UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10 HANFORD PROJECT OFFICE
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0013549

April 26, 1994

Bryan L. Foley
Department of Energy
Richland Operations Office
P.O. Box 550, MS A5-19
Richland, WA 99352

9413293.3193

Re: Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility

Dear Mr. Wisness

35426

The U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and their contractors have completed the review of the Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility, Decisional Draft, DOE/RL-93-99, Hanford, Washington. Enclosed are the combined comments on the technical and regulatory content of this report.

Also enclosed is a copy of Ecology's comments, as the support agency, for inclusion into the Administrative Record. A separate response to these comments is not required.

A Word Perfect 5.1 diskette is enclosed for you convenience.

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

Sincerely,

Pamela S. Innis
Unit Manager

enc.

cc: Patrick W. Willison, DOE
Steven H. Wisness, DOE
Michael Collins, DOE
Norm Hepner, Ecology
Dan Duncan, EPA
Dean Ingemansen/Andy Boyd, EPA
Jeff Ross, PRC
Bill Lum, USGS
Vern Dronen, WHC
Administrative Record, ERDF

INTRODUCTION

The U.S. Environmental Protection Agency (EPA), the Washington State Department of Ecology (Ecology), and their contractors have completed the review of the Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility, Decisional Draft, DOE/RL-93-99, Hanford, Washington. General and specific comments are provided separately for each section of the report.

GENERAL COMMENTS

Based on ongoing Tri-Party negotiations, the preferred alternative for trench design encompasses only 1.6 square miles. All text and figures should be modified to note this change. Site selection is a very controversial topic and will likely be the focus of many public comments. A summary of the site evaluation also should be provided in the text.

The No Action alternative is not well defined and is not ranked against the other alternatives. Based on the RI/FS analysis, it is not possible to clearly choose a preferred alternative over No Action. The discussion of No Action needs to be strengthened and better defined.

The RI/FS document refers to the ERDF as a landfill and wastes to be disposed of within the ERDF as RCRA closure and corrective action wastes. ERDF is not a landfill and wastes to be disposed of in ERDF are remediation wastes. All incorrect references should be changed.

Appendix B should be incorporated into the main body of the RI/FS and the alternatives should be evaluated using the direct exposure scenerio.

The Executive Summary and Chapters 1, 7 and 8 need to further discuss how treatment of waste will be addressed. The use of a CAMU must be justified through a clear demonstration that its use expedites and improves remedial decisions, and that existing requirements, policies and guidelines for selecting remedies are addressed.

The NEPA/SEPA analysis is incomplete. Impacts of construction, operation, and credible accidents are not thoroughly discussed. Additionally, other impacts are not discussed, including wind and water erosion, displaced soil, transportation from waste and borrow sites, habitat, air, etc. There must be a discussion of the consequences of actions both specific to this project and cumulative impacts. Furthermore, mitigation of these impacts are not provided for in the regulatory package. The package needs to lay out steps that may be taken to reduce or compensate for the impacts. Some of these steps are found in the CAMU application but many are not. Examples of some of these steps include preparedness for accidents and actions taken to mitigate habitat impacts.

EXECUTIVE SUMMARY

SPECIFIC COMMENTS

Executive Summary, Pg. ES-1, First Paragraph, Third Sentence: The ERDF CAMU will handle only remediation waste created during CERCLA and RCRA corrective action cleanup. RCRA closure waste will not be accepted at this time.

Executive Summary, pg. ES-1, para 2: Milestone reference number is incorrect. Correct reference number is M-70-00.

Executive Summary, Pg. ES-1, First Paragraph, Last Sentence: Waste should be classified as hazardous/dangerous waste, not specifically dangerous.

Executive Summary, Pg. ES-1, Second Paragraph, Fourth Sentence: The NEPA road map is an additional part of the regulatory package. It should also be noted that the regulatory package will suffice for SEPA documentation of an EIS.

Executive Summary, pg. ES-1, para 3/pg 1-3, para 3: Cultural resources is referenced as a NEPA value addressed during the typical RI/FS process. Within the same paragraph, cultural resources is stated to be a NEPA value not normally addressed in the RI/FS process. Please correct.

Executive Summary, Pg. ES-1 Through ES-2: The proposed site will not cover four square miles. That amount of land was reserved for waste management using the standard trench configuration. The proposed ERDF site, using the deep area-fill trench configuration, will cover only 1.6 square miles.

Executive Summary, pg ES-2, para 1: The paragraph states that radiological contamination has been spread by animals to the ERDF expansion area and may be present east of the REDOX plant in the 200 West Area. Is this true? Since site is being reduced, this paragraph will require modification.

Hydrogeology, page ES-2. This section does not include a summary of information on aquifer hydrogeologic properties such as transmissivity and hydraulic conductivity. Although such information is apparently limited (as discussed in Section 2.6.2.2 of the remedial investigation/feasibility study [RI/FS] report), the currently available and relevant information should be summarized in the executive summary. Any additional site-specific hydrogeologic information collected during the recent

Environmental Restoration Disposal Facility (ERDF) site field investigations should be incorporated into this executive summary as available.

Executive Summary, page ES-3, Waste Characteristics: This section briefly describes the volumes of waste anticipated to require disposal in ERDF from the 100, 200, and 300 areas. The total for these areas is 37.2 million cubic yard. This estimate is much greater than previous estimates. Change these waste volumes estimates to be based on the same reference used by the ACOE.

Executive Summary, Pg. ES-5, Fourth Paragraph, First Sentence: Institutional controls are considered useful for short-term protection and should be noted as such. Assuming the loss of institutional control, the surface barrier is the only inhibitor for human, plant and animal intrusion. Direct exposure is relevant if the barrier does not prevent, to the extent practicable, intrusion or provide adequate shielding from radioactive waste. Also, the barrier should provide for release of gases from the waste.

Executive Summary, page ES-5, paragraph 4. The intruder scenario is dismissed based on institutional controls and a surface barrier. The risk assessment should be revised to show potential risks beyond the period of institutional controls. This is required by DOE Order 5820.2A. Experience at other DOE sites, such as at the Savannah River Site (SRS), indicates that the intruder scenario drives many of the radionuclide waste acceptance criteria (WAC) limits. For example, the SRS E-Area Vaults (EAV) radiological performance assessment (RPA) includes risks and potential limits for 26 radionuclides. Only 9 of these radionuclides show the groundwater pathway as limiting; 15 of the radionuclide limits are driven by the agricultural intruder scenario; and 2 of the radionuclide limits are driven by air

emissions. Based on this information, the intruder scenario should be revised to incorporate elements found in DOE and Nuclear Regulatory Commission (NRC) guidance.

Executive Summary, page ES-5, paragraph 5. This discussion of exposure pathways for radionuclides should state whether a pathways analysis was done. This is important since it appears that applicable exposure pathways, such as inhalation of radionuclides, have not been included in the risk assessment.

Executive Summary, Pg. ES-5, Last Paragraph: Is the year 540 based on the closure of the ERDF or is operational time included?

Executive Summary, Pg. ES-6, Third Paragraph: Given the limited amount of sampling done at the waste sites during limited field investigations, it is likely that maximum concentrations will be taken into consideration and not dismissed as this paragraph states.

Executive Summary, page ES-6, paragraph 3. The text states that by using maximum detected concentrations it is likely that the predicted risks are much higher than actual risks. The text should also recognize that because many of the source areas from which waste would be brought to the ERDF have been minimally characterized, maximum detected concentrations to date may be significantly less than maximum concentrations actually present.

Executive Summary, page ES-8, paragraphs 2 and 3. The text states that leachate criteria have a higher priority than soil criteria. However, WAC development should also include potential exposures based on the intruder scenario. The relationship between soil criteria, leachate criteria, and the intruder scenario should be discussed in the text. The text should also be revised to identify the specific uranium radionuclide that will exceed the maximum soil concentration.

Executive Summary, page ES-9, para 2: In discussing travel times and risks, provide the numerical higher risk estimates and shorter travel times for a wetter climate.

Executive Summary, page ES-10, para 2: In the discussion of long-term objectives for ERDF, the recommendation for barriers is different for differing scenarios. This is an inappropriate discussion.

