FEMP--9500424

DRAFT FINAL FEASIBILITY STUDY REPORT AND PROPOSED PLAN FOR OPERABLE UNIT 4 RESPONSE TO COMMENTS

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

FEBRUARY 1994

U.S. Department of Energy
Fernald Field Office

DRAFT FINAL
FEASIBILITY STUDY REPORT AND PROPOSED PLAN
FOR OPERABLE UNIT 4
RESPONSE TO COMMENTS

Fernald Environmental Management Project
Fernald, Ohio

February 1994

U.S. Department of Energy
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Section

DRAFT FINAL
FEASIBILITY STUDY REPORT AND PROPOSED PLAN
FOR OPERABLE UNIT 4
RESPONSE TO COMMENTS
(Continued)

2.0 Response to Comments Pursuant to Discussions with U.S. EPA
(Monday, February 7, 1994)

2.1 . . . . . U.S. EPA Region V Comments on the FS
by Pat VanLeeuwen

2.2 . . . . . U.S. EPA Region V Comments on the CRARE
by Pat VanLeeuwen

3.0 Response to Revised Comment Review for Operable Unit 4 FS/CRARE
(February 10, 1994)

3.1 . . . . . U.S. EPA Region V Comments on the FS
by Pat VanLeeuwen

3.2 . . . . . U.S. EPA Region V Comments on the CRARE
by Pat VanLeeuwen

NOTE: Unless otherwise noted, all comment references to sections, page numbers, and lines in the text refer to either the Draft Final Feasibility study Report for Operable Unit 4, December 1993, or the Draft Final Proposed Plan for Remedial Actions at Operable Unit 4, December 1993.

SECTION 1

RESPONSE TO COMMENTS

DRAFT FINAL

FEASIBILITY STUDY/PROPOSED PLAN

FOR

OPERABLE UNIT 4

(Saturday, February 4, 1994)

SECTION 1.1

U.S. EPA REGION V

FS COMMENTS

BY

PAT VANLEEUWEN

U.S. EPA REGION V FS COMMENTS
by
PAT VANLEEUWEN

) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.1/2.2.2.1/AD Page #: 2-4/2-14/D.2-1 Line #: 16/15/7 Code: E
Original Comment #: 1
Comment: I see again the use of "BRA" in reference to the Baseline Risk Assessment. I still think that this acronym may be offensive to the public and should not be used in a public document. Please devise another acronym.
Response: Disagree.
Action: This acronym is used in U.S. EPA guidance, literature, and has been used at the FEMP for a number of years. To date, the public has never indicated to any degree that the acronym "BRA" is offensive. However, for the purpose of this FS document, the acronym "BRA" will be replaced with the words "Baseline Risk Assessment."
Comment #2: **The response to this comment is acceptable.**

) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.1 Page #: 2-10 Line #: 27 Code:
Original Comment #: 2
Comment: This statement is not quite correct. The 1e-4 value is not a discrete limit. Sites with a total estimated ILCR in the 1e-4 to 1e-6 range may be subject to remedial action; total residual risk must be less than 1e-4 after remedial action.
Response: The sentence should be reworded.
Action: The phrase ". . .is not usually warranted." is replaced by ". . .may not be warranted." Add sentence, "However, this incremental risk should be less than 10^{-4} after remediation."
Comment #2: **The response to this comment is acceptable.**

) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.1 Page #: 2-13 Line #: 1-7 Code:
Original Comment #: 3
Comment: This is a biased statement. See above. Risks above 1e-4 might be acceptable or risks below that level might be unacceptable, based on site-specific conditions.
Response: The paragraph will be revised.
Action: After ". . .site specific conditions. . ." add "as well as risks below 10^{-4} may not be acceptable."
Comment #2: **The response to this comment is acceptable.**

) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.1 Page #: 2-14 Line #: 6 Code:
Original Comment #: 4
Comment: I usually suggest that PRGs be calculated for the 1e-6, 1e-5 and 1e-4 risk levels to enable flexibility in the remedial decisions and save calculations by the risk manager and public. Tables should present all three numbers, as well as the Detection Limits for each chemical.
Response: FEMP agrees with the inclusion of 10^{-5} risk level to show the spectrum of potential

remedial goals. However, FEMP does not believe the addition of the detection limits will be beneficial. In part, this is because the detection limits for soil vary widely depending on the soil matrix and the analytical requirements. This is particularly true for radionuclides.

Action: Include the 10^{-5} risk level PRG in text and tables.

Comment #2: **The response to this comment is acceptable. However, U.S. DOE should be aware that the site managers may not know when PRGs are below the Detection Limits for particular contaminants in a particular medium without this information and thus may choose unsuitable cleanup levels for some chemicals. This inclusion would help to direct cleanup goals to an achievable level.**

Response: **It is agreed that detection limits can be an important factor in the determination of PRLs. The determination of PRLs from PRGs is a multi-step process in which detection limits will be considered, as appropriate. It so happens for Operable Unit 4, that all major COCs are inorganic and background concentrations are available. However, in Operable Unit 1, for example, detection limits are used in the presentation of PRLs.**

Action: **None.**

5) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.1 Page #: 2-10/2-14 Line #: 1/13 Code:
Original Comment #: 5

Comment: I usually suggest calculation of concentration levels at the HQ = 0.1 and 1.0 levels, unless there are few non-carcinogens. Using a HQ of 0.2 only allows a combo of 5 chemicals plus 5 pathways before the HI of 1.0 is exceeded. This is especially important if remedies for different media/operable units are considered separately.

Response: Both the Risk Assessment Work Plan and Part III of the Sitewide Characterization Report specify the use of a HI of 0.2 as the target for calculating PRGs. The PRGs presented in this FS are multipathway PRGs which encompass all exposure pathways for a receptor. An additional consideration is that the OU4 area is a small part of the overall site acreage and represents a small part of the overall receptor exposure.

Action: No action.

Comment #2: **The response to this comment is acceptable.**

6) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.1 Page #: 2-16 Line #: 15-17 Code:
Original Comment #: 6

Comment: Labels are not consistent with the RI and serve to confuse the reader. The "Future Land Use with Federal controls" is <u>not</u> a change in land use; this is the Current Land Use with Controls described in the RI. The "Future Land Use Without Federal Controls" is the Future Land Use in the RI. The scenarios and exposure parameter values should be identical.

Response: Additional clarification text will be provided.

Action: The referenced text has been revised to indicate that in addition to the Future Land Use Without Federal ownership scenario evaluated in the Baseline Risk Assessment, the FS has developed a new scenario, Future Land Use with Continued Federal Ownership, to facilitate evaluation of long-term risks with continued land use restrictions.

Comment #2. The additional land use scenario, Future Land Use With Continued Federal Ownership, is sufficiently described in Section D.3.2.2.3 to eliminate the conclusion

apparent in the prior draft, and the scenario is well justified. The response to the comment is acceptable, but review also the response in comment #16.

7) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table 2-5 Page #: 2-19 Line #: Code:
Original Comment #: 7

Comment: What is the basis for the PRGs for the carcinogenic PAHs? Are they based on Benzo(a)pyrene? There are no toxicity values for the dermal exposure pathways for PAHs. Describe how these values were calculated and modified to include dermal considerations.

Response: They were based on benzo(a)pyrene. They will be re-calculated to be based on the TEF values.

Action: Recalculations of PRGs.

Comment #2: **The original comment here was not a request for a recalculation, but for a description of the methodology used to calculate the PRGs for PAHs and how dermal considerations were incorporated in the calculation. The text gives a detailed description of the approach for radionuclides, lead and PCBs, but does not address PAHs. My understanding is not furthered by the recalculation.**

Response: **Originally the PRGs for PAHs used a conversion of oral SFs to calculate the dermal contribution for the PRGs. However, for the December 1993 submittal, this methodology was abandoned to be consistent with the U.S. EPA comments, on the April 1993 Operable Unit 4 Remedial Investigation Report. Therefore, the PAH PRGs were re-calculated without using the dermal contribution.**

This is not a serious problem for Operable Unit 4 because once the top six inches of surface soil will be removed, there will not be a potential exposure to PAHs as no PAHs were detected in the subsurface soils. Therefore, a change in PRGs will not cause a change in the remedial action or remedial risk.

Action: **None.**

8) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-22, 2-23 Line #: Calculations Code:
Original Comment #: 8

Comment: I know it does not matter whether you calculate the soil PRG based on an Air PRG (do Air calculation first) or calculate the soil PRG based on the total unit risk. However, the methods used for the calculation of the soil PRGs for the on-site farmer and the off-site farmer should be identical for clarity. Not everyone will understand your logic. Please revise the off-site farmer calculations to be consistent with the other scenario calculations presented.

Response: The method of calculating the PRGs was changed. In addition, all parameter changes resulting from comments on the Baseline Risk Assessment were incorporated into the calculations. As a result, the presentation of PRG calculations was changed.

Action: The presentation of PRG calculations will be changed.

Comment #2: **After reviewing the revised table 2-5, I am now truly confused. The PRGs in this draft sometimes differ from those presented in the prior draft by orders of magnitude, e.g., the new PRG for 1 or 2-butanone (at the HI - 0.2 level) is 15 mg/kg for the future resident farmer, while the PRG in the previous draft was 0.21 mg/kg. Large differences are also apparent for Pb-210, antimony, barium, chromium,**

benzo(a)pyrene, and some other contaminants in this exposure scenario; large differences can also be seen in other exposure scenarios. What changes in the risk calculations were made in this scenario (I see only the addition of two new exposure pathways) and other scenarios to result in orders of magnitude difference in the calculated PRGs? Such changes in methodology warrant further review.

Response: **All PRGs were re-calculated incorporating the methodology and exposure parameter changes used for the Operable Unit 4 Baseline Risk Assessment in response to EPA comments. The methodology changes included not using the unit risk approach previously used to calculate the PRGs. Part of the reason for the changes was the recognition of errors in the previous calculations. These changes have been checked by hand calculation verification and separate spreadsheet calculations.**

Action: **None**

9) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 24 - 27 Code:
Original Comment #: 9

Comment: There seems to be a major problem here. I am concerned with the calculation of PRGs that are "2.6 and 36 times less than background." Risks from exposure to radionuclides were to be based on concentrations above background, so PRGs based on these same concentrations should not present unrealistic levels of attainment.

Response: The intent of this statement is to show that the calculated PRGs for the RME on-property resident farmer are indistinguishable from background concentrations. The purpose of the Table 2-5 is to present the calculated remediation levels values which are to be considered in addition to background values. It is noted that background concentrations result in risk greater than 1×10^{-4}.

Action: Modify the text by inserting the following sentence after "...respectively." "The PRGs for Ra-226 and U-238 are indistinguishable from either the respective ARAR or background concentrations. Therefore, if ARAR or background concentrations were chosen as the remedial goal, there would not be an incremental risk due to the presence of Ra-226 or U-238."

Comment #2: **I think that the argument can be made that the PRGs proposed under this scenario would require remediation of soils to background, which may not be practical. However, the ARAR for Ra-226+ progeny is not risk-based and would actually increase the risk to greater than $10e^{-3}$; its use may not be consistent with CERCLA guidelines.**

Response: **FEMP agrees that the use of the ARAR for Ra-226 and progeny is not health-based and is not protective. This table of PRGs merely presents the information. In Section 2.2.3.1, Section 2.2.3.2 and Table 2-11, these points are considered in the selection of PRLs. The ARAR for Ra-226 was not used, but rather the PRG plus the background.**

Action: **None.**

10) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 28 Code:
Original Comment #: 10

Comment: The mill tailings standards referred to here are not risk-based and are not considered protective for Superfund; Region V (Larry Jensen) has been working on new guidelines for clean-up of radionuclides in soil. Should discuss these also.

Response: FEMP agrees that these cleanup goals are not risk based and are not directly applicable to Superfund remedial goals. However, they do represent cleanup goals at other sites where radionuclides are COCs and represent what may be technologically feasible. They were presented to give the broad picture of remedial goals. At the present time the FEMP does not have a copy of these draft guidelines.

Action: No action.

Comment #2: **This discussion should point out that the mill tailings standards are not directly applicable to Superfund goals and that their application would result in an increased risk over background.**

Response: FEMP agrees that the mine tailings standards are not applicable to Superfund goals. These standards were not used in the selection of PRLs, see Table 2-11.

Action: None.

1) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 11-15 Code:
Original Comment #: 11

Comment: The description of the recreational scenario presented here does not match the description presented on page 2-16, lines 3-14. Where are the Unit Risk Factor calculations for this exposure scenario? If not in the RI, reference the appropriate section in the FS,

Response: Agreed.

Action: Change 120 days on page 2-16, line 9 to 110 days.

Comment #2: **I noticed that a lower EF value (110 days/year) was chosen rather than the original value of 120 days/year. What was the rationale for this choice?**

Both U.S. EPA and Ohio EPA had noted in the prior review that the parameter values for the recreational scenario are not very conservative. U.S. EPA expected to see the development of the expanded trespasser scenario reflect a more conservative approach, as we discussed at the December 1, 1993 meeting. We did not expect that our agreement to a tiered approach and inclusion of an expanded trespasser scenario constituted acceptance of the minimal exposure values presented here.

A casual glance at any exposure pathway shows that the Expanded Trespass scenario does not represent much increase over the Current Land Use trespass scenario - e.g., a look at the Incidental Ingestion of Soil/Sediment pathway shows that the total soil ingestion (15.6 gm) of the adolescent in the Current Land Use Trespass scenario has been reduced to 13.2 gm in the Adolescent (Child) Expanded Trespasser scenario, so that the total exposure by ingestion for trespassers aged 6-50 represents only a 20% increase over the original exposure scenario. For non-carcinogens, this will result in a less conservative exposure and less risk.

Response: The value of 110 days for the youth portion of the Expanded Trespasser (Recreational User) has always been used for the Operable Unit 4 FS. The 120 day number in the text for the September submittal was a typo which was corrected for the December version.

In the December 1, 1993 meeting, it was agreed that OU5 would be looking at soil cleanup levels in more detail than OU4 and that they would consider additional

receptors that would be reflective of various cleanup alternatives. We also agreed that the recreational user would be called an expanded trespasser because the OU4 FS and Proposed Plan contemplates a fence with "no trespassing" signs, etc. DOE committed to clearly describing the basis for the trespasser.

The expanded trespasser scenario was originally developed as a part of the proposed tiered evaluation of the site, as discussed in the December 1 meeting between DOE and EPA. This particular scenario was based on an exposure pattern that allows maximum use of the site without unacceptable risk (while maintaining limited access controls) but also allowing the development of final remediation levels that are achievable with current remedial technologies. This particular exposure pattern is conservative. The exposure assumptions made are based on an individual that would frequently enter the site for 2 hours/day, 110 days per year, for 12 years as a youth and 1 hour/day, 40 days/year, for 32 years as an adult. Thus, the exposure scenario allows a cumulative lifetime exposure of 44 years from age 6 to age 50. This exposure scenario is comparable to an individual using a neighborhood park throughout their lifetime as a youth and adult.

Please find attached a position paper on the "Expanded Trespasser Receptor Scenario" (Attachment A). This position paper demonstrates that the PRLs for the expanded trespasser in the FS are adequately conservative, protective, and practically speaking, push the envelope of technical feasibility. Furthermore, the Amended Consent Agreement permits the progressive definition of the RME outside the OU4 FS process without adversely impacting sitewide decision making.

Action: **No further action required.**

12) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table 2-6 Page #: 2-26 - 2-30 Line #: Code:
Original Comment #: 12

Comment: A) Identify the scenario used as the basis of PRGs. B) It is not clear what the units are for the ARAR-based PRGs. C) List CRQLs for all chemicals; add 1e-5 risks to table.

Response: A) Agreed.
Action: Add "Groundwater Use by a Farmer" to the table title.

Response: B) Agreed.
Action: Add units to ARAR column.

Response: C) See response to comment #4.
Action: Add 10^{-5} risks to table.

Comment #2:
a) **Did I miss something? I did not see the change in the table title as indicated in the "Action."**
b) **The response to this comment is acceptable.**
c) **The response to this comment is acceptable, but see also the response to comment #4 above.**

Response: **The groundwater PRGs are for all receptors in all scenarios. To make this clearer the title of Table 2-8 will be changed.**

Action: **Add to the title of Table 2-8: "RME Farmer - All Scenarios."**

13) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.4 Page #: 2-31 Line #: 10, 11 Code:
Original Comment #: 13
Comment: The PRG is identified as the Soil PRG; it should be the Groundwater PRG.
Response: Agreed.
Action: Change to Groundwater PRG.
Comment #2: **The comment is no longer applicable, the calculation section was removed.**

14) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.4 Page #: 2-31 Line #: 12-17 Code:
Original Comment #: 14
Comment: Regarding the discussion of MCLs, indicate that MCLs are not risk-based, but are based on technology and economics. They are also based on a single pathway of exposure. Therefore, PRGs often are lower than MCLs. The CRQLs used may not be appropriate for this site if they cannot be used to characterize the risk.
Response: Agreed that MCLs are not necessarily risk based and represent a single pathway of exposure, but are risk based modified by technology and economic considerations.
Action: The text will be modified.
Comment #2: **The response to this comment is acceptable.**

15) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table D.3-4 Page #: D-3-13 Line #: Code:
Original Comment #: 15
Comment: A) It does not seem reasonable to calculate risks from exposure of berm removal to the non-remediation worker using an exposure duration of 3 years if this activity is expected to be completed in a shorter time period, e.g., one work season. The method used averages the risk over a longer time period than the actual exposure and may underestimate the risk to this receptor. If the work is expected to take 750 hours, an exposure period of 8 hrs/day x 94 days would be more appropriate. I recommend doing and discussing alternate exposure periods in Section D.3.4.1.2. B) The SA value for the Dermal Contact pathway is the CT value, not the RME (95th percentile) value. This SA was also addressed in the RI review.
Response: A) The berm soil will be removed in stages during the waste removal/treatment operations that occur over a period of 3 years. As such, the duration of intermittent exposure is 3 years. Assuming continuous exposure over a period of 94 days would be inappropriate. No document changes required. B) Agreed.
Action: A) No Action. B) Table D.3-4 will be revised to incorporate the parameter values contained in the Final Baseline Risk Assessment. The risks presented elsewhere in Appendix D will be recalculated using these parameter values.
Comment #2: **a) Explain in footnote "e"/Section D.3.4.1.2 that the berm soil will be removed in stages during the waste removal/treatment operations that will occur over a period of 3 years.**
b) The response to this comment is acceptable.
Response: **Agreed.**
Action: **Add to the footnote "e" of Table D.3-4 to further state that:**

"The berm soil will be removed in stages over a period of three years."

16) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: D.3.2.2.3 Page #: D-3-19 Line #: Code:
Original Comment #: 16

Comment: Problem with consistency between RI and FS reports in the labeling of scenarios. Again, the basis of notation should be land use, not time. The scenarios described here change with land use and federal control. They should be identical to scenarios developed in the RI, as these are the scenarios to be addressed in the FS. This change in emphasis confuses the reader. See discussion of this point in Comment #6.

Response: Additional clarification in the text will be provided.

Action: The referenced text has been revised to indicate that in addition to the Future Land Use Without Federal Ownership scenario evaluated in the Final Baseline Risk Assessment, the FS has developed a new scenario, Future Land Use with Continued Federal Ownership, to facilitate evaluation of long-term risks with continued land use restrictions. Further discussion can be found in Attachment D.II.

Comment #2: **The additional land use scenario, Future Land Use With Continued Federal Ownership, is sufficiently described in Section D.3.2.2.3 to eliminate the confusion apparent in the prior draft, and the scenario is well justified. However, what is missing in the scenario description is the basis of the scenario - deed restriction for 1000 years (i.e., essentially forever). This assumption should be discussed in the presentation of the scenario. Whether this restriction also precludes the use of the site for future commercial/industrial/federal purposes (worker exposure was not evaluated) should also be discussed. It should also be pointed-out that this scenario was developed for this OU, and may not be appropriate for all OUs at the Fernald site.**

I continue to hope that remediation of some portions of the site will be sufficient to restore some land to public use, whether it be at the residential, recreational, commercial or industrial level of use. I think that it will be difficult to say to residents of the area that the federal government so contaminated this site that it will cost millions of public dollars to clean it up to a level where it must be left unused, forever, to avoid presenting a health risk to area residents.

Response: **Agreed.**

Action: **Insert new sentence at line 5 on page D-3-21:**

> **"The land for Operable Unit 4 would be deed restricted for at least 1000 years. This deed restriction would preclude any commercial development such as industrial or other commercial operations. This scenario was developed for Operable Unit 4 and may not be applied to the site as a whole."**

Insert on line 17 after ". . .establishing residence. . ." "or using the land for commercial purposes."

17) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table D.3-6 Page #: D-3-22 Line #: Code:

Original Comment #: 17

Comment: The SA values presented for the Dermal Contact while Bathing pathway are CT values, RME values. See discussion in the RI review also.

Response: Agreed.

Action: Table D.3-6 will be revised to incorporate the parameter values contained in the Final Baseline Risk Assessment. The risks presented elsewhere in Appendix D will be recalculated using these parameter values.

Comment #2: **I am confused by the response. I did not see the indicated change in the SA values presented for the Dermal Contact While Bathing pathway in Table D.3-5.**

I also reviewed the added Dermal Contact with Soil/Sediment parameter values presented in the same table. The SA values for the last 4 receptor populations (RME On-Property Farmer through Off-Property Resident Farmer) are total body surface area values; it appears that the CT Water Contact values were used instead of the RME Soil Contact (should be 25% of SA) values.

Response: **Agreed. The values in this table are in error. These are typos as the correct values were used in the risk assessment calculations.**

Action: **The dermal exposure parameters have been corrected in Table D.3-5.**

18) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table D.3-9 Page #: D-3-35 Line #: Code:
Original Comment #: 18

Comment: A) Where did the Cancer SF of 17 for the carcinogenic PAHs come from? There are no Cancer SFs for dermal exposure to PAHs. This exposure is expressed in a semi-quantitative manner; in general, it is assumed that the risk from dermal exposure to PAHs is at least as great as the risk from oral exposure. B) I do not understand the value or discussion of the cadmium oral RfD. Who did these calculations? Who reviewed the values? The HEAST office in ECAO, Cincinnati, reports that the IRIS value of 5e-4 is the only verified RfD for cadmium. C) The RfD for fluoranthene (IRIS) is 4e-2, not 4e-1. D) What is the basis of the RfD calculation for thallium? Most thallium salts have RfDs in the 7-9e-5 range. E) Re the use of "QUAL", this should only be used if the contaminant is indeed discussed qualitatively. It makes no sense to discuss qualitatively carcinogenic effects from exposure to non-carcinogens. Reserve the designation for valid applications.

Response: Agreed.

Action: Table D.3-9, as well as Tables D.3-10 and D.3-11, will be replaced with Tables D.4-1 through D.4-4 from the Final Baseline Risk Assessment. The risks presented elsewhere in Appendix D will be recalculated using these parameter values.

Comment #2:
- a) **The response to this comment is acceptable.**
- b) **The response to this comment is acceptable.**
- c) **Fluoranthene, as well as many other chemicals, was eliminated as a COC in the revised Table D.3-9. Actually, the list of 34 COCs was reduced to 19 in the revision. What is the basis for the elimination of all these contaminants at this stage of the document?**
- d) **The RfD for thallium appears plausible.**
- e) **The response to this comment is acceptable.**

Response: **As stated in Section 2.2.1, only those contaminants which had a risk greater than 10^{-7} or a HI of less than 0.1 for a particular media were retained as COCs for the**

FS. In revising the FS for the December submittal it was discovered that not all tables were consistent. The tables of the FS, including Appendix D, were edited to be consistent and contaminants were deleted from some tables.

Action: **None.**

19) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: D.3.3.1 Page #: D-3-34 Line #: 14-17 Code:
Original Comment #: 19

Comment: I have previously commented that inhalation RfCs should be used when provided; contractors should not calculate RfDs from RfCs.

Response: The inhalation RfCs were taken from the OU4 Baseline Risk Assessment. In the RI Report for Operable Unit 4 Section D.4, the method of calculation was presented. This method is also referenced in RAGS.

Action: No Action.

Comment #2: **I have previously commented that inhalation RfCs should be used when provided, contractors should not calculate RfDs from RfCs. It is apparent that this calculation presents an opportunity for error.**

This document, page D-3-43, lines 9-10, indicated that RfD values were derived from RfC values by multiplying the latter by the default inhalation rate of 20 m^3/day. HEAST, March 1992, page 27, indicates that the RfC may be converted to a corresponding inhaled RfD by dividing by 70 kg, multiplying by 20 m^3/day and adjusting by an appropriate absorption factor. HEAST further stated that "this conversion, however, may often be technically incorrect, and the appropriateness of doing this must be evaluated on a case-by-case (read chemical-by-chemical) basis." It is clear that the method described in the FS, Section D.3 is incorrect, it is not clear whether the RfD values derived in the RI Report are in error. At the least, this potential problem with derived inhalation RfD values should be discussed in the document.

Response: **The text on page D-3-43 (previously D-3-14) is incorrect, in that the division of the RfC by 70 was left out. The text will be corrected and the uncertainty section will be amended to include a discussion on this conversion. It should be noted that the conversion was performed as in the Baseline Risk Assessment and the RfD values in the Baseline Risk Assessment were used in the FS Risk Assessment.**

Action: **On page D-3-43, line 9, insert after ". . .by", "dividing the RfC values by 70 kg and by".**

On page D-5-5, insert after the first paragraph:

> **"An important element of uncertainty for the inhalation pathways is the conversion of RfCs to RfDs by using default conversion factors. This presumes that the concentration effects on the lung is a function of dose per body weight. Many of the RfCs are derived from inhalation exposures of animals in which the toxic effects are on the lungs and not related to body weight, but rather are a function of concentration. An example of this is HCl toxicity, where the toxic effect is on the lungs and is a function of the concentration of HCl. For those cases where the toxic effect is systemic such as in mercury**

toxicity, then the conversion to dose per body weight may be appropriate. However, in the case of children, not correcting for body weight may lead to an under estimation of the HI. The approach chosen for this risk assessment was to use the dose related RfD approach as the toxic effects from the Operable Unit 4 COCs are more to be systemic. The order of uncertainty using this approach is within the uncertainty of the determination of RfCs.

0) Commenting Organization: U.S. EPA Commentor: VanLeeuwen
Section #: 2.2.2.3 Page #: 2-26 Line #: 27 Code: M
New Comment #: A
Comment: EPA's benchmark level for blood lead in children is 10 μgm/dl in 95% of the children under the age of six.
Response: Agreed. The sentence is in error.
Action: Revise text.

1) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: D.3.2.1 Page #: D-3-12 Line #: 10 Code: M
New Comment #: B
Comment: How was frequency of detection used in the selection of COCs for evaluation in the FS report? Was it used to reduce the list of CPCs considered in the Baseline Risk Assessment for this OU? A discussion of this point is lacking in this report.
Response: The FS did not use frequency of detection as a COC selection criteria.
Action: None.

ATTACHMENT A

EXPANDED TRESPASSER RECEPTOR SCENARIO

POSITION PAPER

EXPANDED TRESPASSER RECEPTOR SCENARIO
POSITION PAPER

The following evaluation is provided to be used as a "Risk Management" tool to assist in finalizing the exposure parameters for the RME receptor scenario for the expanded trespasser. Three alternative scenarios were considered for this evaluation primarily affecting the youth portion of expanded trespasser receptor as follows:

- Alternative A - increase exposure frequency (days/year) by 25% for the youth only;
- Alternative B - increase exposure frequency by 50% for the youth only; and
- Alternative C - increase exposure time (hours/day) by 50% for the youth only.

Table 1 presents a comparison of exposure parameters for the youth for the scenario put forth in the Feasibility Study, for the three alternative scenarios, and for the trespassing youth. Alternatives B and C are essentially the same but present changes in the exposure time rather than frequency. A comparison of these three scenarios show a cumulative hours exposed of 2,496 hours for the trespassing youth, 2,640 hours for the expanded trespasser (youth portion), and 3,312 hours for Alternative A, and 3,960 hours for Alternative B and C. Cumulative lifetime exposure time is an important factor to consider since many of the radionuclide remediation goals are driven by external radiation exposure, which is a function of the cumulative exposure time on site. The cumulative hours exposed for the youth in the Feasibility Study expanded trespasser scenario (2,640 hours) is approximately 6% higher than for the trespassing youth (2,496 hours). The cumulative hours exposed for the youth of Alternative A is approximately 33% higher than for the trespassing youth scenario, while cumulative hours exposed for the youth for Alternatives B and C are approximately 60% higher for the trespassing youth.

Table 2 presents a summary of the exposure factors for the alternative expanded trespasser scenarios, including the adult values, and for the trespassing youth. The cumulative hours exposed for both the youth and adult portions of the expanded trespasser in the Feasibility Study are 58% higher than for the trespassing youth. The cumulative hours exposed for Alternative A for the expanded trespasser scenario is 4,592 hours which is approximately 85% higher than the trespassing youth. For Alternatives B and C, the cumulative time exposed is more than twice the value assumed for the trespassing youth.

The exposure factors for the Alternative scenarios for the expanded trespasser scenario were put into an exposure model and risk-based preliminary remediation levels (PRLs) were calculated for four radiological constituents of concern: $Ra_{226 + 5d}$, $Th_{228 + 7d}$, $Pb_{210 + 2d}$, and $U_{238 + 2d}$. In addition, PRLs were calculated for the trespassing youth and provided for comparison in Table 3. The following observations were noted.

- The expanded trespasser, considering the youth and adult in the Feasibility Study, is more conservative than the current trespassing youth.

- Of the four radionuclides, the PRLs for $Ra_{226 + 5d}$, $Th_{228 + 7d}$, and $U_{238 + 2d}$ are primarily driven by external radiation exposure. $Pb_{210 + 2d}$, however, is influenced more by incidental ingestion.

- The PRLs were for $Ra_{226 + 5d}$ and $Th_{228 + 7d}$ are reduced to background for all Alternatives, including the scenario from the Feasibility Study.

A comparison of the PRLs presented in Table 3 for the expanded trespasser in the Feasibility Study suggest that the trespassing youth is adequately protected by all of the scenarios since the PRLs for the trespassing youth exceed those for all of the expanded trespasser scenarios.

To summarize, the expanded trespasser scenario (formerly the recreational scenario) represents the last scenario of a tiered approach for evaluating the feasibility of remediating a Superfund site. For those sites with more limited contamination, a tiered approach may include the following land use scenarios:

- agricultural land use (i.e., the RME farmer);
- residential land use (a scenario that would consider an individual with an exposure lasting approximately 30 years without considering exposure to farm-produced livestock or produce);
- industrial/commercial (i.e., an on-site worker); or
- recreational (development of a park with adults and children visiting on a seasonal basis).

The order of these scenarios is from most conservative (i.e., unrestricted future use or agricultural use) to least conservative (more restricted use or recreational), with the latter scenarios requiring some institutional controls preventing some unrestricted future use. A last alternative, restricted use or non-use, is only considered when there are no feasible alternatives for remediating the site to a level that would be protective of human health and the environment.

At the FEMP, all of these potential land use scenarios were considered. However, based on the environmental site setting (rural), and the persistence of the contamination present, only two of the four land uses scenarios seemed plausible for the FS: unrestricted future use (agricultural); or restricted use with future government control (i.e., recreational). However, the recreational scenario was changed to the expanded trespasser scenario to allow consideration of some institutional controls and to consider a fence and posted signs (items not present in a recreational area). The other two land use scenarios, residential or industrial, would require institutional controls, that prevent future agricultural use over 1,000 years, to ensure future protection of human health. Corresponding PRLs for these four scenarios

would be lowest for the agricultural scenario, slightly higher for the residential, and slightly higher again for the commercial/industrial scenario. However, the PRLs for even the commercial/industrial scenario (based on Superfund default exposure factors presented in Table 2) are still very low as compared to the expanded trespasser scenario. The commercial/industrial PRLs are provided for illustration in Table 3.

Furthermore, it should be noted that the PRLs currently identified in the FS would be protective of human health and the environment for the off-property farmer (all pathways) as well.

Additionally, practical consideration should be given to further reduction of PRLs from a technology and cost basis. Large scale continuous soil washing facilities have yet to be developed to efficiently remove uranium isotopes to levels below the proposed remediation goals. Treatability data for other radionuclides and the heavy metals is not available, but information from other Superfund sites suggests that background concentrations will not be achievable. The preliminary information indicates that there would be a least a 15-fold increase in the volume of soil that would have to be remediated to go from a level protective of the expanded trespasser to levels that approach background concentrations. Soil volumes that would be remediated to meet the PRLs for the expanded trespasser are in the hundreds of thousands of cubic yards. Based on these site-wide considerations, it was determined that it would not be desirable or technically feasible from either a treatment or a disposal standpoint to remediate to levels at or near background because of the extreme cost to the public.

DOE agrees in principal with USEPA in the application of consistently defined RME receptors uniformly to the FEMP operable units for each projected future land use. USEPA should recognize that the exposure parameters describing each receptor were developed and proposed by DOE as representing the most reasonable maximum exposure the FEMP site could support for a given future land use. DOE considers it important to recognize that the full development of each exposure pathway comprising each of the RME receptor scenarios are highly dependent on the distribution and areal extent of contamination. For Operable Unit 4, DOE identified proposed remediation goals for both the on-property and the expanded trespasser on the basis that the residual concentrations of contaminants were uniformly distributed across the Operable Unit 4 area, and on the assumption that this specific area was fully capable of supporting the development of each receptor scenario. Clearly, the probability that the 5.8 acre area comprising Operable Unit 4 would fully support these exposure scenarios cannot be considered reasonable. For example, while it may be reasonable to assume that an expanded trespasser would expend approximately 210 hours per year on the 1050 acre FEMP site, it is inconceivable that the same receptor would expend the same duration in the boundaries of Operable Unit 4, making the current expanded trespasser scenario inherently conservative in nature.

Based on the above discussion, DOE recommends no changes to the current RME receptor scenario as provided in the Feasibility Study Report for Operable Unit 4. The expanded trespasser is adequately conservative and as well the amended Consent Agreement permits the progressive definition of the RME outside the OU4 FS process without adversely impacting sitewide decision making.

TABLE 1
COMPARISON OF ALTERNATIVE EXPOSURE FACTORS FOR YOUTH PORTION OF EXPANDED TRESPASSER SCENARIO

Exposure Parameters	EXPANDED TRESPASSER SCENARIOS Feasibility Study Youth (7 to 18)	Alternative A[a] Youth (7 to 18)	Alternative B[b] Youth (7 to 18)	Alternative C[c] Youth (7 to 18)	Trespassing Youth (7 to 18)
Receptor Parameters					
Body Weight	43	43	43	43	43
Averaging Time – Noncancer (days)	4380	4380	4380	4380	4380
Averaging Time – Cancer (days)	25550	25550	25550	25550	25550
Incidental Ingestion of Soils					
Intake Rate (mg/day):	100	100	100	100	100
Fraction Ingested (unitless)	0.1	0.125	0.125	0.19	0.25
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Dermal Contact with Soils (chemicals only)					
Surface Area (m^3):	0.42	0.42	0.42	0.42	0.42
Adherence Factor (m^2):	1	1	1	1	1
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Inhalation of Particulates					
Inhalation Rate (m^3/hr):	0.83	0.83	0.83	0.83	0.83
Exposure Time (hr/day):	2	2	2	3	4
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Soil to Air Resuspension Factor[d] (g/m^3)	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06
External Radiation Exposure					
Shielding Factor (unitless):	0	0	0	0	0
Exposure Time (hr/day):	2	2	2	3	4
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Conversion factor (yr/hours)	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04
Cumulative Hours Exposed:	2,640	3,312	3,960	3,960	2,496

Notes:

[a] Assumes 25% higher exposure frequency (days/year) for the youth.

[b] Assumes 50% higher exposure frequency (days/year) for the youth.

[c] Assumes 50% higher exposure time (hours/day) for the youth.

[d] Calculated based on air modeling results for OU4.

