3, p. 2-3

Comment - Table 3 shows all the requested detection limits to be several orders of magnitude higher than the contract-required detection limits. Also, many achieved detection limits exceed both claimed and requested detection limits.

9 2 1 2 6 6 1 1 8 6 7

More information on the causes and effects of these phenomena is needed.

56. **APPENDIX D, Section 2.4, p. 2-3**

Comment - This section needs clarification. Besides the usual questions on statistical treatment, there are questions on the relevance of X-ray fluorescence (XRF) and leachate (liquid-phase) assays to the inductively coupled plasma (ICP) and furnace assays actually used for these background soil samples. The differences inherent in the assay methods must be separated from other variables. For instance, the sensitivity (detection limit) of XRF is a function of the excitation source, so, in some systems, chromium has a very high detection limit. Other factors govern detection limits in ICP, so lead has a relatively high detection limit. These factors must be considered.

57. **APPENDIX D, Section 2.6, p. 2-5**

Comment - The given cumulative distribution function plots are not useful; they are difficult to read and make it impossible to connect the two assays of a single sample. A regression of Maxwell S-Cubed results against Datachem results, preferably on a log-log plot, would help determine if there is an interlaboratory effect.

58. **APPENDIX D, Section 2.7, p. 2-5**

Comment - The meaning of "truncation" as applied to the calcium data, is not clear. The text should explain how censored data (such as the low end of the data in Figure 22B) are handled. There is extensive literature and several proposed methods on handling such left-censored environmental data.

59. **APPENDIX D, Section 2.7, p. 2-7, lines 23-26**

Comment - Sodium is noted to occur in a number of different repositories and it is concluded that multiple distributions are a reasonable result. If the conceptual model is correct, these repositories should be relatively well distributed throughout the soil column and sodium analysis should fit a single statistical distribution. The occurrence of multiple distributions for sodium appears to violate the conceptual model. It appears that either the conceptual model is incorrect or that some other overriding factor controls the distribution of sodium. The discussion presented in Section 2.7 does not adequately explain the

9 2 1 2 6 6 1 1 8 6 3

deviation of the sodium distribution from the conceptual model and should be expanded.

TYPOGRAPHICAL ERRORS

EXECUTIVE SUMMARY, p.iii, line 17: Change "organic" to "inorganic".

CHAPTER 5, Section 5.3, p.5-2: The last word in this paragraph should be "values" and not "valves".

APPENDIX A, Section 2.1, pg 2-2, line 7: Delete the word "the" at the end of this line.

APPENDIX A, p. 2.3, line 2: Change "quart" to "quartz".

APPENDIX D, Section 2.7, p. 2-7, line 18: Change "will be" to "were".

9 2 1 2 6 5 1 1 3 6 9

CORRESPONDENCE DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
P. S. Innis, EPA	S. H. Wisness, RL	Incoming:9205501 XREF:9253209D XREF:9205500

Subject: HANFORD SITE SOIL BACKGROUND REPORT REVIEW

INTERNAL DISTRIBUTION

Approval	Date	Name	Location	w/att
		Correspondence Control	A3-01	
		G. D. Carpenter	B2-16	
		C. K. DiSibio	B3-03	
		D. F. Farwick	H4-16	
		C. J. Geier	B2-19	
		J. D. Hoover	H4-57	
		T. Legore	B4-63	
		R. E. Lerch, Assignee	B2-35	
		R. J. Landon	B2-19	
		P. J. Mackey	B3-15	
		H. E. McGuire, Level 1	B3-63	
		J. K. Patterson	L4-92	
		K. S. Pedersen	R3-35	
		S. M. Price	H4-57	
		A. L. Prignano	H4-57	
		F. A. Ruck III	H4-57	
		T. B. Veneziano	B2-35	
		T. M. Wintczak	L4-92	
		R. D. Wojtasek	L4-92	
		EDMC	H4-22	
		FAR/LB	H4-57	

9 2 1 2 6 5 1 1 8 7 0