Executive Summary, Pg. ES-10, Last Paragraph: The Hanford Barrier is designed to minimize bio-intrusion and long term maintenance. It should be noted that the RCRA modified barrier is less likely to inhibit bio-intrusion over the long-term and that the low permeability soil provides minimal protection against bio-intrusion and will require maintenance against plant intrusion.

Typographical Errors (Provided only for the Executive Summary)

Executive Summary, Pg. ES-3, Fifth Paragraph, First Sentence: Delete the word "were".

Executive Summary, Page ES-4, First Paragraph, Last Sentence: Add the units (m^3) after 4.7 million.

Executive Summary, Pg. ES-4, Third Paragraph, First Sentence: Change "simulated" to "simulate".

Executive Summary, Pg. ES-8, Second Paragraph, Second Sentence: Change "were determining by back-calculated" to "were determined by back-calculating". Also, change "concentrations" to singular at both places in this sentence.

Executive Summary, Pg. ES-9, Second Paragraph, Last Sentence: Add the word "in" after "result".

Executive Summary, Pg. ES-9, Last Paragraph, First Bullet: Change "provide" to "provides".

Executive Summary, Pg. ES-10, First Paragraph, Third Sentence: Delete "the observe".

SECTION 1.0

SPECIFIC COMMENT

Section 1.0, page 1-1, paragraph 1. The requirements of DOE Order 5820.2A should be addressed as part of the discussion for land disposal units.

Section 1.1, Pg. 1-1, Third Paragraph: It should be noted in this paragraph that the State has included CAMU in the WAC corrective action regulations and will be the lead regulatory agency for the facility once HSWA authority is granted. Until that time EPA will be the lead regulatory agency.

Section 1.1, page 1-2, para 1: In providing background, the incorrect milestone number is given. The correct milestone number is M-70-00. Additionally, a discussion of the permitting of ERDF under RCRA needs to be made more clear. Elaborate that a modification to the Hanford Sitewide Permit will be sought prior to operation of the facility.

Section 1.2, Pg. 1-2, First Paragraph, Third Sentence: Technology is available to <u>treat</u> the waste but not destroy it. The text should be changed to note this.

Section 1.2, Pg. 1-2, Second Paragraph, First Sentence: This sentence should be reworded to note that the intent of the CAMU is to promote more protective and cost effective management of waste. The intent of the CAMU rule was not to avoid meeting LDRs but rather to allow flexibility in treatment of those wastes with out requiring that LDRs be met. It is the expectation of EPA that treatment to LDRs be analyzed/attempted for remediation wastes and that justification be provided if they are not met.

Section 1.3, Pg. 1-3, Second Full Paragraph, Second Sentence: This sentence should be deleted. The wastes at the operable units will never be "fully characterized". Current investigations rely on limited characterization activities, use of process knowledge, and the observational approach. Additionally, to the extent possible, a discussion of treatment technologies concerning LDRs should be given.

Section 1.3, Pg. 1-3, Second Full Paragraph, Fifth Sentence: It has been stated in past ERDF meetings that a separate document will be published containing specific waste acceptance criteria. This should be referenced in the text.

Section 1.3, page 1-3, para 2: In discussing RI/FS content at the source operable units, the text incorrectly states that source operable units will assess treatment options in the context of waste acceptance criteria for the ERDF. Treatment as a remedy will be assessed during the FFS at each operable unit and will include treatment necessary to meet ERDF waste acceptance criteria.. If treatment is chosen as the preferred remedy, treatment will occur. If treatment is necessary to meet ERDF waste acceptance criteria, similarly, it will be done.

Section 1.4, Pg. 1-4, Second Paragraph, First Sentence: This paragraph should note that the 6 square miles was set aside for remedial waste management activities and that by optimizing the

trench design the ERDF will occupy only 1.6 square miles of that area.

Section 1.4, pg 1-4, para 3, second bullet: The lowest off-site dose in event of a radiological incident was deleted from the final SER. Delete this factor.

Section 1.4, Pg. 1-4, Last Paragraph: One CAMU criteria states that uncontaminated land will be used for a land based unit only if the action is more protective than using contaminated land. This has not been demonstrated in the evaluation of Site 3 versus the BC control area.

SECTION 2.0

GENERAL COMMENTS

Overall, this section contains lengthy discussions of the regional geological and hydrogeological settings of the Hanford site. This section should be reduced to contain a brief general description of the Hanford Site and all available ERDF specific information. However, the sections on local geology (2.4.4) and local hydrogeology (2.6.2) do not appear to contain information that may have been collected during the recent ERDF site field investigations. The geologic cross sections (Figures 2-30, 2-31, 2-32, and 2-33) and the cross section locator map (Figure 2-40) show that geologic and hydrogeologic information is represented by only four well borings within the ERDF site (that is, only four wells within the ERDF site boundary are shown in the cross sections). Although Figure 2-40 does show nine other wells within the ERDF site boundary, it is not known if specific data from these wells have been incorporated into these site-specific RI/FS geologic and hydrogeologic descriptions. The text in Section 2.6.2.2, likewise states that "limited data are available for aquifer properties of transmissivity and hydraulic

conductivity in the aquifer beneath the ERDF site" and that only "two wells near the site . . . were tested in 1958 and 1973." Any additional site-specific information collected during the recent ERDF site field investigations should be incorporated into this RI/FS report, as available, to allow a thorough understanding of the site.

SPECIFIC COMMENTS

Section 2.1.2, Pg. 2-2, First Paragraph, First Sentence: The proposed ERDF will cover only 1.6 square miles with the remaining area reserved for future waste management activities.

Section 2.1.2, Pg. 2-2 and Figure 2-1: Public comment requested examination of the BC control area for waste management. This site should be considered for use as the expansion area for waste management activities.

Section 2.5, Pgs. 2-24 and 2-25: No reference is made as to the pedological characteristics of the ERDF site soils, nor to their relevance in the siting or design of the facility. Please clarify.

Section 2.6.1.2, pg 2-30: This section should reference the 200 Area AAMS reports.

Section 2.6.2.1, pg 2-31: This section should reference the 200 Area AAMS reports.

Section 2.7.3.10, Pg. 2-37, Last Sentence: A clarification needs to be made when referencing the "ERDF site" versus the "currently planned ERDF boundaries". This sentence implies that the significant sites are outside of the 1.6 square mile boundary of the current design of the ERDF, but this not made clear.

Section 2.7.4, Pgs. 2-37 and 2-38: This section needs to be tied directly to the ERDF, specifically, in 2.7.4.1 and 2.7.4.2. The number of people employed at the ERDF and approximate period of employment should be stated. Also, the amount of money spent on the design, construction, operation and closure of the facility should be noted. Additionally, Sections 2.7.4.3 and 2.7.4.4 should note that little effects would be realized from the ERDF project.

Section 2.7.4.11, Pg. 2-40: This section should note that the current design of the ERDF trench and barrier are such as to minimize the visual impact in the area.

Section 2.8, Pg. 2-42, First Paragraph, Last Sentence: A lead in sentence stating the significance of range fires in the shrub-steppe habitat would help clarify this sentence.

Section 2.8, page 2-42, paragraph 1. The text states, "Ecologically important species include plant species of medicinal and dye value, commercial and recreational wildlife including state- and federal-listed endangered species and candidate species." Medicinal and dye value and commercial and recreational wildlife are not characteristics of ecologically important species; these values do not improve or contribute to the overall health of any ecosystem. They are human-based values and should be identified as such. In addition, threatened species and critical habitat should be added, since they are ecologically important values.

Section 2.8.1.1, Pg. 2-44, Second Full Paragraph: It is important to note that certain species of birds nest in only the mature big sage (taller than 6 feet) and that these sage are located south of the 200 Areas.

Section 2.8.1.4, pg 2-45, para 5, sent 2: The reference for the discussion on loggerhead shrikes should be changed to Poole 1992.

Section 2.8.1.5, Pg. 2-46, Fifth Paragraph: This paragraph should note the reason behind the high fawn mortality.

Section 2.8.2, Pg. 2-47, Last Sentence: West Pond has a restricted but unique biota regime due to the high alkalinity.

Section 2.8.3, pg 2-48: This discussion should include the DOE-RL policy to treat federal candidate and state threatened and endangered species as if they are listed federal threatened and endangered species.