TABLE 2
SUMMARY OF ALTERNATIVE EXPOSURE FACTORS FOR EXPANDED TRESPASSER

Exposure Parameters	Feasibility Study Expanded Trespasser Youth (7 to 18)	Feasibility Study Expanded Trespasser Adult (18 to 50)	Alternative A[a] Expanded Trespasser Youth (7 to 18)	Alternative A[a] Expanded Trespasser Adult (18 to 50)	Alternative B[b] Expanded Trespasser Youth (7 to 18)	Alternative B[b] Expanded Trespasser Adult (18 to 50)	Alternative C[c] Expanded Trespasser Youth (7 to 18)	Alternative C[c] Expanded Trespasser Adult (18 to 50)	Trespassing Youth (7 to 18)	Commercial / Industrial Worker[e] (> 18 years)
Receptor Parameters										
Body Weight	43	70	43	70	43	70	43	70	43	70
Averaging Time – Noncancer (days)	4380	11680	4380	11680	4380	11680	4380	11680	4380	9125
Averaging Time – Cancer (days)	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550
Incidental Ingestion of Soils										
Intake Rate (mg/day):	100	100	100	100	100	100	100	100	100	100
Fraction Ingested (unitless)	0.1	0.05	0.125	0.0625	0.125	0.0625	0.19	0.0625	0.25	0.5
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Dermal Contact with Soils (chemicals only)										
Surface Area (m^3):	0.42	0.575	0.42	0.575	0.42	0.575	0.42	0.575	0.42	0.575
Adherence Factor (m^2):	1	1	1	1	1	1	1	1	1	1
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Inhalation of Particulates										
Inhalation Rate (m^3/hr):	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	2.5
Exposure Time (hr/day):	2	1	2	1	2	1	3	1	4	8
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Soil to Air Resuspension Factor[d] (g/m^3)	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06
External Radiation Exposure										
Shielding Factor (unitless):	0	0	0	0	0	0	0	0	0	0
Exposure Time (hr/day):	2	1	2	1	2	1	3	1	4	8
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Conversion factor (yr/hours)	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04
Cumulative Hours Exposed:	2,640	1,280	3,312	1,280	3,960	1,280	3,960	1,280		
Total:		3,920		4,592		5,240		5,240	2,496	50,000

Notes:

[a] Assumes 25% higher exposure frequency (days/year) for the youth.

[b] Assumes 50% higher exposure frequency (days/year) for the youth.

[c] Assumes 50% higher exposure time (hours/day) for the youth.

[d] Calculated based on air modeling results for OU4.

[e] Based on default risk assessment guidance exposure parameters (EPA, 1992).

TABLE 3
SUMMARY OF RISK–BASED PRELIMINARY REMEDIATION GOALS[a] FOR ALTERNATIVE EXPANDED TRESPASSER SCENARIOS

Constituent	EXPANDED TRESPASSER SCENARIOS				Trespassing Youth	Commercial/ Industrial Worker[b]
	Feasibility Study	Alternative A	Alternative B	Alternative C		
Radionuclides (pCi/g)						
Ra_{226+5d}	0.37	0.32	0.28	0.28	0.58	0.029
Th_{228+7d}	0.4	0.34	0.3	0.3	0.63	0.031
Pb_{210+2d}	77	52	46	46	97	4.8
U_{238+2d}	59	50	44	44	91	4.4

Notes:

[a] Value is risk–based assuming a 10^{-6} risk level.

[b] Based on standard default exposure factors.

Alternative A: 25% increase in exposure frequency for youth (days/year) over feasibility study.
Alternative B: 50% increase in exposure frequency for youth (days/year) over feasibility study.
Alternative C: 50% increase in exposure time for youth (hours/days) over feasibility study.

SECTION 1.2

U.S. EPA REGION V

CRARE COMMENTS

BY

PAT VANLEEUWEN

U.S. EPA REGION V CRARE COMMENTS
by
PAT VANLEEUWEN

) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: App K Page #: General Line #: Code:
Original Comment #: 1
Comment: Land Use Scenarios. The scenarios are not consistent with the RI Risk Assessment or FS scenarios and serve to confuse the reader. The differences between the FS "Future Land Use With Federal Controls," the RI "Current Land Use With Controls," and the CRARE "Future Land Use, Government Scenario" may not be apparent to all readers. The FS "Future Land Use Without Federal Controls" is labeled the "Future Land Use" in the RI and "Future Land Use, Private Sector" in the CRARE. The latter scenarios and exposure parameter values appear to be identical, adding to the confusion. A consistent set of scenarios for risk evaluation should be developed for use in all documents. If a particular scenario is not applicable for a particular OU CRARE, it should be listed with a NA designation. The development of some consistency at this stage of the site investigation will allow evaluation of risks in a consistent manner for all reports within a given Operable Unit and facilitate the summing of risks in the CRAREs and final site wide risk assessment. Without such consistency, I fear we will all lose our way. I am already flipping between documents and this is only the first CRARE!
Response: Agreed. Multiple names for similar land uses can lead to confusion, as well as, differences between baseline and remediation scenarios. One purpose of the meeting in Chicago with EPA on December 1, 1993, was to help illustrate both the consistencies and differences between the risk assessments. Text has been added to both the FS and risk assessment (Attachment D.II) and the CRARE to clarify this issue.
Action: Text and tables have been revised for clarity in Sections K.1 and K.5.
Comment #2: The response to this comment is acceptable.

) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: App K Page #: General Line #: Code:
Original Comment #: 2
Comment: Other Consistency Issues. 2-1) All terms should be given the name labels in all documents. One example is the label "Chemicals of Concern (COCs)" which was changed to "Chemicals of Potential concern (COPCs)" in the RI, making it inconsistent with the FS and CRARE reports.

2-2) All exposure pathway parameter values and toxicity values should be the same in all reports for an individual Operable Unit. Any corrections made in the RI Risk Assessment should be carried into the FS and CRARE reports. RI Risk Assessment comments should be reviewed to assure this consistency.
Response: 2-1) The CRARE is a post-remediation time frame document. As such, total potential chemicals of concern will be reduced to reflect the screening in both the RI and FS. Further, some constituents will be removed, treated or contained such that exposure to humans and the environment is precluded.
Action: 2-1) Provided clarification in Section K.4.1.
Response: 2-2) The final, approved RI has been reviewed and its parameters/toxicity valves used.

If exceptions are warranted due to the CRARE being both a site-wide and a postremediation document, they will be so noted.

Action: 2-2) Incorporated RI parameter and toxicity values per response.

Comment #2: I still think that the distinction between "potential COCs" and "COPCs (Chemicals of Potential Concern)" is rather fuzzy and assumes that the reader understands how these lists of chemicals have changed in each report. Wouldn't it be simpler to merely discuss the "COCs" or "potential COCs" in each report?

Response: It is agreed that further clarification in Section K.4 can be provided to clarify the distinction between COCs and potential COCs.

Action: The text has been revised throughout Section K.4 to clarify the distinction between COCs or potential COCs through the final screening level.

3) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: App K Page #: K-2-3 Line #: Code:
Original Comment #: 3

Comment: Population Demographics. The discussion of population demographics on page K-2-3 proposes that the population density of the area will remain at the present levels for the 1000-year evaluation period. Other sections of the document propose no change in land use. This proposal is not realistic. The population growth and land use should be coupled to some reasonable growth and land use projections. The State should be able to provide more appropriate and acceptable assumptions.

Response: Disagree. For the purposes of the CRARE, the off-property resident farmer is the theoretical point of maximum fenceline impact for both air and groundwater COC modeling. Predicting the actual location of populations over the next 1000 years would at best be a guess. Even if the FEMP was surrounded on all sides by residential housing 100 years in the future, the risk would be no greater than that of the off-property resident farmer, since a farmer's exposure exceeds that of a resident.

Action: No Action.

Comment #2: Your response is logical. However, the comment was addressed at the second bullet under Demographics: "The population density will remain at present levels for the 1000-year evaluation period per Appendix I of this FS report." This assumption is not only unrealistic, it appears to be irrelevant. I don't see the need to include it here or in the FS report.

Response: Agreed. After further evaluation, the response to the original comment is unrealistic and irrelevant to the FS Report. Population densities are expected to change over the 1000-year evaluation. However, for the purpose of the CRARE, these changes were assumed to not be significant. In other words, land use will stay approximately the same and population densities would not experience order of magnitude growth.

Action: The text has been revised to make the statement more realistic and understandable. The Demographics bullets on page K-2-3 have been revised to read as follows:

"• During the 1000-year evaluation period, the surrounding land use would remain primarily agricultural.

• Population density changes for the 1000-year evaluation period are assumed not to be significant."

4) Commenting Organization: U.S. EPA Commentor: Van Leeuwen

Section #: App K Page #: Line #: Code:
Original Comment #: 4
Comment: Use of MCLGs to Eliminate COCs. I know of no case where it would be appropriate to eliminate contaminants from the risk assessment based on MCLGs. MCLs and MCLGs are single chemical, single pathway values, and are based on technology, not risk. It has not been demonstrated that elimination of chemicals in groundwater, based on their MCLGs, would not make a significant change in the risk calculation, especially when the chemical is present in other media.
Response: See U.S. EPA (Saric) CRARE Comment #8.
Action: See U.S. EPA (Saric) CRARE Comment #8.
Comment #2: The response to U.S. EPA (Saric) CRARE Comment #8 is acceptable.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: App K Page #: Line #: Code:
Original Comment #: 5
Comment: HI Benchmark Value. The CERCLA benchmark of 1.0 refers to the cumulative (all chemical, all pathway) HI. This distinction should be noted. The Benchmark should be further examined for target organ/mechanism of action impact.
Response: These HI benchmark distinctions have been added to the text in Section K.2.4. The target organ/mechanism of action impact is not provided in this CRARE, but will be provided in the next CRARE.
Action: Text has been modified per response.
Comment #2: The response to this comment is acceptable.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: K.3.3 Page #: K-2-14 Line #: 16-20 Code:
Original Comment #: 6
Comment: Farmer Soil Ingestion Rate. Comments on other Operable Unit 4 reports have already noted that the adult farmer ingestion rate of 480 mg/day while farming. I cannot derive the 180 mg/day value given here using the farm exposure parameter values listed. Some explanation/adjustment is required.
Response: See U.S. EPA (Saric) CRARE Comment #11-3.
Action: See U.S. EPA (Saric) CRARE Comment #11-3.
Comment #2: Regarding the response to U.S. EPA (Saric) CRARE comment #11-3, I did not see a reference to the discussion in Section K.3.3 in the footnotes to Table K.3-1. The problem with the discussion of the farmer exposure described in Section K.3.3, page K-3-12, was noted in the comments from the OU4 RI review: the exposure for the additional 250 days/year during the 50 year farming period is not included in the exposure description, leaving the reader to speculate how the total soil ingestion of 4560 gm was derived. I previously asked that this be corrected in the RI report. I assumed that it would also be corrected in all OU4 reports.
Response: Agreed.
Action: Add to the Footnotes, a footnote "e" as follows:

- **'IR for the farmer is based on the explanation found in Section K.3.3.**

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Page #: K-3-2 Line #: Code:

Original Comment #: 7

Comment: Selection of PRG for U-238. The selection of the PRG for U-238, based on the recreational user in the CRARE "Future Land Use, Government scenario" appears to be somewhat arbitrary. The appearance is that this scenario was developed in the CRARE to defend the 60 pCi/g clean-up level rather than the 0.28 pCi/g level estimated in the SWCR. As we discussed in the Tuesday teleconference, a better strategy would be to develop a tiered approach, listing PRGs for levels of land uses. It would then be reasonable to select OU appropriate PRGs based on technical feasibility and cost. The major decision is whether this should be presented in the FS, the CRARE, or both.

Response: The 60 pCi/g cleanup level is consistent with the OU4 FS Proposed Remediation Level (PRL). PRGs are set in each OU's FS, and are merely evaluated in the CRARE. This PRL was developed consistent with the approach presented to EPA on December 1, 1993. Attachment D.II contains the additional relevant discussion.

Action: Expanded discussion in Section K.3-1 consistent with response.

Comment #2: The inclusion of Attachment D.II in the FS report and the discussion and reference to this attachment in Section K.3.1 provide a better understanding of the decision here. The response to the comment is acceptable.

8) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table K.3-1 Page #: Line #: Code:
Original Comment #: 8

Comment: Recreational User Definition. The parameter values for the recreational scenarios presented in Table K.3-1 were judged by USEPA and Ohio EPA as not being very conservative. We expect to see the development of the recreational user scenarios reflect more closely the idea that the area may revert to a very attractive area for hunters, hikers, bikers, etc.

Response: The description of the recreational user scenario has been modified in accordance with agreements reached at the December 1, 1993 meeting with EPA. No change to exposure parameters were necessitated, but a more complete description of this scenario including a name change to "expanded trespasser" has been provided in both the FS Section 2 and CRARE Section K.5.1.4.

Action: Modified Section K.5.1.4 and provided reference to Section K.5.1.4 discussion in Section K-3.2 per response.

Comment #2: Both U.S. EPA and Ohio EPA had noted in the prior review that the parameter values for the recreational scenario presented in Table K.3-1 were not very conservative. U.S. EPA expected to see the development of the expanded trespasser scenario reflect a more conservative approach, as we discussed at the December 1, 1993 meeting. We did not expect that our agreement to a tiered approach and inclusion of an expanded trespasser scenario constituted acceptance of the minimal exposure values presented here and in the FS report. A casual glance at any exposure pathway shows that the Expanded Trespass scenario does not represent much increase over the Current Land Use Scenario - e.g., a look at the incidental ingestion of soil/sediment pathway shows that the total soil ingestion and (15.6 gm) of the adolescent in the Current Land Use Trespass scenario has been reduced to 13.2 gm in the Adolescent (Child) Expanded Trespasser scenario, so that the total exposure by ingestion for trespassers aged 6-50 represents only a 20% increase over the original exposure scenario. For noncarcinogens this would result in a less

conservative exposure and less risk.

Response: **See response to USEPA (Pat VanLeeuwen) FS Comment No. 11.**

Action: **See action for USEPA (Pat VanLeeuwen) FS Comment No. 11.**

) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: K.4-0 Page #: Tables Line #: Code:
Original Comment #: 9

Comment: This section presents tables of potential COCs in various media after multiple screenings. The reader cannot follow the elimination.

A) I did not see a list of the COCs in each OU before the second screening, so I can't follow what was eliminated.

B) Some VOCs in the subsurface soil/groundwater are eliminated. Where did they go? The chlorinated hydrocarbons disappear without a resulting increase in vinyl chloride. My understanding, is that the modeling did not consider degradation, only volatilization. Please explain in more detail.

C) Additional explanation has been provided in Section K.4-2, Figure K.4-1 and footnote of Table K.4-6. Table K.4-10 gives the list of potential COCs retained after final screening for all OUs. There are no PAHs, hydrocarbons, phthalates, etc., in this list. Some media in some OUs must contain these additional contaminants. The methodology of this whole chapter is unclear.

Response: A) A list of potential COCs by media and OU has been provided to illustrate those COCs surviving the initial screening process.

B) Organic degradation is considered using decay rates in Howard et. al (as specified in the RAWPA). Further, for the CRARE it is assumed that all groundwater pump and treat operations are completed, which remove VOCs and other organics.

C) The CRARE is a post remediation document. As such, all VOCs with a vapor pressure of 10mm of Hg or higher would be gone, and other organic chemicals subject to degradation or remediation will also be gone.

Action: A) Expanded and modified Table K.4-2 per response.

B) Additional explanation has been provided in Section K.4-2, Figure K.4-1, and footnote to Table K.4-6.

C) Text has been added in Section K.4-2 to more fully explain the screening methodology.

Comment #2: The methodology is much clearer with the changes made in this section.

a) The response is acceptable.
b) The response is acceptable.
c) The response is acceptable.

0) Commenting Organization: U.S. EPA Commentor: Van Leeuwen

Section #: Page #: K-5-7 Line #: 16-18 Code:
Original Comment #: 10
Comment: Discussion of the RME. Page K-5-7, lines 16-18 refers to the use of receptor characteristics, such as "behavior" and "physical attributes" to develop receptor intakes. What is referred to by these labels, exposure characteristics, and definitions of populations of concern?
Response: Text has been added to clarify the exposure parameters.
Action: Modified text per response.
Comment #2: The response to this comment is acceptable.

11) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Page #: K.5-11 Line #: 1-6 Code:
Original Comment #: 11
Comment: "Home-Builder" Receptor. This rationalization might be defensible for this OU, but I do not think that it will apply to all OUs. The "home-builder" may well be exposed to additional media and by additional pathways than the on-site farmer, such as ingestion of subsurface soil and surface water.
Response: Agreed.
Action: None.
Comment #2: The changes on page K-5-11, lines 21-23 are acceptable.

12) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table K.7-2 Page #: Line #: Code:
Original Comment #: 12
Comment: Toxicity Values. I noted that the oral Cancer Slope Factor for benzo(a)anthracene, based on benzo(a)pyrene, listed in Table K.7-2 is incorrect. The correct value is 7.3. Check also any incorrect toxicity values noted in prior OU4 reviews.
Response: Agreed.
Action: This value for benzo(a)anthracene has been changed and the accuracy of other toxicity values have been checked.
Comment #2: The response to this comment is acceptable.

13) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Page #: K-7-55 Line #: Code:
Original Comment #: 13
Comment: Toxicological Profiles. A) I have commented on omissions in tox profiles in prior OU4 reviews. Please review these. The Lead Tox Profile, page K-7-55, does not include a discussion of the EPA OSWER Directive on Lead Soil Clean-up Levels or the EPA Lead IEUBK Model, leading the reader to mistakenly conclude that the health effects of lead cannot be addressed in the risk assessment.

B) I did not see any Tox Profile for PAHs or the many COCs that were omitted as discussed above. These may need to be included.
Response: A) Agreed.
Action: A) Discussions have been added to the lead toxicity profile as requested.
Response: B) Since the CRARE is a postremediation document, it is reasonable to anticipate that most, if not all, of the COCs in the environmental media would be gone or isolated from the environment. Therefore, it is not appropriate to discuss the omitted COCs in the

CRARE.

Comment #2: **The inclusion to the leading profile is acceptable. Regarding the Tox Profiles for PAHs I am not certain I understand the elimination of PAHs in the final screening, as it cannot be determined whether any or all PAHs will degrade. PAHs continue to be major COCs at most Superfund sites because they often do not degrade depreciable, especially if they are tightly bound to the soil or if other chemicals toxic to microorganisms are also present in the soil. The presentation here seems to indicate that PAHs need not be considered for remediation.**

Response: **It must be remembered that the CRARE starts after all remediation is complete, including groundwater remediation. This is at least 50 years in the future. The PAHs have been infrequently detected throughout the site at levels generally less than 10 mg/kg. Many of the surface soils containing PAHs will have been removed and the level of PAH contamination will have been greatly reduced. In addition, the biodegradation over this period of time was estimated using conservative decay coefficients found in the literature. It was estimated that 99.9% of the PAHs would decay in this time period. Given the infrequent detection, the relative low levels and the biodegradation rates, the PAHs were screened out.**

Action: **No Action.**

SECTION 1.3

U.S. EPA REGION V

RADIATION SECTION

FS COMMENTS

COMMENTS ON THE DECEMBER 1993 DRAFT FINAL FEASIBILITY STUDY REPORT FOR OPERABLE UNIT 4
U.S. EPA REGION 5 RADIATION SECTION

1) Commenting Organization: U.S. EPA Commentor: Rad
Section #: 4.2.2 Page #: 4-18 Line #: 25 Code: C
Original Comment #: 13

Comment: Please describe in text the DOT specification 7A Type A packaging to be used to contain the poured molten glass, specifically the container volume, material, and its ability to withstand molten glass temperature and contact without degradation.