Section 2.8.3.2, pg 2-49, para 4, sent 4: Delete this sentence. Change reference to "whitesnake" to "whipsnake" in following sentence. Also indicate that the "woodhouse toad" is a state monitor species.

Figure 2-45, Pg. 2F-45: The legend should describe the purpose of the dashed and solid lines.

SECTION 3.0

SPECIFIC COMMENTS

Section 3.0, page 3-1. The discussion of waste characteristics should address the development of a radiological source term as well as maximum soil concentrations.

Section 3.1.1.1, page 3-2: The discussion excludes N Reactor from consideration. A general discussion of N Reactor operations and waste sites should be included.

Section 3.1.2, Pg. 3-4, First Paragraph: Specify the damage that was caused to retention basins by redirecting highly contaminated effluent to cribs.

Section 3.1.2, Pg. 3-5, Seventh Paragraph: Drains in the F Area also received liquid waste from the decontamination processes.

Section 3.1.2, Pg. 3-6, Fourth Paragraph: The Lewis Canal received discharge of effluent during the Ball 3X outage.

Section 3.1.2, Pg. 3-7, Last Two Paragraphs: Detail is given on the unplanned releases in F and K, however no detail on the release at N is given.

Section 3.1.3, Pg. 3-8: The text notes that physical property samples were taken at B and D Areas, however only limited data from D Area is given. Additional physical property data should be supplied. Also, physical property samples were taken as part of the K and F Area investigations, however data may not be available for this document. This should be noted in the text.

Section 3.1.3, pages 3-8 and 3-9. This section describes characteristics of 100 Area wastes. However, radionuclide activity levels associated with the specific waste forms are not identified. Further, the specific wastes and waste forms that are intended for the ERDF should be identified. The bulleted list includes transuranic (TRU), low-level, low-activity, and high-activity wastes. It is not clear which of these waste streams will be considered for the ERDF. The text should also discuss waste forms (such as soils, pipelines, plastic, or concrete) that occur as low-level, low-activity, high-activity, and TRU wastes, and quantify the amount of the 18 million cubic meters (m^3) of waste in the 100 Area that will be disposed of in the ERDF.

The first bullet is especially confusing. The first two sentences state that all radioactive or mixed waste is considered to be low-level waste, including low- and high-activity wastes. The last sentence states that the high-activity waste may include TRU waste. The maximum quantity of TRU waste allowable for low-level classification should be noted.

Section 3.1.4, Pgs. 3-9 and 3-10: This section fails to whether data from the 100-FR-1 Operable Unit were used in determining 100 Area chemical characteristics.

Section 3.2, pages 3-10 through 3-12. The text at the top of page 3-11 states that contaminated materials will consist almost entirely of soils, with small quantities of other materials such as pipe. However, at the bottom of page 3-11 and top of 3-12 it states that approximately 100 miles of pipeline will be exhumed for disposal. Further, the chart on page 3-12 shows a waste volume of 1.4 million m^3 of pipeline. These discrepancies should be resolved.

Section 3.2.2, Page 3-10, First Paragraph, Third Sentence: When noting in-situ disposal methods for the 200 Area the text should state that "for the purpose of this document, it is assumed that higher activity sites will likely be stabilized in place and ..." This change in text should be included throughout the document. Determining presumptive remedies for 200 Area waste sites is not within the scope of this RI/FS.

Section 3.2.2, Pg. 3-11, First Paragraph, Fourth Sentence: Presumptive remedies are not within the scope of this RI/FS. Lead in to this sentence with "For the purpose of this document it is assumed".

Section 3.2.3, Pg. 3-11, First Paragraph, First Sentence: Add the word "likely" after the word "will".

Section 3.3.2, Pg. 3-14, Fourth Paragraph, Third Sentence: Ethylene glycol has been inadvertently discharged into the process trenches.

Section 3.3.3, page 3-17, table: The table shown on this page does not include unplanned release wastes that are discussed in paragraph immediately above it. These wastes should be included in the table.

Section 3.4, page 3-18, paragraph 1. The text states that tables 3-11, 3-12, and 3-13 list maximum soil concentrations in the 100 and 300 areas. The text should explain why the 200 Area concentrations are not included.

Table 3, pg 3T-1: The table lists wastes and waste types. Are these wastes all to be disposed of in ERDF. What is basis for grouping wastes based on 12 inch grain size?

Table 3-1, page 3T-1. The definitions included in this table are confusing. Definitions of TRU waste should be consistent with those found in DOE Order 5820.2A; that is, wastes contaminated with alpha-emitting transuranic radionuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram (nCi/g). This comment also applies to Section 3.1.3.

Table 3-2, page 3T-2a. This table is inadequate for developing a radiological source term. Total radionuclide activities (in curies) should be identified for applicable radionuclides and associated waste forms. As currently written, the table identifies radionuclide concentrations only in picocuries per gram (pCi/g), which is primarily useful for soils. That is,

contamination data for pipelines (and other solid wastes) in units of pCi/g may not be appropriate. Much of the contamination may be surface contamination that would be available for leaching or other mechanisms of environmental dispersion. Therefore, a radiological source term based on total curies, rather than on soil concentration, would be more appropriate.

Some of the radionuclides listed in the table would not be detectable or present in the quantity shown, or are naturally occurring. Barium-140, beryllium-7, cerium-141, cobalt-53, europium-152, iron-59, ruthenium-103, and zirconium-95 all have half-lives of less than 65 days. However, several radionuclides associated with nuclear fission and plutonium production that may be present are not included in the table, such as iron-55, praseodymium-147, samarium-151, plutonium-241, and neptunium-237. These other radionuclides should be addressed as well.

Table 3-6, page 3T-6. This table indicates that only soils in the 300 Area process ponds and trenches will require remediation. Since these waste units also include the 300 Area sewer system, it is unclear why solid wastes such as pipelines are not included in this table.

Table 3-7, page 3T-7. Specific radionuclides and their associated activities should be included in the "Contaminant" column. Generic designations such as "radioactive wastes," "U," and "Pu" are not adequate for developing a radiological source term.

Tables 3-8 and 3-11, pages 3T-8 and 3T-11. This table shows gross alpha activity of 4,450 pCi/g from the 346-5 390 process waste trench. However, these same trenches show total uranium activity (which is primarily alpha emissions) as 20,000 pCi/g. This discrepancy should be addressed (see comments on Table 3-2, page 3T-2a).

SECTION 4.0

GENERAL COMMENTS

Table 4-1 lists the most likely values for general parameters used in the ERDF modeling. The table proves to be useful when checking calculations. A table similar to the one in Appendix A, the fate and transport modeling section, would be useful for checking the equations and tabular results provided in that appendix. Such a table should be included and should be expanded by adding a column showing the names of each of the parameters (for example, I_{FC} would be listed as the infiltration rate before the final cover is completed).

The partitioning coefficients listed in Table 4-2 were recalculated using methods described in Lyman (1990). It is recognized that different methods will yield different results; all recalculated values were sufficiently close to the values in Table 4.2. The earlier text (section 4.1.2.2), which discusses the K_{oc} and K_d values, should include an estimate of the uncertainty associated with the calculation methods used.

The infiltration rates selected for the natural soils and barrier configurations do not appear to be derived from the lysimeter studies conducted at the site or the modelling efforts using HELP or UNSAT-H. Because the potential impacts to groundwater are partially controlled by this parameter, the selected values should be carefully evaluated to ensure that they are not overly conservative.

The analytical model used to calculate concentrations of contaminants at various points of compliance is unproven. Prior to definitive design an EPA approved model for fate and transport calculations should be used with available ERDF data.

SPECIFIC COMMENTS

Section 4.1.1, pg 4-1: This section discusses why a detailed performance assessment is not warranted. Is it not true that we are or will be conducting a performance assessment. A discussion of the merits of the evaluation needs to occur. If a performance assessment is to be performed, this paragraph should be changed to support work that is or will occur.

Section 4.1.2.1, page 4-3, paragraph 1. The text cites results of lysimeter studies and states that the presence of deep-rooted vegetation reduces the infiltration rate to zero. None of the alternatives presented later considers a design where growth of native vegetation on the surface of the landfill is encouraged. Such a design would presumably reduce risks associated with leachate from the landfill since leachate production would be reduced to almost nothing. The text should include consideration of an alternative that incorporates vegetation on the landfill surface.

Section 4.1.2.1, page 4-4, last paragraph. The saturated zone porosity was assumed to equal 0.40. The porosity is critical in the calculation of numerous parameters; including transit times. The text should cite a reference for this value.

Section 4.1.2.2, page 4-4, paragraph 2. The fraction of organic carbon (f_{oc}) is given as 0.5 percent. The percent carbon is critical in estimating the partitioning coefficient (K_d) and in determining the retardation coefficient (R). The organic content should be representative of the fill material placed in the landfill and of the soils underlying the fill. The text should indicate how the fraction of organic carbon was determined and whether values are site-specific or have been chosen from reference sources.

Section 4.1.4, pg. 4-7, para 2: This discussion compares the BC control area to the primary site. It concludes that the BC control area has greater distance to groundwater and would therefore be more protective of groundwater. This does appear correct. Is the depth to groundwater for the BC Control Area correct? On pg 4T-1, the vadose zone thickness for the primary site is listed as 80 m (Assumed to be below the bottom of the trench; however, based on page 4-7 information this is incorrect). Please clarify.

Table 4.7, page 4T-7a to 4T7c. The solubilities of organic compounds listed in this table generally correspond well with data listed in alternative sources. Some compounds list multiple solubilities; this is a concern only when these multiple values vary over more than an order of magnitude. Such wide ranges are shown for fluorene, gamma-chlordane, and tetrachloroethene. These wide variations are not explained, nor are references cited in Section 4.1.2.2, but should be.

SECTION 5.0

SPECIFIC COMMENTS

Section 5.1, pg 5-1, para 4: This discussion on using human health-based CsOPC to evaluate ecological risk is too broad a statement. For example, pesticides are lethal by design to pests. This discussion should at least make note that in some instances the use of human health-based standards is inappropriate to evaluate ecological risk.

Table 5-1, page 5T-1a. This table presents the contaminant reference doses and slope factors. The ingestion reference dose for 4-chloro-3-methylphenol (2E+0 mg/kg-day) could not be verified using the source cited (EPA 1993). EPA 1993 lists 2E+0 mg/kg-day only as the subchronic reference dose for

4-chloro-3-methylphenol. A chronic reference dose should be used to evaluate the toxicity of this compound; otherwise the lack of a sufficient toxicity factor should be discussed in the uncertainty section.

Table 5-3, page 5T-3a. This table presents risk-based screening concentrations (RBC) for soil pathways (nonradioactive contaminants). The carbon disulfide soil RBC based on the inhalation pathway is listed as 4.8E-1 mg/kg-day, but should be 4.8E+1 mg/kg-day according to the reviewer's recalculation.

SECTION 6.0

GENERAL COMMENTS

Incremental cancer risk (ICR) values for arsenic and carbon-14 presented in this section are listed as >1E-02. EPA guidance (1989) states that chemicals with intakes corresponding to risks greater than 1E-02 should be calculated using an alternative equation (page 8-11). This is a one-hit equation for high carcinogenic risk levels and should be used to develop more realistic risk estimates.

The risk assessment section repeatedly refers to the conservatism involved in the risk estimates. This is due to the use of conservative assumptions in the exposure assessment and the toxicity assessment. It may be appropriate to assess the risk to groundwater exposure using Region 10 "average" default factors (EPA 1991a). Because the maximum concentrations detected were used as the exposure point concentrations, average exposure factors may provide more realistic estimates.

SPECIFIC COMMENTS

Section 6.0, Pg. 6-1, First Paragraph, Fourth Sentence: The design alternatives include low permeability soil covers. This cover offers minimal protection from bio-intrusion. Plant roots may penetrate through such a cover. Also, covers are designed to discourage only inadvertent human intrusion and therefore cannot completely eliminate exposure potential.

Section 6.0, p. 6-1: The introduction to this chapter indicates that "...soil exposures would occur only as a result of a failure event in conjunction with a loss of institutional control." This statement is inaccurate. The report, on page 9-6, discusses institutional controls and indicates that institutional controls "will be implemented at the ERDF during the operational period and after closure." The report (I believe) also indicates that one can assume institutional controls to fail within 100 years. If that is true (or if it can be assumed), the report does not indicate what the risks would be for exposure to contaminated soils after either the end of the effective life of the institutional controls. One can assume that at that time, people might excavate/drill into or otherwise breach the cap over the ERDF. Shouldn't the risk assessment address this soil exposure risk?? It may be that the risk is minimal, but the report on page 6-1 shouldn't say that "it is appropriate to consider only exposures to groundwater." Some sort of discussion regarding breach of the caps should be addressed/accounted for in the risk assessment Chapter.

In addition, there are soil ingestion possibilities for worker ingestion of airborne soil contaminants that probably should be addressed in this Chapter, not just in Chapter 9, section 9.3.16.

Section 6.2.3.1, pg 6-9, para 4, sent 5: Have the 5 remaining inorganic contaminants which are not being considered a concern because there HQ is less than 1 been evaluated to determine if they have similar effects as the contaminants of concern. If so, they should be considered a contaminant of concern.

Section 6.2.3.1, pg 6-9, para 8, sent 1: It is stated that none of the contaminant-specific HQs should be added together based on critical effects and simultaneous presence. It appears from Table 6-10 that Al and Ni would be present simultaneously and have the same critical effects. Therefore, Ni and Al combined HQ should be examined.

Section 6.2.4, page 6-11, paragraph 2. The text states that the estimates in this risk assessment are based on a set of assumptions that together are extremely unlikely. This statement should be justified.

Section 6.2.4.3, page 6-13, paragraph 2. This paragraph discusses the uncertainty involved with the exposure parameters used in the risk assessment. The text states that assuming a person will drink 2 liters a day for 30 years is not reasonable. Both of these values are in fact at or near the 90th percentiles of their respective distributions (EPA 1991b). The "2 liters per day for 30 years" assumption is conservative, but is not unreasonable. In addition, the purpose of the reasonable maximum exposure (RME) is to evaluate the highest exposure that is reasonably expected to occur now or in the future. This paragraph should be revised accordingly.

Section 6.2.4.4, pg 6-14, para 3, last sent: The use of the term "considerable" may be inappropriate, it is at minimum a poor word choice. Can the statement be rephrased to reflect the "conservativeness" of the uncertainty.

Section 6.2.4.5, page 6-15, paragraph 5. This section discusses the uncertainty associated with summation of risk across pathways and contaminants. Risks were not summed over contaminants for this risk assessment. The text should be revised accordingly. The potential for underestimating risks should the modeling be incorrect should also be discussed in the uncertainty section.

Table 6-5, page 6T-5. This table presents the ICR values for ingestion of groundwater. The arsenic ICR is listed as >1E-02 (2E+00). EPA guidance (1989) states that chemicals with intakes corresponding to risks greater than 1E-02 should be calculated with the alternative equation (page 8-11) presented below.

Risk = 1 - exp(-chronic daily intake * slope factor)

The ICR calculated for arsenic using this equation is 8E-1. This equation should be used to more realistically estimate risk.

SECTION 7.0

GENERAL COMMENTS

Several of the applicable or relevant and appropriate requirements (ARARs) listed in Table 7-1 are identified as "potentially applicable" because their applicability depends on certain actions occurring, which are explained in the comments column of the table. However, all of the ARARs listed depend on certain situations that cause the regulations or standards to be triggered. Therefore, it is unnecessary to use the term "potentially" to modify ARAR; it should be removed.

The action-specific ARARs should include the 1987 Clean Water Act Amendments codified in 40 CFR 122, 123, and 124, which pertain to NPDES stormwater permit requirements. These requirements should be included because runoff controls at the unit must meet the

appropriate stormwater discharge requirements of the Clean Water Act. In addition, the action-specific section should include the National Ambient Air Quality Standards Section 109, which require ambient dust above a certain level to be monitored and controlled.

SPECIFIC COMMENTS

Section 7.1.1, p. 7-2: The first sentence in this section should read as follows: "Chemical-specific ARARs may be federal **or** state **statutory or regulatory requirements** and other guidance...."