Response: Information describing the packaging is provided in Section 2.5.7.1 and again in the packaging section of Section 4.2.2.7. The containers would be constructed of carbon steel. The containers and the packaging system would be designed so that the containers would not be damaged during the direct pours. The highest melting temperatures of the glass would still be approximately 300°F below that of the melting point of the carbon steel.

Action: Text will be added emphasizing the point that the containers would not be damaged by the direct pour. Additional information will be provided in Section 2.5.7.1 that the containers will be constructed of carbon steel.

2nd Comment: **A more detailed description of the 7A Type A containers is essential; the assumption cannot be made that the reader is as familiar with 7A Type A containers as 55-gallon drums and sea/land containers. DOE's description lacks specifics on container construction as well as the typical uses for such a container. In addition to stating that the containers are made of carbon steel, it's important to note specifics about construction (solid cast metal, formed from carbon steel plate, etc.) and actual thickness of the carbon steel material used. It would also be relevant to note whether such containers have been historically used to contain direct molten glass pours, and whether glass monolith studies performed were conducted with 1 m^3 volumes of molten glass poured into 7A Type A or similar carbon steel containers.**

Response: **The 7A Type A containers referenced in the description are a modification of the 7A Type A packaging currently used by the FEMP for shipments of low-level waste to the Nevada Test Site. Typically the containers are white metal boxes with dimensions of 4'x 4'x 7' or 4'x 2'x 7'. Total weight of these boxes when full cannot exceed 8000 lbs. This limitation is self imposed due to mechanical handling restrictions at the FEMP and at NTS. Because of the density of the vitrified residues, weight limitations would be reached before the 4'x 4'x 7' container was 50% full. Therefore, the dimension of the OU4 boxes were modified to 4'x 4'x 4' to minimize void space.**

The use of the term 7A Type A specifies a container which meets certain performance standards specified in 49 CFR § 173, Subpart I. Dimensions of these package are variable as long as they meet the performance criteria. Further evaluation of design specifications (i.e., solid casting or use of steel plates for box construction) were not performed for the purposes of the FS. Further design and modifications of these containers will be performed during the RD/RA stage of the project. Studies are currently underway to identify potential containers and specific

container design needs, which will comply with DOT specifications and are capable of withstanding packaging and transportation of the vitrified materials. One very important aspect of the design is how they will effectively screen radiological exposure doses from the residues to meet ALARA principals and to adhere to the dose rate requirements specified by DOT regulations.

Therefore for the purpose of this FS, current descriptions and specifications of the containers used during this remediation are sufficient. Additional studies are and will continue to be performed to further develop DOT compliant packages which provide the greatest advantages of safety, handling, disposal, and cost.

Action: No action.

2) Commenting Organization: U.S. EPA Commentor: Rad
Section #: 4.2.2.3 Page #: 4-40 Line #: 8 Code: C
Original Comment #: 21

Comment: It is stated that the maximum expected effective dose equivalent associated with the treated K-65 residues would be 1.5 rem/hour. Please explain how this exposure rate was derived and where an individual would have to be, relative to the solidified waste form, to receive this maximum dose.

Response: "The referenced text is incorrect and will be revised."

Action: DOE states that 2 sentences will be deleted, inserting statements supporting a dose rate assessment based upon untreated silo contents.

2nd Comment: Note this comment concerns DOE's estimation of radiation dose from treated silo residues to an intruder.

First, it does not appear that the text of the draft final document was revised to address my original comments, as DOE stated in the response to comments. Secondly, the original comment asked that the derivation of 1.5 rem/hr dose to the intruder be explained, a polite way of requesting that the math and the unit balance be corrected. DOE instead responded by changing the method used to estimate dose to the intruder, now basing dose on untreated silo contents instead of the treated material as it had done in the draft FS. This change in dose assessment method reduces the dose to the trespasser by a factor of about 428, greatly altering estimates of residual risk.

Due to the lack of information provided, as well as the subsequent change in dose assessment methodology, the validity of the intruder dose rates and derivation methods provided are in question. Estimated radiation dose from the treated silo material should be based on treated silo material, not untreated material. Revision of the text should have been as simple as reviewing the values and units used in the draft FS to produce the "1.5 rem/hr" value, but the change in assessment method raises questions about DOE's ability to perform that assessment, as well as assess residual risk due to on-site storage of treated silo residues.

Response: Original response was not incorporated into the text.

Action: Sentences 2 and 3 will be deleted and replaced with the following text referenced in the original "Action" for Original Comment #21:

"The potential dose rate to an individual from intruding into the disposal vault has been approximated by the Baseline Risk Assessment's calculation of potential dose rates above the untreated silo contents. The baseline risk assessment calculated the potential dose to a trespasser on the silo dome to be 3.5 mrem/hr. To address direct intrusion onto the top of the wastes, the baseline calculations were modified to eliminate shielding and distance between the source and receptor. The resultant dose rate increased to approximately 80 mrem/hr at a point of 1 meter (3 ft) above the waste surface. The density of the vitrified waste will be more than that of the untreated waste. This will offset the contribution to the dose rate from increase in radionuclide concentrations in the vitrified waste. Therefore, the approximated dose rate presented here is adequate for risk discussion purposes, especially when there are other unknown parameters such as design details of waste disposal facility and concentrations of radionuclides in the vitrified waste."

SECTION 1.4

U.S. EPA REGION V

RADIATION SECTION

PP COMMENTS

COMMENTS ON THE "PROPOSED PLAN FOR REMEDIAL ACTIONS AT OPERABLE UNIT 4 RESPONSE COMMENTS

Commenting Organization: U.S. EPA Commentor: Rad
Section #: 3.2 Page #: 15 Line #: Code: C
Original Comment #: 2

Comment: It is stated here that Silo 3 has a significantly lower radon emanation rate than Silos 1 and 2. However, according to the Remedial Investigation Report for Operable Unit 4, the Silo 3 annual radon release rate and emission flux is greater than that of Silo 1; a radon emission flux of 108 pCi/m^2-sec is not insignificant.

Response: Generally, DOE responds by stating that the Silo 3 radon flux rate is in fact 20 pCi/m^2-sec, and that the radon source term ILCR is insignificant as compared to all of the constituents of concern under the current source term scenario.

Action: DOE states "Non required."

2nd Comment: Being that Silo 3 will be dismantled and its contents processed and shipped, the radon flux rate is ultimately irrelevant. What is disturbing are the general statements that are made without supporting data, as well as DOE's adjustment of RI data as the need arises. The fact that data from the RI can be easily adjusted undermines the credibility of the RI in presenting source term information.

Response: As indicated in the response (December 1993) to the previous comment, the estimated radon flux from Silo 3 was closer to 20 pCi/m^2-sec not the overly conservative 108 pCi/m^2-sec presented in the Remedial Investigation Report. This conservative radon flux was based on an assumption during the preparation of the RI that the headspace volume was similar to that in Silos 1 and 2. Subsequent investigation revealed that field measured data on the headspace volume did exist to support the radon flux rate of approximately 20 pCi/m^2-sec and was documented in previous DOE correspondence to U.S. EPA (see attached reference letter, DOE-417-91, Gerald W. Westerbeck to David Kee, "REPORT ON RADON FLUX ESTIMATES," dated December 17, 1991). Also, Appendix D of the Operable Unit 4 Remedial Investigation Report provides detailed information on the contribution to overall Operable Unit 4 risk due to silo radon emissions. As indicated in the previous response (December 1993), this overestimation of radon flux for Silo 3 does not significantly change the baseline risks or the pertinent risk-based decision.

Action: No Action.

Department of Energy
FMPC Site Office
P.O. Box 398705
Cincinnati, Ohio 45239-8705
(513) 738-6319

DEC 17 1990
DOE-417-91

Mr. David Kee
U.S. Environmental Protection Agency
Region V, 5AR-26
Air and Radiation Division
230 S. Dearborn Street
Chicago, Illinois 60604

Dear Mr. Kee:

REPORT ON RADON FLUX ESTIMATES

Reference: Letter, DOE-157-91, Gerald W. Westerbeck to D. Kee, "Proposed Provisions to be Included in the Clean Air Act Compliance Agreement," dated November 6, 1990.

As part of the on-going negotiations of the FFCA/NESHAP, the DOE has agreed to submit a report on radon flux estimates from potential sources other than the K-65 silos at the Feed Materials Production Center (FMPC). The subject report is enclosed, with supporting documentation.

The estimated radon flux from Silo 3 currently exceeds 20 pCi/m^2-s. Based on this estimate and the fact that a measurement program is not practical, DOE agrees to initiate an evaluation of the need for a removal action under CERCLA for Silo 3, in accordance with our proposed language for the FFCA/NESHAP as referenced above. The results of this evaluation will be provided to U.S. EPA when completed.

The "RADON" model used to estimate flux from Waste Pits 1, 2 and 3 proved to be inappropriate. The model predicted a range of values for flux, from 0.03 to 197 Ci/m^2-s. This was because a wide range of radium was measured in the pits and cover thicknesses also varied considerably. The model was not able to evaluate sources covered with water, so values for Pit 5 and the Clearwell are not available.

To rectify the problems inherent in the model, DOE is developing a program for directly measuring radon flux from the pits.

If you have any questions, please contact Behram Shroff at FTS 774-6003.

Sincerely,

Ray Hansen for

Gerald W. Westerbeck
FMPC Site Manager

DP-84: Shroff

Enclosure: As stated

cc w/encl.:

R. B. Allen, EM-422, GTN
E. G. Feldt, EH-232, FORS
A. Wallo, EM-231, FORS
W. Dillow, SE-31, ORO
G. Gulezian, USEPA-V
L. Hamsing, USEPA-V
C. A. McCord, USEPA-V
M. Bulter, USEPA-V
S. Lee, USEPA-V
G. E. Mitchell, OEPA-Dayton
H. St. Clair, SWOAPCA
W. H. Britton, WMCO

ESTIMATES OF RADON FLUX FROM FMPC WASTE PITS 1, 2, 3, AND SILO #3

Estimates of radon flux from FMPC Waste Pits 1, 2, 3, have been made using the NRC-approved RADON computer code (see table). The RADON code was developed for use at uranium mill tailings sites where both the radium concentration and the pertinent geophysical parameters are relatively homogeneous. In attempting to apply the RADON code to the FMPC waste pits, it was found that the wide range of radium concentrations measured in the pits and the estimated variations in cover thicknesses resulted in a very wide range of possible radon flux value. A typical computer run for Pit 2 is attached as requested.

The RADON computer code is not able to account for water cover; hence radon flux estimates are not available for Pit 5 and the Clearwell, both of which have water covers. As previously discussed, Pits 4 and 6 are not sources per definition in 40 CFR 61.91; therefore, they are not included in this report.

Ranges of Radium Concentration, Cover Thickness and Radon Flux

	^{226}Ra (pCi/g)				Cover (cm)		Rn Flux (pCi/m^2 sec)	
Pit	Max	Min	AVG	+/- 2 SD	Max	Min	Max	Min
1	60.2	12.0	30.5	123%	30	15	47	5.6
2	412	12.2	117.7	283	60	15	197	1.7
3	369	3.1	124.2	218	240	22.5	159	.03

The large range of possible radon flux values illustrates the problems encountered in attempting to apply a computer model to a situation where assumed homogeneity does not exist. The range of flux values would decrease somewhat if, instead of maximum and minimum radium concentrations, the average ± 2-sigma standard deviation was used. However, the two-standard-deviation range goes from ± 123% to ± 283% for the waste pits. And if uncertainties in the other parameters (such as soil density and moisture) were included, the maximum and minimum flux values would be even further apart.

The estimate of the flux from Silo #3 is based on a number of assumptions, measurements and calculations listed below. A conservative, yet reasonable, approach was utilized in arriving at this estimate.

ASSUMPTIONS

1. The primary mechanism for release of radon from Silo #3 is the thermal expansion of the air in the headspace.

2. Silo #3 does not act as a pressure vessel to any significant degree, and is unable to contain the warming headspace air.

3. The area through which radon escapes is the area of the Silo #3 dome, 496 m^2.

4. Data on internal temperature of Silos #1 and #2 on May 8-11, 1987 after adjustment for percent sunshine during those days, represents average annual internal temperatures for Silo #3.

MEASUREMENTS:

1. The radon concentration in the Silo #3 headspace is 2.07×10^5 pCi/L ($\pm$ 12%).

2. The average internal maximum temperature fluctuation in Silos #1 and #2 measured on May 8-11, 1987 is 32.2 F (17.9 C).

3. The average internal maximum temperature fluctuation in Silo #3 for 7 days in December, 1990 was 10.5 C.

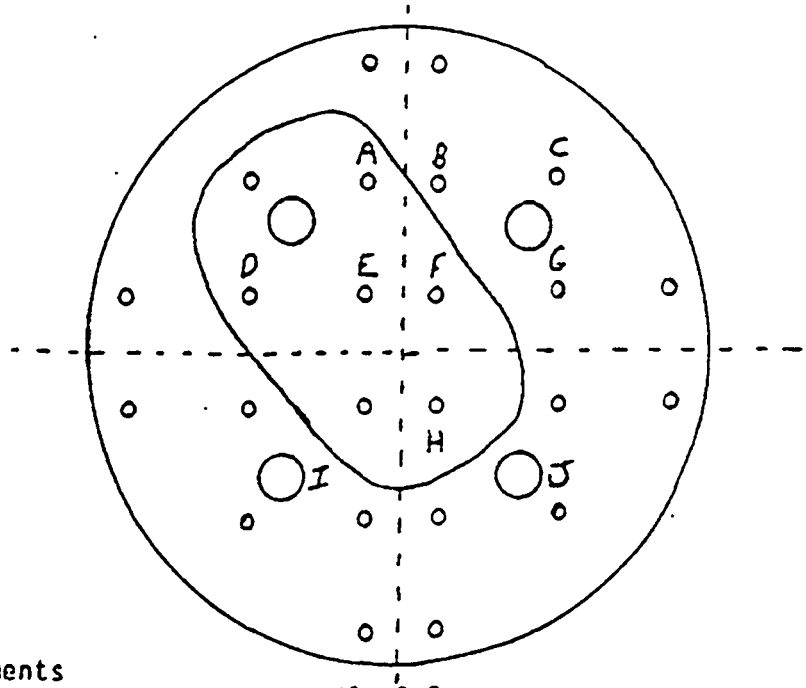
4. The daily temperature fluctuation at a point 2.5 ft. below the surface of the Silo #3 residues averaged approximately 0.1 C. There is no detectable pressurization of Silo #3.

CALCULATIONS:

1. The headspace volume was calculated to be 105 m^3 (see attachment). This was based on observations by at approximately 8 locations below the Silo #3 dome.

2. For the May 8-11, 1987 time period, the percent sunshine recorded at Greater Cincinnati Airport was 92.5%. The average for years 1984-1989 is 53%. Therefore, the sunshine factor for the May 8-11, 1987 time period is 1.745. When the observed temperature rise of 32.2 F is adjusted by this factor, the resulting average temperature fluctuation of 10.25 C is very close to the measured average for Silo #3 for 7 days in December, 1990 of 10.5 C.

Methodology for Calculating Headspace Volume in Silo 3



Silo 3 Dome
(Top View)

Actual Measurements
(underneath dome to
top of residue):

A=3'
B=1/2'
C=0'
D=3'
E=5 1/4'
F=2'
G=0'
H=3 1/4"
I=0'
J=0'

Assumptions

1) Location E is the center of the headspace.
2) The area of the headspace is elliptical in shape.
3) The dome surface used in the calculations is symmetrical.
4) The surface of the residues is level for calculations.
5) Radon is emitted from the silo as a result of thermal expansion of the air in the headspace.
6) The silo does not act as a pressure vessel.
7) Radon is being emitted through the entire dome. 496m^2

THE ESTIMATE:

1. A temperature change each day of 18.45 F (10.25 C) will cause 105 m^3 of air to increase in volume to:
$$[(273 + 10.25)/(273)] \times [105] = 108.94\ m^3$$

2. The extra volume (3.94 m^3) will escape. This air will contain
$3.94\ m^3 \times 2.07 \times 10^8\ pCi/m^3 = 8.161 \times 10^8\ pCi$ of ^{222}Rn

3. Averaged over the area of the Silo #3 dome,
$[8.161 \times 10^8\ pCi] / [496\ m^2] = 1.645 \times 10^6\ pCi/m^2$ each day

4. And averaged over the 86,400 seconds per day,
$[1.645 \times 10^6\ pCi/m^2 \cdot day] / [86,400\ sec/day] = 19.04\ pCi/m^2 \cdot sec$

The uncertainty in the measurement of headspace radon concentration was $\pm$12%. Combined with the uncertainties inherent in the estimation of temperature fluctuation and headspace volume, as well as the potential contribution to flux due to diffusion through four inches of concrete, it can be concluded that radon flux from Silo #3 exceeds 20pCi/m^2 sec.

*****| RADON |*****

Version 1.2 - May 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

Pit 2/18 12/9/90

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Pit 2 Waste

THICKNESS	400	cm
CALCULATED POROSITY	0.479	
MEASURED MASS DENSITY	1.38	g cm -3
MEASURED RADIUM ACTIVITY	412	pCi/g
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	8.720D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	12.747	%
MOISTURE SATURATION FRACTION	.367	
CALCULATED DIFFUSION COEFFICIENT	2.200D-02	cm^2 s^-1

LAYER 2 Pit 2 Cover

THICKNESS	15	cm
CALCULATED POROSITY	0.219	
MEASURED MASS DENSITY	2.07	g cm -3
MEASURED RADIUM ACTIVITY	0	pCi/g
DEFAULT LAYER EMANATION COEFFICIENT	.35	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5.6208	%
MOISTURE SATURATION FRACTION	.532	
CALCULATED DIFFUSION COEFFICIENT	7.800D-03	cm^2 s^-1

DATA SENT TO THE FILE RNDATA' ON DRIVE A:

N	FO1	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

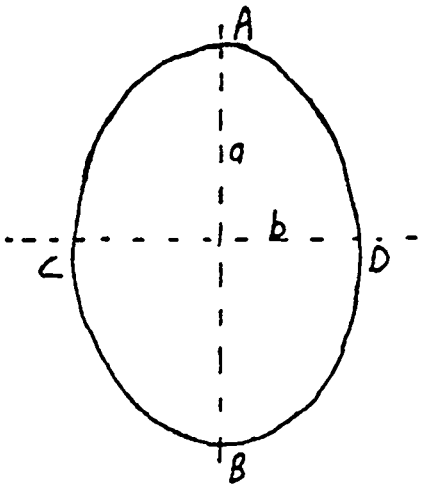
LAYER	DX	D	P	Q	XMS	RHO
1	4.000D+02	2.200D-02	4.792D-01	8.720D-04	3.671D-01	1.380
2	1.500D+01	7.800D-03	2.189D-01	0.000D+00	5.316D-01	2.070

BARE SOURCE FLUX FROM LAYER 1: 4.189D+02 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi L^-1)
1	4.000D+02	2.029D+02	2.099D+05
2	1.500D+01	1.969D+02	0.000D+00

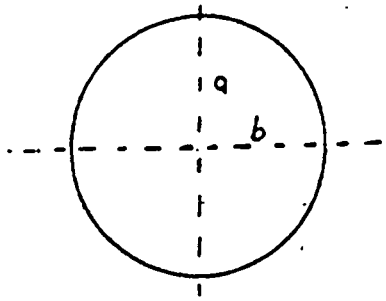
F-2'



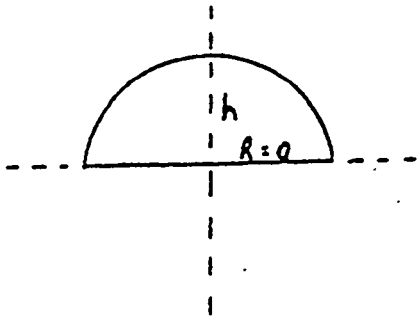
Scaled off engineering drawing
AB = 52 ft.
CD = 34 ft.