Section 7.1.1, p. 7-3: Under the RCRA subheading, the third sentence in the first paragraph should read as follows: "Hazardous waste management regulations promulgated pursuant to RCRA are **codified** at 40 CFR **Parts 260 through 271.**"

In addition, the third sentence in the second paragraph under the RCRA subheading is missing some words. It should probably read as follows: "In addition, RCRA regulations for solid waste, **codified as Groundwater Protection Standards in 40 CFR 264.92,** establish three...."

Section 7.1.1.1, page 7-12, The Endangered Species Act. Under the Endangered Species Act discussion, in the last sentence, it states that the Washington State Department of Wildlife and the U.S. Fish & Wildlife Service "should be consulted" regarding endangered or threatened species. Energy must send a letter to the U.S. Fish & Wildlife Service to request management policies, etc. It is not optional; Energy as the lead agency under the ESA is responsible for such federal coordination. Same comment under Section 7.1.2.2, p. 7-13, for SEPA procedures under WAC 232-012 for the State Department of Game.

Section 7.1.3.1, p. 7-14: Under the RCRA subheading, second full paragraph, it states that the RCRA regulations that are applicable to TSD facilities at Hanford are found at 40 CFR Part 265 because Hanford operates under interim status. While this is true, ERDF will need to comply with the final facility standards at 40 CFR Part 264, since ERDF will be part of the Hanford Site-Wide RCRA permit through the permit modification process. Thus, this reference should be to the Part 264 standards.

Section 7.1.3.1, page 7-14, third paragraph: The CAMU rule was written to provide flexibility in the application of treatment technologies with out requiring that LDRs be met. Treatment should be examined for wastes and justification provided for not meeting LDRs. A specific evaluation of treatment options should take place at the operable units, however general discussion must be noted within the text.

Section 7.1.3.2, pg 7-20, para 3: Incorrect WAC reference. Correct reference is WAC 402-6

Table 7-1, page 7T-1g. This table identifies the Standards Applicable to Transporters of Hazardous Waste, 40 CFR 263, as an applicable requirement. The comment column states that it is applicable "because the facility will receive hazardous waste for disposal and also has the potential to generate waste requiring off-site transport." This statement should explain that the waste being received is not from off site but from other on-site locations. In addition, 40 CFR 263.10(b) states that these regulations do not apply to on-site transport. Therefore, 40 CFR 263 should in fact be classified as relevant and appropriate, not as applicable. This table should also include the applicable tank requirements in 40 CFR Subpart J.

Table 7-1, page 7T-1f. The action-specific ARARs listed in this table omit reference to the federal Surface Mining Control and

Reclamation Act (SMCRA) administered by the Office of Surface Mining. The reclamation requirements contained in this act and implementing regulations with regard to overburden handling, soil salvage and stockpiling, soil redistribution, revegetation, and land use appear to be appropriate and relevant to the closure requirements for the ERDF. The appropriate and relevant criteria should be reviewed with regard to the applicability of SMCRA and the closure plan for ERDF.

Table 7-1, p. 7T-1h: The first entry of this table on this page, under the "Comment" heading, has some grammatical problems. The last sentence of the first paragraph under the "Comment" heading should read as follows: "Requirements for closure of a CAMU will be identified at the time the CAMU is designated and **will** incorporate requirements deemed necessary **by the Regional Administrator** to **protect** the public and minimize releases to the environment."

Table 7-3, pg 7T-3: Table needs revised. Will provide changes during comment resolution.

SECTION 8.0

GENERAL COMMENTS

The feasibility study does not analyze thoroughly the various trench configurations to optimize geometry and performance. At the least, a value engineering workshop should be conducted before development of the definitive design of the ERDF facility to select the optimum configuration, liners, and barriers.

The long-term effectiveness for each of the alternatives was not analyzed using the baseline risk assessment assumptions for the wastes present. The baseline risk assessment relies on maximum detected soil concentrations and associated predicted groundwater

concentrations (see page ES-6). The residual risks associated with the alternatives discussed in Section A.4 assume that the waste would not exceed the waste acceptance criteria described in Appendix D. Waste acceptance criteria can be developed for each alternative so that residual risks are acceptable.

In addition, an alternative with wastes present in the trench without an engineered barrier or liner was not developed or evaluated. A baseline scenario with a nonengineered barrier was described in Section A.4.1, but this scenario was not included as an alternative in the feasibility study. This alternative should be used as the baseline alternative with which to compare the other alternatives.

SPECIFIC COMMENTS

Section 8.0, pg 8-1, para 1: Incorrect reference to detailed evaluation. Change reference from chapter 10 to chapter 9.

Section 8.0, pg 8-1, para 3: It states that items not fully addressed in the RI/FS will be addressed in the detailed design and CAMU permit application. These items are not fully addressed in the CAMU permit application and this statement should be changed.

During the initial public comment period for the ERDF, several comments were received questioning the merit of bulk disposal, siting the US Ecology disposal practices as an alternative. Chapter 8 should include an evaluation of disposal of the waste in containers versus bulk disposal. If this option merits further evaluation after screening, a discussion should be included in Chapter 9. A brief discussion of this option should be included in the Executive Summary.

Section 8.0, page 8-1, fifth paragraph: The last sentence of this paragraph is misleading and should be deleted. Though treatment may not apply directly to the facility, it does apply to the waste going into the facility.

Section 8.2.3, page 8-6. The assumption of a 70-foot depth for the deep area fill design is not explained, but should be.

In optimizing the layout of a disposal cell and enhancing the performance of the waste encapsulating system, the focus is usually on the cover geometry and design. This is because the cover plays so critical a role in the long-term effectiveness of the disposal cell. If a good cover layout such as the one for the Hanford barrier is achieved, the disposal cell performance is satisfactory. For this reason, other options within the deep area-fill design that should be evaluated include:

- Increasing the trench depth beyond 70 feet and maintaining the final cover above grade.
- Constructing the trench totally below the natural ground level including the final cover. In this case, the top of final cover is at the natural topographic grade. The total height of the disposal trench is 85 feet including the 15-foot-tall Hanford barrier and 70-foot-deep trench.

In addition to the advantages discussed in this section, these options may require the least amount of land compared to the proposed 70-foot-deep area-fill design. Deep valley landfills with depths of waste exceeding 300 feet are examples of area fills greater than 70 feet deep (Brendel et al. 1987).

Section 8.5.1, page 8-9, second paragraph: The second and fifth sentences conflict. Several plant species indigenous to the Hanford site have root depths beyond 5 meters.

Section 8.5.1, page 8-0, fourth paragraph, last sentence: Barriers considered for placement over mixed waste should provide long-term protectiveness with minimal maintenance.

Section 8.5.2, page 8-10: This section notes that asphalt should not be consider for barriers because of high maintenance requirements due to settlement, yet asphalt is carried into two other alternatives. Clarification should be made as to why asphalt is considered for the other options.

Section 8.5.6, pg 8-11, para 4: The statement made the a RCRA barrier's ability to maintain its integrity over hundreds or thousands of years is uncertain. Is this statement not equally appropriate for both modified RCRA and Hanford barrier?

Section 8.6.4, page 8-14, paragraph 2, third bullet. A synthetic high-density polyethylene (HDPE) geomembrane over 1 foot of compacted clay is proposed as a low-permeability liner in the single composite liner system. A geotextile cushion is also proposed to lie over the HDPE membrane to minimize damage during placement of the drainage layer. The thickness specifications for the HDPE membrane and geotextile cushion, however, are not identified but should be.

This comment is also applicable to the RCRA double liner design.

Section 8.6.4, page 8-15, paragraph 2. Replacement of the gravel drainage layers with drainage geocomposites for both the secondary and primary leachate collection systems on the side slopes of the RCRA double liner is not explained, but should be. EPA's minimum technology guidance uses gravel drainage layers on the floor as well as on the side slopes. Further, the reason for not using a geotextile cushion over the primary drainage geocomposite to minimize damage during placement of the operations layer is not explained, but should be.

Additionally, the minimum values for hydraulic conductivity in the primary and secondary leachate collection system are not identified but should be. The thickness specifications for the primary and secondary drainage geocomposites are also missing and should be included here.

SECTION 9.0

SPECIFIC COMMENTS

Section 9.2, EVALUATION CRITERIA, p. 9-2: A general comment regarding this Chapter: is it Energy's intent that all the ARARs identified in Chapter 7 will apply or be relevant and appropriate for all the alternatives discussed in Chapter 9 ??? This section of the RI/FS must identify the specific ARARs that either apply or are relevant and appropriate to the alternative being discussed, so that the reader can check to see if they agree with Energy's opinion or if there are other ARARs that might apply. If it is true that each and every ARAR identified in Chapter 7 is an ARAR for each and every alternative discussed in Chapter 9, and that each and every ARAR will be met for each alternative, this should be made clear in Section 9.2. If not, the reader needs to know whether Energy is anticipating that certain ARARs for certain alternative will or cannot be met. If that is the case, then Energy's discussion of that particular alternative needs to discuss why the ARAR won't be met, and if not, why not (i.e., not believed to be technically practicable, or an ARAR waiver under CERCLA is suggested/appropriate for that alternative).

On page 9-2, it states that "...all the retained alternatives will comply with chemical-specific ARARs." No mention is made of either the location-specific or action-specific ARARs. These too must be addressed, and the preferred location for that discussion is under the detailed evaluation of each specific alternative.

As this RI/FS is currently organized, it is unclear which ARARs will apply to which alternatives, and why they are ARARs for that alternative. A general discussion of "possible" ARARs for all of the ERDF alternatives will not suffice. See Section 6.2.3.2 of the October 1988 EPA "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA", OSWER Directive #9355.3-01.

Section 9.3.1, p. 9-6: Under the Institutional Controls section, how long is the anticipated effective life of these controls?? This should be included in this discussion. Also, the effective life of the institutional controls affects the "effectiveness" of the alternative(s) and, as mentioned above, may affect the risk assessment discussion (e.g., should institutional controls fail, the possibility of increased risk due to uncontrolled access).

Section 9.3.1, page 9-6, fourth paragraph: Institutional controls may address the first RAO, however, these cannot be guaranteed for long term protection.

The last sentence of this paragraph should be clarified.

Section 9.3.5, p. 9-8: Under the on-site transportation discussion, will wastes coming to the ERDF have to comply with waste transport requirements of the U.S. Department of Transportation and/or 40 CFR Part 263 of the RCRA regulations??? The Hanford Site-Wide draft Permit, under draft permit condition II.Q., specifies some of the requirements for waste transport between facilities located on the Hanford facility.

Section 9.3.8, page 9-11 . This and subsequent sections provide scores for evaluating liners and alternatives. The scoring process, however, is not discussed, but should be, to allow verification of the evaluation process.

Section 9.3.8, pg 9-13, para 2: The modeling assumption that the operational period is 100 years must be supported.

Section 9.3.8, page 9-13, paragraph 4. This paragraph states, "If these future impacts are considered unacceptable, then corrective actions could be implemented before groundwater is impacted." The kind of corrective actions to be implemented at the facility should be identified.

Section 9.3.8, page 9-13, last paragraph: The second liner in a double liner system severs as a leak detection system for the first liner system in place of vadose zone monitoring. With a single liner system without vadose zone monitoring, leaks would only be evident when groundwater monitoring indicates contaminant transport from the disposal facility. This allows little time for corrective measures.

Section 9.3.8, page 9-14, first paragraph, last sentence: Liners are an important element in waste disposal units during operation and following closure in the near term. Leachate will likely be produced due to precipitation during operation. Leachate may also be produced after a cover is in place as waste reaches its optimum moisture content, recognized to be as low as 3% for some soil.

Section 9.3.9, page 9-14, paragraph 2. The text states that the modified RCRA barrier has 9 layers and the Hanford barrier has 11 layers. Section 8.5.6 states that the modified RCRA barrier includes 7 layers and the Hanford barrier is composed of 10 layers. These inconsistencies should be corrected.

Section 9.3.9, pg 9-14, para 5: The discussion of administrative implementability is confusing. It appears that the low-permeability engineered soil barrier scores for compliance with

MTRs when, in fact, it does not meet MTRs. Scoring for implementability must be placed into context and explained.

Section 9.3.9, page 9-17, third paragraph: The assumption that the barriers will have periodic maintenance ad. infinitum is unfounded. The barrier used over sites containing mixed waste should, to the extent practical, function with little to no maintenance.

Section 9.3.9, page 9-17, last paragraph: It is unclear how the asphalt layer provides additional erosion resistance since the primary function of this layer is an infiltration barrier. If the overlying layers erode to the final layer then the barrier no longer functions.

Section 9.3.10, page 9-19, last sentence: Verify that the HRA-EIS will cover all barrier materials. It was last heard that only the McGee Ranch soils were covered by this document.

Section 9.3.16, pages 9-20 to 9-22. This section discusses worker risks from inhalation of dust and volatile contamination, as well as external exposure to radiation; and refers to the Source Inventory Development Engineering Study for the Environmental Restoration Disposal Facility (USACOE 1993), also known as the source inventory report (SIR). The SIR calculates the maximum allowable soil concentrations for various contaminants, based on NIOSH and OSHA limits on air concentrations and on anticipated milligrams per cubic meter of soil grains expected during dusty conditions. The methods used in the SIR are adequate, and these maximum allowable concentrations are compared to measured source area soil concentrations. However, the first full paragraph on page 9-22 states that "It is important to note the conservative bias inherent in this analysis," and the next few paragraphs provide an uncertainty discussion. A potentially nonconservative

assumption inherent in this analysis is that the fraction of contamination in suspended soil particles may not be the same as the fraction present in analyzed soil samples. This is because the soils that suspend are the smaller grains. Some compounds may preferentially bind to smaller grains; others may preferentially bind to larger particles. This will affect the concentrations observed when dusts suspend in air. This preferential binding, which is difficult to predict, depends on several factors, including organic soil content and soil chemistry. In the absence of specific information, it is typically assumed that suspended dusts have the same concentrations as soils; this should be included as a source of uncertainty.

Section 9.4, DETAILED EVALUATION, pages 9-22 through 9-32: As stated earlier, the detailed discussion of how each of these alternatives will or won't meet ARARs is missing. This discussion MUST be included under each specific alternative.

Section 9.4.1, page 9-23, paragraph 1. In the alternative analysis for this feasibility study, a centralized landfill on the Hanford site is not considered. This FS, however, focuses mainly on the development of alternatives by selecting combinations of barrier and liner technologies for the centralized landfill. The alternative with no liner and no final barrier should therefore be evaluated to better compare with other alternatives.

SECTION 10.0

SPECIFIC COMMENTS

Section 10.0, page 10-1, last paragraph. The first sentence states that waste acceptance criteria were developed for all of the contaminants identified in potential waste from the 100 and

300 areas. The reason for not developing waste acceptance criteria for the 200 Area waste, however, should be explained since it is anticipated that the ERDF will also receive waste from the 200 Area (Executive Summary, page ES-3).

APPENDIX A

GENERAL COMMENTS

A table, similar to Table 4-1, which lists most likely values for general parameters used in the ERDF modeling, would be useful for checking the calculations and tabular results included in this appendix. Such a table should be included with a column showing the names of each of the parameters (for example, I_{FC} would be listed as the infiltration rate before the final cover is completed).

SPECIFIC COMMENTS

Section A.4.2, Results for Hypothetical Wetter Climate Conditions. A hypothetical wetter climate is assumed to determine whether risks would differ if more leachate were generated because of additional precipitation. For alternatives having a leachate removal system in place, the risk was lower for many contaminants because a significantly larger mass of contaminant is removed from the landfill during the 100-year period of operation. This prediction of reduced risk is biased by the assumption that the climate changes instantaneously. Under a more likely scenario with climate changing slowly over several hundred years, the leachate removal system would be operating during a dry period and leachate production would be enhanced during the wetter period. The removal of a smaller mass of contaminants from the landfill would result in a larger contaminant mass being available for leaching during the wetter

period. The text should discuss this scenario and the resulting risks to human health and the environment.

APPENDIX B

GENERAL COMMENTS

External exposure ICR values for cesium-137, cobalt-60, europium-152, and total uranium are listed as >1E-02. EPA guidance (1989) states that chemicals with intakes corresponding to risks greater than 1E-02 should be calculated with an alternative equation (page 8-11). This is a one-hit equation for high carcinogenic risk levels, and should be used to provide more realistic risk estimates.