Area of an ellipse:

Area = π ab
= π(26)(17)
= 1388.6 ft.^{2}



a=b=R
πR^2 = 1388.6 ft.^{2}
R = 21 ft.



Volume of a Spherical Segment:

$V = 1/6\ \pi h(h^2+3a^2)$
$V = 1/6\ \pi(5.25)\ [(5.25)^2 + 3(21)^2]$
$V = 3712.6$ ft.^{3}

$$3712.6 \text{ ft.}^3 \times \frac{1 \text{m}^3}{35.3147 \text{ ft.}^3} = 105 \text{m}^3$$

SECTION 1.5

U.S. EPA REGION V

COMMENTS ON THE PP

BY
JIM SARIC

TECHNICAL REVIEW OF DRAFT FINAL FEASIBILITY STUDY REPORT FOR OPERABLE UNIT 4

1) Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Page #: NA Line #: NA Code: M
Original Comment #: 5

Comment: This section discusses the detailed analysis of alternatives. The response to comments indicates that a discussion describing principal threats associated with Operable Unit 4 will be presented in the introduction to the detailed analysis for each subunit. However, no such discussion is included. This section should be revised (1) to explain what the term "principal threats" means with respect to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and (2) to identify the wastes or contaminated media considered to be principal threats.

Response: Each subunit discussion will be further modified to discuss the principal threats associated with each subunit and identify the contaminated media and pathways involved.

Action: The following text will be added at the introductions to Subunits A, B, and C at Sections 4.2, 4.3, and 4.4 respectively:

(a) SUBUNIT A

Principal Threats

The NCP describes principal threats as those involving liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. Consistent with the NCP, the RI Report for Operable Unit 4 provided a detailed characterization of the source term within Subunit A (Silos 1 and 2) and identified those contaminants which contributed to an ILCR value greater than 1×10^{-6} and a hazard quotient greater than 1.0. The RI Report for Operable Unit 4 identified that the principal threats to human health and the environment posed by the Silos' 1 and 2 contents are from the following contaminant/transport pathways:

- Direct Radiation
  Direct exposure to gamma radiation from radioactive constituents within the silos residues.

- Air Emissions
  Dispersion of radon that escapes from the silos into the atmosphere.

- Groundwater Transport
  Leaching of contaminants from the silo contents via subsurface soils to underlying perched water.

Potential remedial alternatives for Subunit A were developed in order to mitigate the short-term and long-term exposure and associated risks from gamma radiation, reduce radon emanation rates from the waste materials, removal and minimization of the leachability of contaminants from the waste materials.

(b) SUBUNIT B

Principal Threats

The NCP describes principal threats as those involving liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. Consistent with the NCP, the RI Report for Operable Unit 4 provided a detailed characterization of the source term within Silo 3 and identified those contaminants which contributed to an ILCR value greater than 1×10^{-6} and a hazard quotient greater than 1.0. The RI Report for Operable Unit 4 identified that the principal threats to human health and the environment posed by the Silo 3 contents in its current configuration are from the following contaminant/transport pathways:

- Direct Radiation
  Direct exposure to Silo 3 residues under the future source term scenario assuming structural collapse of the silo.

- Air Emissions
  Dispersion of Silo 3 contents under the future source term scenario assuming structural collapse of the silo.

- Surface Water Runoff
  Erosion of released Silo 3 contents under the future source term scenario assuming structural collapse of the silo.

Potential remedial alternatives for Subunit B were developed in order to mitigate the short-term and long-term exposure and associated risks from gamma radiation, eliminate potential of air dispersion of silo contents from silo collapse, and eliminate potential for contaminated surface water runoff resulting from released Silo 3 contents under the future source term scenario (assuming structural collapse of the silo).

(c) SUBUNIT C

Principal Threats

The NCP describes principal threats as those involving liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. Consistent with the NCP, the RI Report for Operable Unit 4 identified the nature and extent of contamination within the Operable Unit 4 boundary, characterizing and identifying those contaminants which contributed to an ILCR value greater than 1×10^{-6} and an HQ greater than 1.0. The RI Report for Operable Unit 4 identified that the principal threats to human health and the environment posed by the Subunit C structures, soil, and debris are from the following contaminant/transport pathways:

- Direct Radiation
  Direct exposure to gamma radiation from radioactive constituents in surface soil.

- Air Emissions
  Dispersion of volatile organic compounds and fugitive dust generated from soil.

- Surface Water Runoff
  Erosion of contaminated soils into Paddys Run from the vicinity of the silos.

Potential remedial alternatives for Subunit C were developed in order to mitigate the short-term and long-term exposure and associated risks from gamma radiation from radioactive constituents in the surface soils, eliminate the dispersion of fugitive dust generated from the soil, elimination of contaminated surface water runoff from contaminated soils into Paddys Run from Operable Unit 4.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 5.3.2.5 Page #: 5-38 Line #: NA Code: M
New Comment #: 1
Comment: Table 5-8 presents the costs for Subunit B alternatives. The costs for alternative 4B are missing from the table and should be added.
Response: Agreed.
Action: Table 5-8 has been revised to include the costs for Alternative 4B. Likewise, Table 5-9 has been revised to include a sensitivity analysis for Alternative 4B costs.

SECTION 1.6

U.S. EPA REGION V

COMMENTS ON THE PP

BY

JIM SARIC

TECHNICAL REVIEW OF DRAFT FINAL PROPOSED PLAN FOR OPERABLE UNIT 4

1) Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6 Page #: NA Line #: NA Code: M
Original Comment #: 17

Comment: This section summarizes the comparative analysis of alternatives. The discussion of the threshold criterion of overall protection of human health and the environment for each of the subunits states that one alternative provides greater overall protectiveness. This criterion is not measured in degrees; therefore, the analysis is limited to a discussion of whether and how overall protectiveness is achieved. The text on pages 68, 74, and 77 should be revised to delete the statements regarding greater overall protectiveness.

Response: Section 6.3 summarizes the comparative analysis of alternatives presented in Section 5 of the Operable Unit 4 Feasibility Study Report. It is agreed that the threshold criterion "Overall Protection of Human Health and the Environment" section should discuss whether and how alternatives achieve overall protectiveness.

The statements on pages 68, 74, and 77 are not meant to measure the "degree" of which the threshold criterion is met, but rather an acknowledgement of the relative "certainty" involved by how long overall protection could be maintained by the subunit alternatives.

Action: Additional text clarifying the certainty to which alternatives would maintain Overall Protection of Human health and the Environment will be added at each location mentioned.

2) Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.4 Page #: 6 to 10 Line #: NA Code: M
Original Comment #: 1

Comment: This section discusses the contaminants present in residues and waste material. This section adequately identifies the contaminants in the residues but does not use the words "principal threat" to describe the residues and waste material. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) describes principal threats as those involving liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. At a minimum, the residues in Silos 1, 2, and 3 and the waste in the decant sump tank are principal threats. This section should be revised (1) to include the NCP description of principal threats and the NCP expectations for the disposition of principal threats, and (2) to identify the waste materials at Operable Unit 4 that are principal threats.

Response: Agreed. Similar text describing the potential threats for Subunits A, B, and C that were incorporated in the Feasibility Study Sections 4.2, 4.3, and 4.4 will be added to the Proposed Plan, Section 2.5.

Action: The following text will be added in Section 2.5:

Principal Threats

The NCP describes principal threats as those involving liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. Consistent with the NCP, the RI Report for Operable Unit 4 provided a detailed characterization of the source term within Operable Unit 4 and identified those contaminants which contributed to an ILCR value greater than 1×10^{-6} and a hazard quotient greater than 1.0. The RI Report for Operable Unit 4 identified that the principal threats to human health and the environment posed by the Operable Unit 4 area from the following contaminant/transport pathways:

- Direct radiation
  - Direct exposure to gamma radiation from radioactive constituents within the silos
  - Direct exposure to Silo 3 residues under the future source term scenario assuming structural collapse of the silo
  - Direct exposure to gamma radiation from radioactive constituents in surface soil
- Air emissions
  - Dispersion of radon that escapes from the silos into the atmosphere
  - Dispersion of volatile organic compounds (VOC) or fugitive dust generated from soil
  - Dispersion of Silo 3 contents under the future source term scenario assuming structural collapse of the silo
- Surface water runoff
  - Erosion of contaminated soils into Paddys Run from the vicinity of the silos
  - Erosion of released Silo 3 contents under the future source term scenario assuming structural collapse of the silo
- Groundwater transport
  - Leaching of contaminants from the silo contents via soils to underlying groundwater
  - Leaching of contaminants from the silo content via soil to a sand silty/clayey lens in the glacial till, which could carry contaminants to surface water and sediment in Paddys Run.

Potential remedial alternatives for Operable Unit 4 were developed in order to mitigate the short-term and long-term exposure and associated risks from gamma radiation, reduce radon emanation rates from the Silos 1 and 2 waste materials, minimize the leachability of contaminants from the waste materials, eliminate potential of air dispersion from silo collapse, eliminate the dispersion of fugitive dust generated from the soil, and elimination of contaminate surface water runoff from contaminated soils into Paddys Run from Operable Unit 4.

SECTION 1.7

U.S. EPA REGION V

COMMENTS ON THE CRARE

BY

JIM SARIC

) Commenting Organization: U.S. EPA Commentor: Saric
Section #: K.3.3 Page #: K-3-11 to K-3-14 Line #: Table K.3-1 Code: M
Original Comment #: 11
Comment: The U.S. Department of Energy's (U.S. DOE) proposed responses to Specific Comments 11-2 and 11-4 through 11-6 are acceptable. However, U.S. DOE's proposed responses to Specific Comments 11-1 and 11-3 are unacceptable for the reasons discussed below.

In U.S. DOE's response to Specific Comment 11-1, the response narrative adequately explains how the inhalation rate (IR) value of the groundskeeper and recreational user was developed. However, U.S. DOE's action states that "a footnote to Table K.3-1 has been added for clarification." Although the footnotes for Table K.3-1 have been revised, none of the footnotes adequately explains how the IR value was developed. U.S. DOE should revise the footnotes for Table K.3-1 to include a footnote that explains how the IR value was developed.

Specific Comment 11-3 requests that justification be provided for the use of the ingestion rate of 0.18 gram per day for the groundskeeper and adult receptor. U.S. DOE's response adequately addresses the derivation and use of this rate for the adult receptor. However, U.S. DOE does not justify the use of this rate for the groundskeeper. In fact, U.S. DOE revise the ingestion rate for the groundskeeper to 0.05 gram per day without providing any explanation for this change. U.S. DOE should provide justification for the use of the new ingestion rate for the groundskeeper.

Response to Original Comment 11-1:
Agreed.
Action: The footnote "e" to Table K.3-1 has been amended to reflect the origin of the IR values. Also, text has been added to Section K.3.3, which is referenced by footnote "e", that describes how the IR value was developed.

Response to Original Comment 11-3:
The ingestion rate of 0.05 grams per day was adopted because this was the ingestion rate used for the groundskeeper in the Operable Unit 4 Baseline Risk Assessment.
Action: The table has been amended to include a footnote "f" for the derivation of the 0.05 gm/day ingestion rate.

) Commenting Organization: U.S. EPA Commentor: Saric
Section #: K.7.6.18 Page #: K-7-55 Line #: 1-20 Code: M
Original Comment #: 24
Comment: The original comment states that U.S. DOE should include a discussion of the use of the uptake/biokinetic model to address lead toxicity. U.S. DOE's response includes a brief discussion of the model. However, U.S. DOE concludes that, "in the absence of site-specific residential exposure variables, this model is not applicable to the Operable Unit 4 CRARE." This response is unacceptable for two reasons. First, U.S. DOE has conducted extensive modeling efforts for various Fernald Environmental Management

Project (FEMP) reports, often without "site-specific" variables; instead, default or estimated values were used. Likewise, default or estimated residential exposure variables could be used in the uptake/biokinetic model. Second, U.S. DOE has already developed or assumed many of the necessary residential exposure variables, such as soil ingestion and inhalation rates. U.S. DOE should revise the Operable Unit 4 CRARE report to include an evaluation of lead toxicity using the uptake/biokinetic model developed by U.S. EPA.

Response: **The EPA Biokinetic model is applicable only to the estimation of lead exposure by children (0 to 6 years old) and is not applicable nor relevant and appropriate to the exposure of the Expanded Trespasser to lead in surface soils. Therefore, the biokinetic model could be used to estimate lead exposures by the on-site farmer child in the CRARE.**

Lead is present above background at the FEMP at levels generally below 200 mg/kg, but has not been identified as a major COC for surface soils. EPA has established a target cleanup level of 500 mg/kg for soil exposures which is based on the Biokinetic Model. Therefore, it seems that running the Biokinetic Model would not provide additional information as to the overall risk. It has been established that the risks to the on-property farmer adult and the on-property farmer child are above the target of 1×10^{-4} from exposure to other COCs.

In addition, the potential exposure to lead in soils will be due to the OU5 soils. These soils are currently incompletely characterized and the spatial relationship to U-238 and other radionuclides has not been determined. It is quite possible that removal and treatment of radionuclide contaminated soils will remove lead as well. Therefore, the determination of source terms for input into the biokinetic model is very uncertain.

In summation, it has been established that there is an unacceptable risk for the on-property farm family, lead concentrations are generally below 500 mg/kg and there will be no additional risk due to lead; and there is incomplete characterization of sitewide residual lead contamination. However , this is an issue which needs to be further examined and later CRAREs can explore this issue further, particularly Operable Unit 5.

Action: **No action by the Operable Unit 4 FS Report.**

SECTION 1.8

OEPA

FS AND PP COMMENTS

BY

GRAHAM MITCHELL

AND

TOM SCHNEIDER

OEPA COMMENTS
ON
OU4 FS/PP REV.1

Feasibility Study Comments

1) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Figure 1-10 Pg #: 1-31 Line #: Code: e
Original Comment #:
Comment: As stated in OEPA's 11/9/93 Comment #1, Wetland WQ is not delineated on the map in black. The wetland is located in the northwest corner of the FEMP. The figure was not revised as suggested in DOE's response to comments.
Response: Agreed, the figure had been revised as per the 11/9/93 comment # 1. However, the September 1993 draft of the figure was inadvertently placed into the December 1993 Draft Final report.
Action: The updated Figure 1-10, with Wetland WQ delineated in black has been placed into the document.

2) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table 2-4 Pg #: 2-11 Line #: Code: c
Original Comment #:
Comment: As stated in OEPA's 11/9/93 Comment #6, DOE should provide, within the FS, the NRC and DOE criteria for the free-release of contaminated material. Simply stating that these criteria will be used does not provide sufficient detail. Just as soil cleanup numbers are provided in the FS, so should the free-release criteria for structural material and equipment.
Response: Agreed, the response to the November 9, 1993 comment was not adequately completed. Tables listing contamination limits for free-release criteria are available from the NRC Regulatory Guide 1.86, from DOE Order 5400.5, and are listed in FEMP site procedures. The free-release criteria in each of these documents are consistent with each other except for DOE Order 5400.5 which reserved limits for the group of radioisotopes which included Ra-226. However, a DOE letter was issued which directs DOE sites to use the contamination limits listed in the NRC Regulatory Guide 1.86 for these group of isotopes.
Action: A table listing surface contamination limits for free-release of debris (i.e., structural building material and equipment) with surface contamination has been provided in a new Table 2-5.

3) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table 2-5 Pg #: 2-20 & -22 Line #: Code: c
Original Comment #:
Comment: As stated in OEPA's 11/9/93 Comment #7, DOE failed to consider the NRC Branch Technical Position paper as a TBC for uranium and thorium cleanup levels. DOE's response suggest the NRC paper is outdated but provides no supporting documentation for excluding the document as a TBC. DOE should provide a reference to USEPA guidance which supports not including the position paper as a TBC. The position paper numbers should be included in Table 2-5.
Response: The referenced NRC Branch Technical Position (FR 52061, October 23, 1981) established interim levels for waste, contaminated with uranium and thorium, which

could be disposed by NRC licensees in accordance with the provisions of 10 CFR §20.302. Since it was a Federal Register notice rather than a rule making, it was considered by DOE as a potential candidate for inclusion in the OU4 FS Report as a TBC. However, the reference was not included in the OU4 FS Report for several reasons. Although the position paper addresses disposal of waste containing uranium and thorium, it does not establish standards for cleanup of contaminated soils which are appropriate to this site.

The paper describes conditions under which NRC licensees could apply to NRC for approval of various waste disposal options. In order to receive NRC approval, the applicant would have to demonstrate that shallow land burial was preferable to other disposal alternatives. The NRC would consider in its decision, factors such as types and quantities of waste, packaging, site characteristics (environment, geology, hydrology, meteorology, topography, use of surface and groundwaters), depth of burial, access restrictions, costs, procedures to minimize risk, and local and state acceptability. DOE considered these, as well as additional site specific factors in reaching the risk levels for residual uranium in OU4 soils.

The NRC reasoning behind the proposed uranium and thorium concentration levels presented in the position paper was not based on actual site-specific risk estimates, but rather on cost and expediency. The first disposal option given in the notice made reference to the 5 pCi/g radium level established by EPA for uranium processing sites as a basis for establishing a waste concentration limit for natural uranium. The paper did not consider the proposed levels for uranium and thorium in the waste as free release levels for soils. The assumption in the position paper was that the waste would be buried (contained), and any soil contamination would be reduced to ALARA levels.