In this risk assessment, ecological risk is determined through biotransfer modeling. This method is much less useful and less accurate than would be the case with the use of laboratory data. No biological data have been presented. Only chemical data are presented, which represent only abiotic media in the ecosystem. Laboratory studies should be used to determine the bioaccumulation potential and toxicity, especially in light of the magnitude of the ERDF.

Ingestion of contaminated food is identified as the exposure route for wildlife; for some species, however, significant exposure occurs through ingestion of contaminated soil, which should therefore be included.

SPECIFIC COMMENTS

Section B.0, page B-1. The text refers to a risk assessment related to contaminated soils as a result of design failure and loss of institutional control. It is not clear if intruder scenarios will be developed. As required by DOE orders,

radiological performance assessments (RPA) shall be conducted for all low-level waste (LLW) disposal sites. One of the key components of an RPA is an evaluation of potential radiation doses to intruders who may inadvertently move onto a closed LLW disposal site after institutional controls are removed. These intruder scenarios at a minimum should include; construction, agriculture, drilling, and post-drilling activities. The text should refer to the appropriate documentation to fulfill DOE requirements.

Section B.2.1.1, page B-1, paragraph 6. Loss of institutional control should be assumed to occur 100 years from the time the disposal site is closed. Although the text specifies trench disposal startup in 1996, it is unclear when closure will occur. This information should be provided as a basis for determining loss of institutional control.

Section B.2.1.2.1, page B-2, paragraph 3. The particulate emission factor of 3×10^{7} cubic meters per kg. ($m^{3}kg^{-1}$) may be appropriate for fugitive dust emissions from the natural setting. However, as suggested in Section B.2.1.1, the inadvertent intruder removes the facility cover and resides in that location. Generally excavation creates far greater dust emissions than normal. For this reason, and as suggested in DOE intruder scenario guidance, two separate conditions should be analyzed.

Appendix B, Section B.2.1.2.3, page B-3. The exposure parameters used are those recommended in the Hanford Site Risk Assessment Methodology (HSRAM). The risk assessment should evaluate the consistency of these values against those to be used in the intruder agricultural scenario required for the radiological performance assessment.

Section B.2.3, page B-5, paragraph 6. Assuming radionuclide loss via radioactive decay may be too conservative and should be reevaluated. Volatilization and groundwater transport contribute significantly to isotopic losses and should be further considered in this assessment.

Section B.2.3.2, pages B-6 and B-7. Instead of providing the outcome of the assessment in ICR for radionuclide exposures, it would be more appropriate to report this outcome in terms of total effective dose equivalent in millirem per year (mrem/yr). Without a total dose from inadvertent intrusion, it is impossible to assure compliance with performance objectives for disposal This should be reconsidered.

Appendix B, Section B.2.3.2, page B-8. The text states that the risk assessment did not evaluate the human exposure to potentially contaminated biota (ingestion) because this pathway only contributes a small fraction to the total exposure. To support this assumption, a screening level calculation should be presented for a contaminant that would tend to bioconcentrate in plants (such as strontium-90 [see Baes et al. 1984]).

Section B.2.3.2, page B-8, paragraph 5. The text states that human exposure from consumption of home grown foods would contribute only a small fraction of the total exposure. However, it is unclear where this assumption came from. As demonstrated in the EAV RPA, consumption of vegetables grown in contaminated soil does, in fact, contribute to the overall dose. This should be reconsidered.

Section B.3.1.1, page B-9, paragraph 1. The last sentence of this paragraph should be deleted, it is irrelevant to this risk assessment and is of questionable accuracy. Even though

significant adverse effects have not been reported, it does not guarantee they have not occurred or are not now occurring.

Section B.3.1.3, page B-10, paragraph 1. The last sentence of this paragraph is untrue; mortality studies could, in fact, be conducted on indicator species. Laboratory bioaccumulation studies would provide empirical data as opposed to the less preferred biotransfer modeling. Therefore, this sentence should be revised or deleted.

Section B.3.2.1.1, page B-11, paragraph 3. Uptake factors and transfer coefficients are considered only for vegetation and prey species. Transfer coefficients for species eating omnivores and primary carnivores are not presented, but should be.

Section B.3.2.1.2, page B-13, paragraph 4. It is stated that the use of a transfer coefficient of 1.0 and a dry-to-wet weight conversion factor of 0.3 were assumed arbitrarily and may not always be protective. Arbitrary decisions should not be incorporated in this document. In addition, the text states that these assumptions may not always be protective. Unless these assumptions are justified, a more conservative approach should be considered. It is recommended that documents such as IAEA 1992 and Baes et al. 1984 be referred to for additional information on determining transfer coefficients.

Section B.3.2.1.3, page B-15, paragraph 3. The text states that there is no aboveground exposure for the burrowing owl. The burrowing owl is often seen by day standing on the ground or on posts (Peterson 1990). In addition, this owl captures prey above ground. Therefore, the exclusion of aboveground exposure should be explained or the assessment should be revised to include such exposure.

Table B-9, page B-33. This table lists the ICR values for exposure to radioactive contaminants in soil. The external-exposure ICRs for cesium-137, cobalt-60, europium-152, and total uranium are all listed as >1E-02. EPA guidance (1989) states that chemicals with intakes corresponding to risks greater than 1E-02 should be calculated using an alternative equation (page 8-11):

Risk = 1 - exp(-chronic daily intake * slope factor)

The cesium-137 external exposure ICR shown in this table is 5E+00 and the ICR calculated using the above equation is 9.9E-1. This equation should be used to develop more realistic risk estimates.

APPENDIX C

GENERAL COMMENTS

The HELP modeling results provide useful information for comparing the long-term performance of the covers and liners screened in the feasibility study. There are, however, inconsistencies in the modeling results that should be addressed before these simulated results are considered to be complete.

The introduction states that an evaporative zone depth of 36 inches, used in all simulations, is typical under current Hanford climate conditions. However, Appendix E, the leachate generation memo, assumes an evaporative zone depth of 18 inches, which is said to be based on previous modeling at the Hanford site. The Low-Level Burial Grounds Dangerous Waste Permit Application (DOE/RL 88-20 1989) is cited. The source of the 36-inch evaporative zone depth should be cited as well.

The evaporative zone depth is partly a function of the maximum leaf area index. The higher the leaf area index, the more

vegetation is available to remove water from the soil at greater depths. All the simulations use a leaf area index of 1.6, which, according to the HELP model, represents a surface vegetation between poor and fair grass cover. The model also defines an evaporative zone of 16 to 32 inches as being representative of bare to fair grass cover. If an evaporative zone depth of 18 inches is used rather than 36 inches, this is more consistent with a leaf area index of 1.6, unless actual field studies have shown otherwise.

The HELP model was run for the nonengineered barrier and the low-permeability barrier using an evaporative zone depth of 18 and 36 inches. The only other difference from the simulations shown in Appendix C was the use of climatological data for Yakima, Washington, instead of the Hanford site-specific data. The average annual percolation through the cover (inches per acre) is summarized below.

Cover	36 inch Evaporative Zone	18 inch Evaporative Zone
Non-Engineered	0.0198	0.1050
Low permeability	0.0001	0.0016

From this table it is clear that by reducing the evaporative zone depth from 36 to 18 inches there is approximately a two-order-of-magnitude increase in the annual percolation rate through the covers. A value of 18 inches is recommended because it is conservative and because it is more consistent with the leaf area index value of 1.6.

The introduction also states that the simulations were run in consecutive 10-year simulations until the system equilibrated or until 110 years of performance were simulated. This does not

appear to be the case for the two liners. Only 50 years of simulation have been conducted for these liners, and equilibrium has not been reached. These liner simulations should be extended until equilibrium is reached or to 110 years, whichever occurs first. Also, the HELP modeling results for these two liners are presented for years 0 through 10. The other simulation results are for years 100 through 110 or when equilibrium is reached. The final simulation runs for the liners should be included.

The text should explicitly state that all simulations were run for a 1-acre area. The actual initial ERDF area of 650 acres should be multiplied by the leachate volume generated by the modeling to obtain the actual predicted volume.

SPECIFIC COMMENTS

Section C.5, page C-4, and Attachment C-4, page C-24. The thickness of layers 1 and 2 is given as 100 centimeters (39.37 inches) on page C-4. The model output on page C-24 lists layer 1 as having a thickness of 19.37 inches and layer 2, 59.37 inches. While the total depth of layers 1 plus layer 2 is the same as that shown in the table and the difference in the results is negligible, the model run should be changed to the correct values for consistency.

Section C.5, page C-5, paragraph 1. The text states that the HELP model does not adequately simulate the crushed basalt layer in the Hanford barrier under arid conditions. The effect, if any, on the modeling results should be included in this discussion.

Table C-2, page C-9 and Attachment C-2, page C-20. The effective porosity, field capacity, and wilting point for layer 7 given in the table do not correspond to the values used in the simulation as shown on page C-20. Either the table or the simulation should

be corrected as appropriate. This change is not expected to affect the results of the modeling, but should be incorporated for consistency.

Table C-5, page 12 and Attachment 6, page C-32. The hydraulic conductivity values for layers 2, 3, and 4, as shown in the table, are $1.6X10^{-2}$, $1.6X10^{-2}$, and $5X10^{-2}$ centimeters per second (cm/sec), respectively. The HELP model output lists the hydraulic conductivities of these layers as $1X10^{-2}$ cm/sec. These values should be checked and corrected accordingly, even though the results may not be significantly affected.

APPENDIX D

GENERAL COMMENTS

This appendix proposes waste acceptance criteria for the ERDF based on soil and leachate concentrations. Soil concentrations are back calculated from groundwater concentrations, based on State of Washington Model Toxics Control Act (MTCA) requirements.

The method used to derive the WAC does not appear to be consistent with U.S. Department of Energy (DOE) and other requirements for protecting human health at land disposal sites. DOE Order 5820.2A, Chapter III, Management of Low-Level Waste, contains specific requirements for developing performance objectives and completing an RPA. Performance objective requirements include completing an intruder scenario and a groundwater protection scenario. Although protection of groundwater was considered, the ERDF WAC are not based on an RPA, and apparently the intruder scenario was not used in the WAC development.

RPAs have been completed for DOE land disposal facilities at the Idaho National Engineering Laboratory (INEL) (EG&G 1990) and the Savannah River Site (SRS) (WSRC 1994). Also, the Nuclear Regulatory Commission (NRC) requires commercial radioactive waste disposal facilities to complete RPAs per 10 CFR 61. The INEL and SRS RPAs are based on radionuclide inventories, applicable release mechanisms, and groundwater and intruder scenarios.

The technical approach for developing the ERDF WAC raises several issues, as summarized below.

- The RI/FS report does not include a radiological source term. Without a source term, reliable dose estimates for the intruder and other scenarios cannot be calculated.

- The WAC does not provide any activity limits for many radionuclides. Based on a potentially unlimited source term, it is not clear how the intruder scenario can be dismissed as insignificant. Also, activity limits are necessary to ensure that wastes do not exceed NRC definitions of Class C waste, as found in 10 CFR 61. Class C wastes cannot be disposed of by shallow land burial according to DOE Order 5820.2A.

- The WAC focuses exclusively on contaminated soils and leachate. It is not clear how the WAC apply to contaminated materials such as pipelines, plastic, and other solids. Technical issues related to waste characterization, transuranic (TRU) wastes, waste packaging, criticality, and fixed-versus-nonfixed radioactivity are not adequately addressed.

- WAC for disposal facilities are generally based on an RPA and a safety analysis report (SAR), both of which require development of a radiological source term. These documents should be included as part of the WAC development process.

The text includes the formulas and assumptions used to assess the risk associated contaminated soils; the results of which are expressed as ICLs. However, the text does not include the calculations used to determine radionuclide concentrations for

the proposed exposure pathways. Without these calculations, along with a realistic source term, it is impossible to determine the validity of the risk assessment.

Based on these issues, it is recommended that:

- A radiological source term be developed for the ERDF.
- WAC development incorporate results of the SAR and RPA that include an intruder scenario. This should be discussed in the ERDF RI/FS Report.
- The handling of waste forms other than soils be addressed. This includes solid wastes such as pipelines, plastic, concrete, and other rubble and debris. Specific technical issues such as characterization, container requirements, and stabilization should also be discussed.
- Safety issues such as criticality and potential exposures to alpha-emitting radionuclides be discussed.
- The RI/FS report include a requirement for maintaining an ongoing radionuclide inventory.
- The exposure pathways of the risk assessment specify total dose received to verify compliance with DOE disposal performance objectives.
- The RI/FS report be revised to address radiological safety issues as well as MTCA and RCRA requirements. Overall, the proposed WAC are not adequately supported in the RI/FS Report.

SPECIFIC COMMENTS

Section D.1.2, page D-1. The approach for WAC development is based on soil and leachate concentrations including MTCA and RCRA regulatory requirements. WAC development should also incorporate results of nuclear safety documentation such as a radiological source term, SAR, and RPA. This emission should be addressed.

The text on this page and Table D-5, indicates unlimited WAC for many radionuclides. Previous sections of the RI/FS report have stated that characterization efforts are ongoing and that existing disposal records are far from complete. Based on an incomplete radiological inventory and WAC that approach infinity for many radionuclides, the intruder scenario should not be discussed as insignificant. This is a key technical issue that should be resolved as soon as possible. The WAC provided in the RPA should be revised based on results of a hazard assessment document (HAD), SAR, and RPA. A realistic source term should be developed for the ERDF that is integrated with WAC requirements. Also, WAC limits that approach infinity do not adequately promote goals such as waste minimization, source reduction, pollution prevention, as-low-as reasonably-achievable (ALARA) radiation exposures, and minimization of short-term risks to workers.

Section D.2.0, page D-2. The groundwater pathway for radionuclide ingestion raises some concern. As expressed in DOE Order 5820.2A, Chapter III 3(a)(4), LLW disposal facilities shall protect groundwater resources consistent with federal, state, and local requirements. Generally radionuclides are limited to MCLs as specified in 40 CFR 141.15 and 141.16. However, the text provides no assurance that actual MCLs will not be exceeded. As recourse, the text should show the calculations used to justify these isotopic limits, or should cite applicable documentation.

Section D.3.0, page D-3. The description of the ERDF WAC is incomplete. Key technical issues such as characterization, containers, handling of solid wastes such as pipelines, criticality concerns, and TRU waste handling should also be addressed in this section.

Also, the text in paragraph 4 appears to dismiss risks for radionuclides that do not reach the groundwater table. However, radionuclides with long half-lives that are retarded in the

vadose zone could show increased risk with time via the intruder scenario. This is especially important for uranium and thorium, which decay to radon gas.

Table D-3, page D-14. This table shows risk-based groundwater concentrations based on MTCA standards. An example equation should be provided to show how these concentrations were derived. Also, since many of EPA's Safe Drinking Water Act radionuclide limits are based on an annual effective dose equivalents (EDE) in mrem, and since EPA's Risk Assessment Guidance for Superfund, 1989, recommends that radionuclide risks be shown as both an incremental cancer risk and as an EDE, this table should be amended to include data that correspond to EPA's annual 4-mrem EDE for radionuclides in drinking water. This is important since many of the risk-based limits in this table appear to exceed the 4-mrem limit. For example, the proposed limit of 38 pCi/L for thorium 232 corresponds to an annual EDE of approximately 126 mrem. These issues should be addressed.

Table D-5, pages D-24 through D-29. It appears that the radionuclide analysis for the ERDF did not account for radionuclide daughter ingrowth. For example, americium-241 may not pose significant risks. However, its daughter, neptunium-237, may pose significantly higher risks. Table D-5 should be revised to account for daughter ingrowth.

As stated in the comments on Section D.1.2, the proposed WAC limits approach infinity for many radionuclides. This approach is questionable since it indicates that a valid radionuclide source term has not been developed. Unlimited WAC also raise additional technical issues such as potential activity within each trench, greater than Class C waste, waste packaging, TRU waste handling, and potential exposures based on an intruder scenario. These issues should all be addressed.

Table D-9, page D-37. This table shows WAC limits for several specific radionuclides, most of which approach infinity. As discussed previously, this table should also incorporate results of an air emissions pathway and an intruder scenario that includes agricultural, construction, and drilling considerations.

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