The NRC Position was considered, and dropped from consideration since it was inappropriate and was not needed to ensure protectiveness. OU4 has established risk based levels in the FS for uranium, thorium, and radium in soils that will be protective under certain land use scenarios. The Proposed Remediation Level in the OU4 FS for radium in soils is lower than the 5 pCi/g referenced in the NRC paper as a basis for disposal of wastes containing natural uranium. This lower concentration will "drive" the OU4 remediation of soil radionuclides, and will result in the removal of uranium to concentrations below those levels already determined to pose acceptable risk if left in place. Based on the ROD under OU5, the final cleanup residual concentrations of these radionuclides may be even lower.

Action: No Action.

4) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 2.2.4.2 Pg #: 2-45 Line #: 7-17 Code: c
Original Comment #:
Comment: As stated in OEPA's 11/9/93 Comment #11, the document should define the free release limits provided in DOE Order 5400.5. Just as soil cleanup numbers are presented in the FS, numbers for structural material and equipment should be provided.

Response: Agreed, the response to the November 9, 1993 comment was not adequately completed. Tables listing contamination limits for free-release criteria are available from the NRC Regulatory Guide 1.86, from DOE Order 5400.5, and are listed in FEMP site procedures. The free-release criteria in each of these documents are consistent with each other except for DOE Order 5400.5 which reserved limits for the group of radioisotopes which included Ra-226. However, a DOE letter was issued which directs DOE sites to use the contamination limits listed in the NRC Regulatory Guide 1.86 for these group of isotopes.

Action: A table listing surface contamination limits for free-release of structural building material and equipment with surface contamination will be provided in a new Table 2-5.

5) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3.3.3.4 Pg #: 3-129 Line #: Code: c
Original Comment #:

Comment: In DOE's response to OEPA's 11/9/93 Comment #16, DOE states that "all of these changes result in an off-site disposal cost that is lower than the on-property alternative." Yet when the costs presented in the FS are compared Alt. 2C is still cheaper than Alts. 3C.1 and 3C.2. DOE must clarify this discrepancy.

Response: The comment response for the 11/9/93 OEPA Comment #16 incorrectly states that the off-site alternative costs are lower than the on-property alternative costs for Subunit C only. As stated in the response, a bulk rate quote and elimination of packaging significantly decreased the cost of Alternative 3C.2. However, addition of a staging facility added some new cost to Alternatives 3C.1 and 3C.2 and elimination of packaging for the on-property alternative reduced cost of Alternative 2C. After incorporation of these revisions, the recalculated cost estimates showed that Alternative 2C costs remained lower than Alternative 3C.2 costs. Therefore, the comment response should have stated that "all of these changes result in an off-site disposal cost which is still higher than the on-property disposal cost for Subunit C."

Action: No Action.

5) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3.2.2.1 Pg #: 3-4 Line #: 1-9 Code: c
Original Comment #:

Comment: It is unclear what the basis is for the drainage layer proposed over the cobblestone layer. It would seem more likely that infiltrating water would migrate vertically through the cobblestone than horizontally along the drainage layer of pea gravel.

Response: The December 1993 text describes the pea gravel layer as the drainage layer which lies over the cobblestone layer. This text incorrectly represents these layers as being separate with distinct purposes. The primary purpose of the cobblestone layer is to be an intruder barrier, but it is also part of the drainage layer along with the sand which all lie over the geomembrane. Therefore, it is the pea gravel, cobblestone, and sand which make up the drainage layer.

Action: The text and figures has been revised to clarify the function of the pea gravel, cobblestone, and sand in Section 4.2.2, 4.3.2, 4.4.2, and Appendix B. (The figure and text subject to this comment from Section 3.2.2.1 has been deleted based on the comment resolution meeting with the OEPA on 2/4/94).

7) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 3.2.2.1 Pg #: 3-6 Line #:Figure 3-3 Code:
Original Comment #:
Comment: It is inappropriate to indicate a location for the proposed vault at this time. There is insufficient data to support any specific location at FEMP.
Response: For the purposes of developing alternatives for this FS and performing NEPA evaluations, the location of the on-property disposal facility would be retained. Section 3.2.2.1 has been revised to state that the siting location is preliminary, and is subject to modification pending future OU5 RI/FS hydrogeological site characterization data. Should the on-property alternative be selected, the location of the disposal facility would be further explored to assure that compliance with OAC technical siting requirements are met. In addition, the current uncertainty associated with siting the disposal facility, supports the remedial strategy to hold the decision for final disposition of the Subunit C waste in abeyance until the approved Operable Unit 3 and 5 Records of Decision are issued. A revised Section 3.2.2.1 is attached (see Attachment B). As per the comment resolution meeting with the OEPA, the technical geological discussion in this section has been removed.
Action: Text has been modified in Section 3.2.2.1 per the response.

8) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3.2.2.1 Pg #: 3-7 Line #: 23-29 Code: c
Original Comment #:
Comment: As stated in OEPA's comments on the previous draft, the proposed disposal facility appears to conflict with the proposed location of the OU3 storage facility as defined in the approved OU3 Proposed Plan. It would appear DOE has failed to consider potential future uses in its evaluation of the location. Based upon this and other data regarding the ability of the location to meet Ohio solid waste disposal facility siting requirements, DOE should delete the proposed location from the FS.
Response: As per the comment resolution meeting with the OEPA, this figure and specific technical information regarding the disposal vault location has been removed. Attachment B provides the revised Section 3.2.2.1 describing the preliminary location of the disposal vault and integration with future hydrogeological site characterization.
Action: Text has been modified in Section 3.2.2.1 per the response.

9) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Figure 3-4 Pg #: 3-9 Line #: Code: c
Original Comment #:
Comment: The cross section provided is not A-A' as defined in Figure 3-3. If DOE decides to leave the proposed location and data in the FS, the figure must be revised to agree with Figure 3-3.
Response: As per the comment resolution meeting with the OEPA, these figures and technical geological discussion has been removed from Section 3.2.2.1.
Action: Figures have been deleted.

10) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Figure 3-5 Pg #: 3-10 Line #: Code: c
Original Comment #:
Comment: The cross section provided is not B-B' as defined in Figure 3-3. If DOE decides to leave the proposed location and data in the FS, the figure must be revised to agree with Figure 3-3.

Response: As per the comment resolution meeting with the OEPA, these figures and technical geological discussion has been removed from Section 3.2.2.1.
Action: Figures have been deleted.

11) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Figure 3-6 Pg #: 3-11 Line #: Code: c
Original Comment #:
Comment: The cross section provided is not C-C′ as defined in Figure 3-3. If DOE decides to leave the proposed location and data in the FS, the figure must be revised to agree with Figure 3-3.
Response: As per the comment resolution meeting with the OEPA, these figures and technical geological discussion has been removed from Section 3.2.2.1.
Action: Figures have been deleted.

12) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Figure 3-7 Pg #: 3-12 Line #: Code: c
Original Comment #:
Comment: The cross section provided is not D-D′ as defined in Figure 3-3. If DOE decides to leave the proposed location and data in the FS, the figure must be revised to agree with Figure 3-3.
Response: As per the comment resolution meeting with the OEPA, these figures and technical geological discussion has been removed from Section 3.2.2.1.
Action: Figures have been deleted.

12.5) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 3.2.2.1 Pg #: 3-14 Line #: 1 Code:
Original Comment #:
Comment: There are domestic users of till wells in the FEMP area. Till does not transmit ground water as readily as sand and gravel, but it does transmit significant quantities of ground water.
Response: As per the comment resolution meeting with the OEPA, this text and technical geological discussion in Section 3.2.2.1 have been removed.
Action: Text has been deleted per response.

13) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 3.2.2.1 Pg #: 3-14 Line #: 14-19 Code:
Original Comment #:
Comment: Ohio EPA was informed by DOE in the 01/19/94 vault siting meeting that the till is saturated. Therefore, infiltration is not limited to the brown till.
Response: As per the comment resolution meeting with the OEPA, this text and technical geological discussion in Section 3.2.2.1 have been removed.
Action: Text has been deleted per response.

14) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 3.2.2.1 Pg #: 3-14 Line #: para 4 Code:
Original Comment #:
Comment: This paragraph should be revised to accurately reflect information presented in the 01/19/94 meeting.
Response: As per the comment resolution meeting with the OEPA, this text and technical geological discussion in Section 3.2.2.1 have been removed.
Action: Text has been deleted per response.

15) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table 3-1 Pg #: 3-15 Line #: Code: c
Original Comment #:
Comment: The table references an OU3 RI (DOE 1990). This document has not been submitted to the EPAs and is not readily accessible. DOE should refrain from referencing documents not available for review.
Response: As per the comment resolution meeting with the OEPA, this table and technical geological information in Section 3.2.2.1 have been removed.
Action: Table deleted as per response.

16) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 3.2.2.1 Pg #: 3-18 Line #: 15-24 Code:
Original Comment #:
Comment: The description of deposition and distribution of sand lenses in this paragraph conflict with the descriptions given by DOE in the 01/19/94 meeting. The technical information concerning the nature and continuity of the sand lenses in this report should be revised to reflect the information given in the 01/19/94 meeting.
Response: As per the comment resolution meeting with the OEPA, this text and technical geological discussion in Section 3.2.2.1 have been removed.
Action: Text has been deleted per response.

17) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 3.2.2.1 Pg #: 3-19 Line #: 18-19 Code:
Original Comment #:
Comment: If the till is saturated, then the till itself may be a significant hydraulic connection to the Great Miami Aquifer system.
Response: As per the comment resolution meeting with the OEPA, this text and technical geological discussion in Section 3.2.2.1 have been removed.
Action: Text has been deleted per response.

18) Commenting Organization: Ohio EPA Commentor: DDAGW
Section #: 3.2.2.1 Pg #: 3-19 Line #: 27-30 Code:
Original Comment #:
Comment: Since no site has been selected, and no individual area has been shown to meet siting criteria, DOE must have a plan of action to be followed if the ARAR's cannot be met.
Response: As stated in response to Comment #7, the location of the disposal facility will be retained for the purposes of this FS, and Section 3.2.2.1 has been revised. In the event, that it is determined that on-property disposal cannot meet ARARs, then the next best alternative will be selected. Because of the remedial integration strategy with OU3 and OU5, further investigation and characterization on the disposal options for these wastes will be performed. This integrated approach allow for the opportunity to take advantage of site-wide disposal options and waste minimization technologies.
Action: Text has been modified per response to Comment #7.

19) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3.3.2.6 Pg #: 3-123 Line #: 8-19 Code: c
Original Comment #:

Comment: This alternative should not be retained for detailed analysis. The alternative can not be retained "because of its potential to be protective of ...". The threshold criteria are either met or not. Potentially being protective is not sufficient. Additionally, the alternative does not meet the NCP's statutory preference for treatment. The alternative should be screened from detailed analysis.

Response: Alternative 4B was developed in response to an U.S. EPA comment regarding the ability of the untreated Subunit B material to leach at a relatively equal rate in comparison to the treated material. Therefore, long-term effectiveness is relatively equal assuming complete loss of containment does not occur. U.S. EPA guidance does state that the use of treatment is preferred, however, treatment is not required. Therefore, this alternative still meets the threshold criteria of being protective of human health and the environment.

Action: The text has been revised to provide the same basis for retaining this alternative as for Alternative 2B. The long-term effectiveness section of Alternative 4B has also been revised.

20) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3.3.3.3 Pg #: 3-129 Line #: 2-4 Code: c
Original Comment #:

Comment: Neither Section 3.3.3.3 nor 4.4.2 provide an explanation for the $24 million decrease in the cost of this alternative from the previous version of the FS. It would seem the change simply resulted from an attempt to ensure on-property disposal was cheaper than off-site disposal.

Response: Through evaluation of the modeling results for the disposal vault and the characteristics of the Subunit C material, it was decided that there was no need to package the Subunit C materials prior to disposal in the on-property disposal vault. Packaging from the September version of Alternative 2C totaled almost $20,000,000. By removing packaging costs, a decrease was also realized from the Risk Budget and Contingency cost components, for a total decrease in costs of $24,000,000. This approach was taken for off-site disposal at a permitted commercial facility (Alternative 3C.2) also. Therefore, no bias to on-property disposal of Subunit C materials was used.

Action: No Action.

21) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3.3.3.4 Pg #: 3-130 Line #: 1-5 Code: c
Original Comment #:

Comment: The language used in this section should be the same as that used in Section 3.3.1.4 (i.e., "Long term reliability is likely greater than that of Alternative 2C because the material would be disposed off site in a remote location ...).

Response: Agreed.

Action: Paragraph has been revised to be consistent with the discussion from Section 3.3.1.4.

22) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3.4.2 Pg #: 3-136 Line #: Code: c
Original Comment #:

Comment: As stated previously, Alternative 4B should be screened. It should be eliminated on the same basis as Alt. 3B.2, protectiveness cannot be assured and the goals of reduction/treatment cannot be met.

Response: The primary basis for the elimination of Alternative 3B.2 was the difficulty involved with permitting a new facility. This reason, added to the fact that other alternatives achieve similar or better long-term effectiveness at comparable cost, did not provide a good basis for

retaining Alternative 3B.2. Alternative 4B does not have the same difficulty associated with implementation. In fact, as stated in the FS, Alternative 4B is the easiest to implement other than the no-action alternative. Alternative 4B did achieve similar long-term effectiveness as Alternative 2B, despite the fact that Alternative 4B does not meet the preference for treatment. Based on this information, it was decided that Alternative 4B was a good candidate for further investigation in the detailed analysis of alternatives.

Action: No Action.

23) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.2.2 Pg #: 4-35 Line #: 25-26 Code: e
Original Comment #:
Comment: The first sentence in this paragraph should be reviewed and revised to correct the typo.
Response: Agreed.
Action: The text has been revised to read, ". . .At the time of preparation of this report, Operable Unit 5 was conducting slug tests and yield tests in a number of monitoring wells completed in the glacial overburden. (This section of the text has been deleted per February 4, 1994 teleconference.)

24) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.2.2 Pg #: 4-37 Line #: 28-30 Code: c
Original Comment #:
Comment: The section fails to address the siting requirements excluding waste disposal over a wetland. All disposal facilities proposed within the FS impact wetlands. DOE must discuss how it intends to comply with this criteria.
Response: Siting of the on-property disposal facilities considered setback requirements, geomorphology, and wetlands. In accordance with OAC 3745-27-07 and 40 CFR §258.12, steps were taken to avoid wetland impacts to the maximum extent practicable. Since avoidance was not practicable, based on the setback requirements and geomorphology, steps were taken to minimize wetland impacts. Compensatory mitigation of wetland impacts will be determined using the 404(b)(1) guidelines of the Clean Water Act in consultation with COE, USEPA, and OEPA. Impacts to wetlands will be considered when making a final remedial decision.
Action: The text on Section 4.2.2.2, page 4-37, lines 16-20, will be revised to read as follows:

> "Restrictions on activities conducted in wetland areas are presented in 40 CFR § 258.12, 10 CFR § 1022, and OAC 3745-27-07. In accordance with these requirements, steps would be taken to avoid wetland impacts to the maximum extent practicable. If avoidance is not practicable, based on the setback requirements and geomorphology, steps would be taken to minimize wetland impacts. Compensatory mitigation of wetland impacts would be determined using the 404(b)(1) guidelines of the Clean Water Act in consultation with COE, USEPA, and OEPA. Impacts to wetlands will be considered when making a final decision."

25) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.2.6 Pg #: 4-66 Line #: 18-20 Code: c
Original Comment #:
Comment: The presence of the disposal vault over contaminated groundwater may impact the ability of groundwater monitoring to determine the integrity of the disposal vault. If the groundwater is

already contaminated, it will be difficult or impossible to determine any contamination that may be resulting from the disposal vault.

Response: It is hard to address this comment without knowing the specifics of the contamination problem and the details of geology directly beneath the selected disposal vault area. If it turned out that the groundwater beneath the selection location was contaminated, a monitoring program could be designed to take the contamination into consideration. Background trends prior to the construction of the vault could be established. The DOE would work closely with the EPA in designing a monitoring program that leaves all parties comfortable knowing that a leak from the disposal vault would be detected.

Action: None.

26) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.2.7 Pg #: 4-68 Line #: 10-12 Code: c
Original Comment #:

Comment: In response to Ohio EPA's 11/9/93 comments, the number of trucks associated with this and other alternatives were significantly reduced. This reduction in trucks and associated personnel are not reflected in any reduction in costs for these alternatives. It would seem such a significant reduction in material and labor cost would have some impact on cost.

Response: The number of trucks was corrected, not reduced, as a result of OEPA's 11/9/93 comments. The number of trucks required was incorrectly stated, but cost calculations were based on actual site work. Therefore, there is no impact on cost due to this correction.

Action: None.

27) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.2.7 Pg #: 4-72 Line #: 18-21 Code: c
Original Comment #:

Comment: This section and subsequent sections on the disposal vault and packaging contain significant errors in basic math. Ohio EPA comments on the previous version of the FS address problems with packaging calculations. Based upon the assumptions presented $2m^3$ per package and 2412 packages, the size of the disposal vault must be 4824 m^3 not the 4372 m^3 stated.

Response: The calculations for packaging requirements for Alternative 2A/Vit are based on a package size of 64 ft^3. Assuming 2412 packages are required, a total of 154,368 ft^3 are required, as correctly stated in the FS. Since there are 0.0283 m^3/ft^3, the multiplication yields 4371.7 packages, which was rounded to 4372 packages. The confusion arises in the text from the approximation of 64 ft^3 as 2 m^3, when in fact it is actually equivalent to 1.81 m^3.

Action: The text has been revised to state that the unit package size is 1.81 m^3, not 2 m^3.

28) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.2.7 Pg #: 4-73 Line #: 1-4 Code: c
Original Comment #:

Comment: As stated in OEPA comments on the previous version, it is still unclear whether DOE is assuming a completely full container. DOE's response to OEPA comments suggested the packages were designed, based on the mass of the waste material, to be completely filled. Based upon the assumptions presented (2412 packages, 1.2 m^3 storage space per package), the available package volume will be 2894 m^3 while only 2770 m^3 is need. This results in approximately 124 m^3 of wasted space or approximately 100 wasted packages. At $955 per

package, this is a significant discrepancy. DOE must review the section and revise for consistency. Additionally, DOE should discuss within the section if the package will be filled completely or not and provide the waste form's weight per volume estimate used in the calculation of packaging requirements.

Response: The number of packages for all alternatives was estimated based on a maximum allowable load of 168 lb/ft^3 or 7,260 lbs per package. The density of vitrified Subunit A material was estimated to be approximately 178 lb/ft^3. Since this exceeds the maximum allowable load, the number of packages was estimated based on weight, not volume.

$$\frac{(4756+4130)\,cy(0.41\ ft^3/cy)(178\ lb/ft^3)}{7260\ lbs/pkg} = 2{,}412\ packages$$

Action: The maximum weight of each container will be clarified on page 4-72 and the basis of the calculation will be noted as another bullet item assumption.

29) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.3.7 Pg #: 4-82 Line #: 15-17 Code: c
Original Comment #:
Comment: As stated in a previous, comment a significant reduction in truck traffic has occurred since the previous version yet no subsequent reduction in cost is realized. DOE should explain why costs were not impacted.
Response: Please refer to response to OEPA Comment #26.
Action: No Action.

30) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.3.7 Pg #: 4-84 Line #: 27-30 Code: c
Original Comment #:
Comment: Based upon the assumptions presented 2m^3 per package and 15009 packages, the size of the disposal vault must be 30018 m^3 not the 27204 m^3 stated.
Response: As stated in response to OEPA Comment #27, based on 1.81 m^3/pkg and 15,009 packages, 27,204 m^3 are required.
Action: The text has been revised to state that the unit package size is 1.81 m^3, not 2 m^3.

31) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.3.7 Pg #: 4-85 Line #: 10 Code: c
Original Comment #:
Comment: Based upon the assumptions presented (15009 packages, 1.2 m^3 storage space per package), the available package volume will be 18010 m^3 while 18274 m^3 is need. This results in approximately 264 m^3 of unpackaged waste or being short 220 packages. At $955 per package, this is a significant discrepancy. DOE must review the section and revise for consistency. Additionally, DOE should discuss within the section if the package will be filled completely or not and provide the waste form's weight per volume estimate used in the calculation of packaging requirements.
Response: The number of packages was based on volume, rather than weight, for cement stabilization alternatives because the density of this material is less than the maximum allowable load of 168 lb/ft^3. Assuming 43 ft^3/pkg (interior dimension) 15,009 packages provides 645,387 ft^3 of

container storage space. The confusion arises due to the approximation of 43 ft^3 as 1.2 m^3, when in fact it is actually 1.22 m^3.

Action: The volume of each package has been revised to state 1.22 m^3 and the basis of the calculation has been added.

32) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.4.7 Pg #: 4-97 Line #: 13-16 Code: c
Original Comment #:

Comment: The section states that it used the same assumptions as for Alternative 2A/Vit, yet when the costs for waste processing are compared Alternative 3A/Vit costs $1.05 million more. DOE must justify this additional cost or correct the Alternative 3A/Vit cost.

Response: The waste processing cost of Alternative 3A/Vit is $1.05 million more than that of Alternative 2A/Vit because of the addition of a staging facility for off-site alternatives.

Action: Assumptions for Alternative 3A/Vit have been revised to include the staging facility in addition to those components noted for Alternative 2A//Vit.

33) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.4.7 Pg #: 4-98 Line #: 10-12 Code: c
Original Comment #:

Comment: DOE must clarify the assumptions used to generate the disposal costs presented in Table 4-5 vs. the assumptions presented in the text. Based upon the assumptions in the text (2412 packages, 2 m^3 per package, $353/m3), the disposal costs would be $1,702,872 not the 1,302,500 presented in Table 4-5.

Response: Disposal costs for Alternative 3A.1/Vit should be based on 2412 packages x 1.81 m^3/pkg x $353/$m^3$. The disposal costs would be $1,541,100, not $1,702,872 as suggested by OEPA or $1,302,500 currently presented in the FS.

Action: The disposal cost for Alternative 3A.1/Vit has been modified to $1,541,100.

34) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.5.7 Pg #: 4-105 Line #: 10-13 Code: c
Original Comment #:

Comment: The section states that it used the same assumptions as for Alternative 2A/Vit, yet when the costs for waste processing are compared Alternative 3A/Cem costs $1.05 million more. DOE must justify this additional cost or correct the Alternative 3A/Cem cost.

Response: The additional $1.05 million is due to a staging facility for off-site shipments. Please refer to response to OEPA Comment #32.

Action: Assumptions for Alternative 3A/Cem has been revised to include the staging facility in addition to those components noted for Alternative 2A/Vit.

35) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.2.5.7 Pg #: 4-106 Line #: 1-3 Code: c
Original Comment #:

Comment: DOE must clarify the assumptions used to generate the disposal costs presented in Table 4-6 vs. the assumptions presented in the text. Based upon the assumptions in the text (15009 packages, 2 m3 per package, $353/m3), the disposal costs would be $10,596,354 not the 8,104,800 presented in Table 4-6.

Response: Disposal costs for Alternative 3A.1/Cem should be based on 15,009 packages x 1.81 m^3/pkg x $353/$m^3$, for a disposal cost of $9,589,700.

Action: The disposal cost for Alternative 3A.1/Cem has been modified to $9,589,700.

36) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.2.7 Pg #: 4-141 Line #: 6-9 Code: c
Original Comment #:
Comment: Based upon the assumptions presented, 2m^3 per package and 2412 packages, the size of the disposal vault must be 4824 m^3 not the 2324 m^3 stated.
Response: The number of packages required for Alternative 2B/Vit is incorrectly stated as 2,412 packages. The actual number of packages should be 1,282 packages. The disposal vault size presented was correctly estimated using 1,282 packages x 1.81 m^3/pkg = 2324 m^3.
Action: The typographical error on the number of packages has been corrected on page 4-141, line 26.

37)
Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.2.7 Pg #: 4-141 line: 26 Code: c
Original Comment #:
Comment: As stated in OEPA comments on the previous version, it is still unclear whether DOE is assuming a completely full container. DOE's response to OEPA comments suggested the packages were designed, based on the mass of the waste material, to be completely filled. Based upon the assumptions presented (2412 packages, 1.2 m^3 storage space per package), the available package volume will be 2894 m^3 while only 1471 m^3 is need. This results in approximately 1423 m^3 of wasted space or approximately 1,185 wasted packages. At $955 per package, this is a significant discrepancy. DOE must review the section and revise for consistency. Additionally, DOE should discuss within the section if the package will be filled completely or not and provide the waste form's weight per volume estimate used in the calculation of packaging requirements.
Response: Due to the density of vitrified material, the number of packages for those options that include vitrification are based on weight, rather than volume, which was the basis used for cement stabilization options. As noted in response to OEPA Comment #36, the number of packages required for Alternative 2B/Vit is 1,282 packages. This provides 1282 packages x 7260 lb/package x (178 lb/ft^3)$^{-1}$ = 52,254 ft^3 or 1935 cy of container space.
Action: See response to OEPA Comment #36.

38) **The OEPA did not have a comment numbered as 38.**

39) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.3.7 Pg #: 4-152 Line #: 18-22 Code: c
Original Comment #:
Comment: Based upon the assumptions presented 2m^3 per package and 4957 packages, the size of the disposal vault must be 9914 m^3 not the 8984 m^3 stated.
Response: As discussed in the response to OEPA Comment #27, each package occupies 64 ft^3. Therefore, 4957 packages occupies 317,248 ft^3. If multiplied by the conversion factor 0.02832 m^3/ft^3, you have 8984 m^3.
Action: See response to OEPA Comment #27.

40) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.3.7 Pg #: 4-152 Line #: 28-31 Code: c

Original Comment #:

Comment: Based upon the assumptions presented (4957 packages, 1.2 m^3 storage space per package), the available package volume will be 5948 m^3 while 5999 m^3 is need. This results in approximately 51 m^3 of unpackaged waste or being short 43 packages. DOE must review the section and revise for consistency. Additionally, DOE should discuss within the section if the package will be filled completely or not and provide the waste form's weight per volume estimate used in the calculation of packaging requirements.

Response: As discussed in OEPA Comment #31, the number of packages for cement stabilized options was based on a volume of 43 ft^3/pkg. 4957 packages would provide, 4957 packages x 43 ft^3/package = 213,151 ft^3 of space or 7894 cy, as noted in the FS. Confusion arises due to the approximation of 43 ft^3 as 1.2 m^3, when in fact it is actually 1.22 m^3.

Action: The assumptions have been revised to state that each package provides 1.22 m^3 of container storage space.

41) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.4.7 Pg #: 4-161 Line #: 18-21 Code: c
Original Comment #:

Comment: The section states that it used the same assumptions as for Alternative 2B/Vit, yet when the costs for waste processing are compared Alternative 3B.1/Vit costs $1.05 million more. DOE must justify this additional cost or correct the Alternative 3B.1/Vit cost.

Response: As discussed in OEPA Comment #32, the waste processing costs for Alternative 3B/Vit are $1.05 million more than for Alternative 2B/Vit due to the staging facility required for off-site disposal alternatives.

Action: Assumptions for Alternative 3B.1/Vit have been revised to include the staging facility in addition to those components noted for Alternative 2B/Vit.

42) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.4.7 Pg #: 4-162 Line #: 15 Code: c
Original Comment #:

Comment: DOE must clarify the assumptions used to generate the disposal costs presented in Table 4-9 vs. the assumptions presented in the text. Based upon the assumptions in the text (2412 packages, 2 m3 per package, $353/m3), the disposal costs would be $1,704,284 not the $692,300 presented in Table 4-9.

Response: Disposal costs for Alternative 3B.1 Vit should be based on 1,282 packages (see OEPA Comment #36) x 1.81 m^3/pkg x $353/$m^3$, or $819,100.

Action: The disposal cost for Alternative 3B.1/Vit has been revised to $819,100.

43) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.5.7 Page#: 4-168 Line #: 23-26 Code: c
Original Comment #:

Comment: The section states that it used the same assumptions as for Alternative 2B/Vit, yet when the costs for waste processing are compared Alternative 3B.1/Cem costs $1.05 million more. DOE must justify this additional cost or correct the Alternative 3B.1/Cem cost.

Response: As discussed in OEPA Comment #32, the waste processing costs for Alternative 3B.1/Cem are $1.05 million more than the cost of Alternative 2B/Vit due to the staging facility required for off-site disposal alternatives.

Action: Assumptions for Alternative 3B.1/Cem have been revised to include the staging facility.

44) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.5.7 Pg #: 4-170 Line #: 13-14 Code: c
Original Comment #:

Comment: DOE must clarify the assumptions used to generate the disposal costs presented in Table 4-10 vs. the assumptions presented in the text. Based upon the assumptions in the text (4957 packages, 2 m3 per package, $353/m3), the disposal costs would be $3,499,642 not the $1,308,600 presented in Table 4-9.

Response: The assumptions stated for the disposal cost for Alternative 3B.1/Cem should be revised to state, "This cost is estimated as described for Alternative 3B.1/Vit, except for the number of packages required." Alternative 3B.1/Cem has more packages than Alternative 3B.1/Vit due to increase in volume from treatment by cement stabilization. The disposal costs for Alternative 3B.1/Cem should be based on 4957 pkgs x 1.81 m^3/pkg x $353/$m^3$. The disposal cost would be $3,167,200 (rounded), not $2,676,800, as noted in Table 4-10.

Action: The disposal cost for Alternative 3B.1/Cem has been revised to be $3,167,200.

45) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.6 Pg #: 4-172 Line #: Code: c
Original Comment #:

Comment: As stated previously, OEPA does not believe this alternative should pass through screening to detailed analysis. Additionally, what basis does DOE have for evaluating an on-site no treatment option without considering an off-site no treatment option?

Response: See response to Comment # 19 for basis for retaining Alternative 4B. The basis for not evaluating a no treatment alternative for off-site disposal is discussed in Sections 3.2.4.4 and 3.2.5.4 of the FS. The opening paragraph of Section 3.2.4.4 for Subunit A off-site alternatives states that:

"A number of programmatic and residue specific considerations were factored into the development of alternatives for residue removal and off-site disposal options. The considerations included:

1. the need to adhere to waste acceptance criteria for the disposal facility including constituent specific leachability requirements.

2. the need to reduce or control radon emanation rates to meet disposal facility acceptance requirements.

3. the need to reduce exposures during loading, transport, and disposal operations consistent with ALARA principles.

In accordance with these considerations, only alternatives which employed residue stabilization were considered for off-site disposal. Waste stabilization, through cement stabilization or vitrification, accommodates these considerations by reducing the leachability of the metal constituents to below disposal facility acceptance thresholds, attenuating radon emanation rates to ensure disposal facility acceptance, and by reducing the volume (vitrification) or direct radiation (cement stabilization) to minimize exposures associated with the handling, transport, and disposal of the residues."

Section 3.2.5.4 for Subunit B off-site alternatives states:

"In order to attain waste acceptance criteria at the off-site disposal facility pertaining to leachability of heavy metals, all alternatives developed for Subunit B involved off-site disposal include a waste stabilization processing step."

Based on these factors disposal of Subunit A and B waste off-site without treatment was not evaluated.

Action: No action.

16) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.6.7 Pg #: 4-186 Line #: 14-16 Code: c
Original Comment #:
Comment: The section should be revised to be consistent with other disposal vault sections within the document. Use metric volume to be consistent.
Response: Agreed.
Action: The text has been revised to provide the metric equivalent of 3400 m^3 (120,000 ft^3).

17) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.3.6.7 Pg #: 4-186 Line #: 17-19 Code: c
Original Comment #:
Comment: Based upon the assumptions presented in the text (3,195 containers, 1.2 m^3/container), 3834 m^3 of package volume will be available while at least 3895 m^3 will be needed. This results in at least 61 m3 of unpackaged material or being short 51 containers. DOE must revise its package and cost estimates. Additionally, DOE should discuss within the section if the package will be filled completely or not and provide the waste form's weight per volume estimate used in the calculation of packaging requirements.
Response: As discussed in OEPA Comment #31, the number of packages for Alternative 4B was estimated based on a maximum volume of 43 ft^3/pkg since the density of Subunit B material is less than the 168 lb/ft^3 threshold for packaging (estimated to be about 120 - 140 lb/ft^3). 3195 packages provides 137,385 ft^3 or 3891 m^3 of space. Since there is 5088 cy or 137,376 ft^3 or 3890 m^3 of material in Alternative 4B. The confusion arises due to the approximation of 43 ft^3 as 1.2 m^3, when in fact it is 1.22 m^3.
Action: The assumptions have been revised to state that each package provides 1.22 m^3 of container storage space.

18) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.2 Pg #: 4-198 Line #: 11-15 Code: c
Original Comment #:
Comment: The text should also state that if an off-property disposal option is chosen for OU3 or OU5 wastes an ESD or ROD amendment to the OU4 ROD would not be necessary. The only circumstance under which an ESD or ROD amendment would be necessary would be if the OU4 wastes are dispositioned inconsistent with the OU3 and OU5 RODs.
Response: Agreed.
Action: The last two sentences of the paragraph (lines 11-15) have been deleted, and replace with the following text:

"However, a ROD amendment to the Operable Unit 4 ROD would not be necessary in the event that the Operable Unit 4 contaminated soils and debris could be dispositioned consistent with the Operable Unit 5 and Operable Unit

3 RODs."

49) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.2 Pg #: 4-206 Line #: 21-29 Code: c
Original Comment #:

Comment: The text should discuss the ARAR or TBC which requires the intrusion or radon barriers for Subunit A and B wastes but not C wastes. The text should define the legal basis for not requiring the barrier for Subunit C wastes.

Response: Subunit C waste will not exhibit the elevated direct penetrating radiation associated with K-65 material in Subunit A. As a result of the radiation hazards associated with the K-65 material, 10 CFR §61.7(b)(5) was adopted as a "relevant and appropriate" requirement for Subunit A, Alternative 2A. The use of 10 CFR §61 is not required, but including it supplies more stringent standards that help ensure protectiveness under the on-property disposal of Alternative 2A. These requirements include a minimum cover thickness of 5 meters above the wastes or the use of specially designed intruder barriers to prevent inadvertent intrusion for at least 500 years. Although the requirements under 10 CFR §61 are not pertinent to Subunits B or C, the on-property disposal options proposed for these subunits will still be designed to maintain protection of human health and the environment. Various requirements under 40 CFR §192 Subpart A, and 40 CFR §264 for RCRA closure and capping, have been identified as "relevant and appropriate" requirements for all on-property disposal alternatives. Since the hazards associated with Subunit C are not as significant as those associated with Subunits A and B, the engineering design will not need to include the barrier requirements of 10 CFR §61.

Action: The text of lines 24-30 will be modified to read:

> "To accommodate these differences, a number of the proposed design features of the representative disposal concept, the above-grade vault may not be needed to ensure protectiveness. Features that would not be needed includes intrusion and radon barriers under 10 CFR §61 as well as waste packaging. The configuration of any on-property disposal facility would be initialized through the remedial design process. For purposes of this FS, the on-property disposal alternatives for Subunit C waste assume that no intrusion or radon barriers will be needed in order to be protective and that the waste will be disposed of in bulk."

50) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.2.3 Pg #: 4-213 Line #: 6-10 & 13-15 Code: c
Original Comment #:

Comment: Ohio EPA's 11/9/93 comments address the fact that simply backfilling with soil was not an acceptable method for risk reduction and that the contaminated soils would need closure in compliance with Ohio law. DOE's response was that the risk assessments did not take into account the six inches of cover soil. This section of text suggests that the cover soil is essential for reducing risk to an acceptable level. Additionally, DOE's response to USEPA Radiation Section Comment #24 suggests the risk assessment did use the backfill as a method of risk reduction. This issue remains unresolved with regard to the role of the six inches of cover soil in risk reduction and the need to proper closure of the contaminated soils.

Response: It is agreed that backfilling with six-inches of cover soil is not acceptable for risk reduction. The risk calculations in the revised Appendix D included exposure to exposed soils and no

credit was taken for backfilling with cover soil.

Action: The text in the following sections have been revised as follows:

- Section 3.2.6.3, Mechanical Removal, the following sentence will be added: "This six inches of backfill soil is not to be considered protective for future users."
- Section 4.4.2.3, lines 8-10 have been revised as follows: "These concerns would be mitigated by the removal of the contaminated soils in order to achieve PRLs, backfilling of the excavated areas with suitable backfill soil, . . . "
- Section 4.4.2.3, lines 13-15 have been deleted.

51) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.2.7 Pg #: 4-222 Line #: Code: c
Original Comment #:

Comment:
a) The previous version of this document included packaging for on-property disposal, as do all prior sections of this version. DOE must provide justification for the elimination of packaging for the on-property disposal of Subunit C wastes.
b) DOE must justify the fact that no "During Remediation O&M costs" are provided for this alternative as are provided for on-property disposal options for Subunit A & B wastes.

Response:
a) Subunit C material is comprised mainly of soils, concrete, piping, and construction debris. It would not be economically feasible to size reduce rubble and debris to accommodate standard containers. Furthermore, the packaging and handling costs for large quantities of soil was considered prohibitive. Consequently, this version of the document did not include packaging for on-property disposal of Subunit C material. Based on the above information, as well as the fact that no credit was claimed for the package in the risk assessment modeling for determining long-term effectiveness, it was decided to place the material directly into the vault. This decision is consistent with similar disposal operations at the Department of Energy's Weldon Springs site.

b) The cost of labor during remediation is included in the "Demolition and Removal" cost component for all Subunit C alternatives. For Subunits A and B, all of the construction labor is included in with operating the treatment systems for the time required is included in the "O&M during remediation" cost component.

Action: No Action.

52) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.2.7 Pg #: 4-224 Line #: 21-25 Code: c
Original Comment #:

Comment: The section does not provide a volume estimate for total amount of Subunit C waste requiring disposal. The proposed vaults have a capacity of 37,400 m^3, while the total from lines 1-16 is just 14,328 m^3. DOE should define the volume of waste used in the cost calculations.

Response: In addition to the items listed in lines 1 - 16, berm soil (8060 m^3) and surface soil (3400 m^3) volumes are part of Subunit C. A bulking factor of 1.3 was applied to the total volume of soil provided on line 16 plus the berm and surface soils, for a total out-of-place soil volume of 29,458 m^3 (38,519 yd^3).

The length of piping (790 m) mentioned on line 7 is included in the 300 m^3 estimate on line 12, so this is not in addition to quantities provided in text (as suggested by OEPA). Assuming a 10 percent void volume on all the material since it is being placed into a vault without containers, the total volume is 34,956 m^3 (1,235,193 ft^3). Since each cell provides 3,400 m^3 (120,000 ft^3) of storage space, (34,956)/(3,400) = 10.3 cells, which was rounded to 11 cells as noted in text.

Action: Further clarification of the basis of volume estimates for Subunit C has been provided in the document.

53) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.3.7 Pg #: 4-234 Line #: 1-4 Code: c
Original Comment #:

Comment: This bullet suggests the storage volume of the waste container is 2 m^3 while the rest of the document reports it as 1.2 m^3. The text should be revised to be consistent with the rest of the document and calculations reviewed to ensure correctness.

Response: Agreed.

Action: The storage volume has been changed to 1.22 m^3.

54) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.3.7 Pg #: 4-234 Line #: 5-8 Code: c
Original Comment #:

Comment: The section should include the volume of all Subunit C waste to be disposed, including soils. DOE must provide the volume used in cost calculations.

Response: Please refer to the response to OEPA Comment #52.

Action: Further clarification of the basis of volume estimates for Subunit C has been added.

55) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.3.7 Pg #: 4-234 Line #: 24-26 Code: c
Original Comment #:

Comment: Based upon the assumptions provided in the text (26,215 containers, 2 m^3/container, $353/m3) the disposal cost should be $18,507,790 not the $11,229,000 reported in Table 4-15.

Response: The disposal cost for Alternative 3C.1 should be based on 26,215 packages x 1.81 m^3/pkg x $353/$m^3$. The disposal cost would be approximately $16,749,500 (rounded).

Action: The correction to disposal cost for Alternative 3C.1 has been made in the document.

56) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 4.4.4.7 Pg #: 4-242 Line #: Code: c
Original Comment #:

Comment: The section should provide the volume of Subunit C waste used in the cost estimates for this alternative. It is obvious a different volume was used for the calculations of alternative 3C.1 and 3C.2. This is determined by dividing the total disposal cost by the per unit volume cost in each alternative. The result suggests that 34958 m^3 was used in 3C.2, while 31810 m^3 was used for 3C.1. DOE must provide a justification for this discrepancy.

Response: The disposal volumes for Alternatives 3C.1 and 3C.2 are different because Alternative 3C.1 includes packaging, as required by NTS, and Alternative 3C.2 does not include packaging because the permitted commercial disposal facility accepts bulk shipment of waste. The disposal cost for Alternative 3C.1 will be adjusted, as discussed in the response to OEPA

Comment #55. The disposal cost for Alternative 3C.2 should be based on a total volume of 34,956 m^3 (1,235,193 ft^3) (see OEPA Comment #52 for volume basis) x \$530/m^3 = \$18,526,700.

Action: The disposal cost for Alternative 3C.2 has been revised in the document.

57) Commenting Organization: Ohio EPA . Commentor: DERR
Section #: Table 5-3 Pg #: 5-5 Line #: Code: c
Original Comment #:
Comment: On-property disposal should not be defined as most reliable. To be consistent with Tables 5-1 and 5-2 as well as all previous text in the FS, only Alternatives 3C.1 and 3C.2 should be defined as most reliable.
Response: Agreed.
Action: The word "most" has been deleted from the Table 5-3, Alternative 2C "Long-Term Effectiveness and Permanence Through Treatment" column entry.

58) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table 5-5 Pg #: 5-11 Line #: Code: c
Original Comment #:
Comment: As stated in OEPA's 11/9/93 Comment #55:
a) Table 4-13 contradicts the B.S.L designation for subunit C alternatives for the future on-property farmer. Table 4-13 suggests the radiological ILCR would be $>1 \times 10^{-3}$ for the future on-property farmer. Additionally, footnote "f" is not appropriate for alternatives 3C.1 and 3C.2, since residual contamination is left in place constituting a radiological ILCR $>1 \times 10^{-3}$ (Table 4-10).
b) Footnotes "b", "g", and "h" are not included within the table. Delete the footnotes or include them in the table.
DOE's response to this comment suggested the table would be revised but no changes were made.
Response: a) Agreed.
b) Footnotes "b", "g", and "h" were deleted from Table 5-5, but not the footnote key.
Action: a) Table 5-5 has been revised to be consistent with Table 4-13 and Table D.4-3.
b) Footnotes "b", "g", and "h" have been deleted and the remaining footnotes have been relettered (a - d). In addition, a new footnote "f" has been added defining the term N/A.

59) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table 5-8 & 5-9 Pg #: 5-38 & -40 Line #: Code: c
Original Comment #:
Comment: These tables fail to incorporate alternative 4B.
Response: Agreed.
Action: Tables 5-8 and 5-9 have been modified to include Alternative 4B.

60) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table 5-10 Pg #: 5-46 Line #: Code: c
Original Comment #:
Comment: These tables fail to include any O&M during remediation costs as to the on-property disposal options for Subunit A & B wastes. DOE must provide a justification for the deletion of this costs from Alternative 2C.
Response: Please refer to the response to Comment #51, Part (b).
Action: No Action.

51) Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table D.III-1 Pg #: D-III-6 Line #: Code: c
Original Comment #:

Comment: What is DOE's basis for the exposure point concentrations used to calculate the on-property resident farmer risks? It would seem reasonable that these concentrations should be the same as the proposed remediation levels.

Response: The basis for the soil concentrations was either the PRLs or the existing subsurface soil concentrations.

Action: Provide additional text on page D-3-23 to the sentence ending on line 3.

> "The exposure point concentrations for the exposures to surface soils are the PRLs of the COCs found in Table 2-11 of the FS. In the case where no PRLs were defined for the COCs, the existing subsurface soil COC concentrations were used as the exposure point concentrations."

Proposed Plan Comments

62) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 1.0 Pg #: 2 Line #: Code: c
Original Comment #:
Comment: There needs to be additional clarification in the paragraphs concerning NEPA/CERCLA integration. Explain why these need to be integrated; what their differences are; is the EIS for OU4 applicable to the entire site; and why EISs have not been prepared for each OU. The experiences with public comment on the OU3 Proposed Plan support the need for additional clarification of the nuances of CERCLA/NEPA integration.
Response: Agreed
Action: The text on page 2 will be revised to further clarify NEPA/CERCLA Integration and additional text will be provided as follows:

"Furthermore, integrated NEPA/CERCLA documents would be prepared for the remaining operable units and tier from the Operable Unit 4 FS/PP-DEIS. Tiering is a process allowed for in the NEPA regulations in which a project will be accomplished in a series of steps (e.g., remediation of the FEMP Site) can be evaluated in stages. The Operable Unit 4 FS/PP-DEIS provides the NEPA evaluation and will result in a decision for Operable Unit 4 only. In addition, it also provides a broad evaluation of the cumulative impacts of all site activities (discussed below) that will only be updated in future documents.

Because NEPA has been integrated into the Operable Unit 4 FS/PP documents, it has resulted in a broader analysis of the alternatives considered in the FS. In other words, the issue of potential environmental impacts is discussed in somewhat more detail than a stand-alone FS. In addition, the opportunities for the public and interested parties to review the FS is expanded.

The integration process employed in the Operable Unit 4 FS/PP-DEIS will be utilized in the FS/PP documents for the remaining operable units (i.e., 1, 2, 3 and 5). It is anticipated that the level of NEPA documentation for the remaining operable units will be EAs rather than EISs; however, this will be evaluated further as the development of respective FS/PP documents progresses. It is anticipated that EAs will be prepared for the remaining operable units because they will rely on the Operable Unit 4 FS/PP-DEIS for the broad evaluation of cumulative impacts."

63) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 2.4.1 Pg #: 9 Line #: 18-21 Code: c
Original Comment #:
Comment: A brief explanation and history of the Radon Treatments System should be included.
Response: The text will be modified to include "The Radon Treatment System (RTS) was installed in November 1987 to reduce radon inventory within the headspace of Silos 1 and 2. The RTS was sampled during a removal site evaluation in January 1992."
Action: Revise per response.

64) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 2.4.1 Pg #: 11 Line #: 27-35 Code: c
Original Comment #:

Comment: DOE should state within this paragraph that groundwater is being addressed by OU5. This will prevent the confusion which occurs when the reader reaches page 16.
Response: Agreed.
Action: This paragraph will be revised to state that groundwater is being addressed by OU5.

65) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 2.4.1 Pg #: 12 Line #: Code: c
Original Comment #:
Comment: DOE should consider the addition of a water table diagram with flow direction to enhance comprehension of this section.
Response: DOE will provide a water table diagram (Figure 2-3) to enhance reader comprehension in this section of the text.
Action: Develop and insert water table diagram.

66) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 2.4.1 Pg #: 12 Line #: 5-16 Code: c
Original Comment #:
Comment: DOE should provide a brief reference to other contaminants and their respective concentrations detected in the perched groundwater within OU4.
Response: DOE concurs with the comment.
Action: A brief reference to the inorganic and organic constituents found in perched water samples has been added to this section.

67) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 2.4.1 Pg #: 12 Line #: 17-31 Code: c
Original Comment #:
Comment: In this section it is concluded that there is "no apparent link between contamination in the GMA and OU4." However, the contamination numbers range from 1 to 40.3 ug/l which seem significant enough to have some effect and therefore to negate the above assumption. DOE should provide some additional discussion within the text as to why OU4 contamination can not be conclusively tied to the GMA contamination.
Response: DOE concurs with the comment.
Action: The sentence beginning "The above data, as well as measurements. . ." was deleted. The following excerpt from the Remedial Investigation Report for Operable Unit 4 has been added:

> "The isotopic ratio of U-234 and U-238 would suggest a natural uranium ratio in these samples. Such a ratio may be expected from Operable Unit 4, but is not a "fingerprint" for this source. The presence of uranium upgradient in the aquifer from an Operable Unit 4 source could be explained by leachate travel in the perched groundwater zone of the glacial overburden with emergence to Paddys Run. Here the diluted leachate could enter the aquifer via stream bed infiltration or flow at the perched zone/stream channel interface. No evidence is available to support or preclude this potential route."

68) Commenting Organization: Ohio EPA Commentor: DERR
Section #: 6.3.3 Pg #: 80 Line #: 7-16 Code: c
Original Comment #:

Comment: Ohio EPA believes the preferred alternative should be 3C.2 because of increased certainty of long term protection of human health and the environment, uncertainty associated with 2C's ability to comply with ARARs (OAC 3745-27-07(B)(5)), 3C.2 is likely to be more implementable than 2C, since DOE has yet to define a location on-property which can comply with OAC 3745-27-07(B)(5). DOE may wish to refrain from drawing a conclusion in this section and defer it to the OU5 and OU3 decisions.

Response: As discussed in the February 4, 1994 teleconference between Ohio EPA, DOE, and FERMCO, all references to a specific on-property location for disposal of Subunit C waste will be removed from the FS. The FS will clearly indicate that this decision will be made by the Operable Units 3 and 5 Records of Decision. As concluded by the detailed analysis presented in the FS, Alternatives 3C.2 and 2C are equally justified. The PP will be revised to state that Alternative 2C, On-Property Disposal, was selected only for the purpose of evaluating long-term effectiveness and other stipulated criteria in accordance with the statutory requirements of Section 121 of CERCLA.

Action: Revise the FS and PP in accordance with the response above.

ATTACHMENT B

REVISED SECTION 3.2.2.1

3.2.2.1. On-Property Disposal Facility

A series of alternatives for each of the subunits involve the construction of an on-property above-grade disposal vault. For the purposes of developing alternatives for this FS and for performing a NEPA evaluation on the potential impact of the alternatives, a representative location of the disposal vault was tentatively selected in a suitable area of the FEMP property. This siting location is subject to relocation based on the future Operable Unit 5 RI/FS hydrogeological site characterization and detailed evaluations on the ability to demonstrate compliance with federal and state ARAR/TBCs. Approval of this FS would not constitute approval of the preliminary location of the representative on-property disposal facility. Compliance with the State of Ohio siting requirements or obtaining waivers for these requirements must still be demonstrated. The final location of any on-property disposal facilities selected for Operable Unit 4 would be dictated by the Operable Unit 5 ROD as part of the site-wide disposal strategy for the FEMP. Subsequent modification to the NEPA impact analysis discussion would be performed at that time.

SECTION 2.0

RESPONSE TO COMMENTS PURSUANT TO DISCUSSIONS WITH U.S. EPA

(Monday, February 7, 1994)

SECTION 2.1

U.S. EPA REGION V

COMMENTS ON THE FS

BY

PAT VANLEEUWEN

RESPONSE TO COMMENTS PURSUANT TO DISCUSSIONS WITH U.S. EPA ON MONDAY, FEBRUARY 7, 1994

7) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table 2-5 Page #: 2-19 Line #: Code:
Original Comment #: 7

Comment: What is the basis for the PRGs for the carcinogenic PAHs? Are they based on Benzo(a)pyrene? There are no toxicity values for the dermal exposure pathways for PAHs. Describe how these values were calculated and modified to include dermal considerations.

Response: They were based on benzo(a)pyrene. They will be re-calculated to be based on the TEF values.

Action: Recalculations of PRGs.

Comment #2: **The original comment here was not a request for a recalculation, but for a description of the methodology used to calculate the PRGs for PAHs and how dermal considerations were incorporated in the calculation. The text gives a detailed description of the approach for radionuclides, lead and PCBs, but does not address PAHs. My understanding is not furthered by the recalculation.**

Response: **Originally the PRGs for PAHs used a conversion of oral SFs to calculate the dermal contribution for the PRGs. However, for the December 1993 submittal, this methodology was abandoned to be consistent with the U.S. EPA comments, on the April 1993 Operable Unit 4 Remedial Investigation Report. Therefore, the PAH PRGs were re-calculated without using the dermal contribution.**

It has been suggested that the oral SF be multiplied by two to account for the lack of a dermal pathway. If this approach was to be adopted, the maximum impact would be to reduce the PAH PRGs by a factor of two.

This is not a serious problem for Operable Unit 4 because once the top six inches of surface soil will be removed, there will not be a potential exposure to PAHs as no PAHs were detected in the subsurface soils. Therefore, a change in PRGs will not cause a change in the remedial action or remedial risk.

Action: **The following text will be added on page 2-19, after line 3:**

> **"The PRGs for the PAH compounds were calculated using the Toxic Equivalence Factor (TEF) approach as detailed in the Operable Unit 4 Baseline Risk Assessment. In this approach, the Slope Factor for benzo(a)pyrene was multiplied by the individual TEF for each PAH. This was done for the oral and inhalation pathways where slope factors were available. The dermal pathway of exposure was not considered for PRGs because of recent guidance from Region V EPA not to derive dermal slope factors from oral slope factors for the PAH compounds. This is consistent with the approach used in the Operable Unit 4 Baseline Risk Assessment."**

8) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-22, 2-23 Line #: Calculations Code:
Original Comment #: 8

Comment: I know it does not matter whether you calculate the soil PRG based on an Air PRG (do Air calculation first) or calculate the soil PRG based on the total unit risk. However, the methods used for the calculation of the soil PRGs for the on-site farmer and the off-site farmer should be identical for clarity. Not everyone will understand your logic. Please revise the off-site farmer calculations to be consistent with the other scenario calculations presented.

Response: The method of calculating the PRGs was changed. In addition, all parameter changes resulting from comments on the Baseline Risk Assessment were incorporated into the calculations. As a result, the presentation of PRG calculations was changed.

Action: The presentation of PRG calculations will be changed.

Comment #2: **After reviewing the revised table 2-5, I am now truly confused. The PRGs in this draft sometimes differ from those presented in the prior draft by orders of magnitude, e.g., the new PRG for 1 or 2-butanone (at the HI - 0.2 level) is 15 mg/kg for the future resident farmer, while the PRG in the previous draft was 0.21 mg/kg. Large differences are also apparent for Pb-210, antimony, barium, chromium, benzo(a)pyrene, and some other contaminants in this exposure scenario; large differences can also be seen in other exposure scenarios. What changes in the risk calculations were made in this scenario (I see only the addition of two new exposure pathways) and other scenarios to result in orders of magnitude difference in the calculated PRGs? Such changes in methodology warrant further review.**

Response: **All PRGs were re-calculated incorporating the methodology and exposure parameter changes used for the Operable Unit 4 Baseline Risk Assessment in response to EPA comments. The methodology changes included not using the unit risk approach previously used to calculate the PRGs. Part of the reason for the changes was the recognition of errors in the previous calculations. These changes have been checked by hand calculation verification and separate spreadsheet calculations.**

Specific changes that caused these deviations were changes in dermal exposure factors, errors in dermal absorption coefficients for metals, specific spread sheet errors for individual chemicals such as 2-butanone, and typographical errors. The Pb-210 was a typographical error. In some cases as for barium, more than one change had a multiplying effect.

Action: **None**

9) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 24 - 27 Code:
Original Comment #: 9

Comment: There seems to be a major problem here. I am concerned with the calculation of PRGs that are "2.6 and 36 times less than background." Risks from exposure to radionuclides were to be based on concentrations above background, so PRGs based on these same concentrations should not present unrealistic levels of attainment.

Response: The intent of this statement is to show that the calculated PRGs for the RME on-property resident farmer are indistinguishable from background concentrations. The purpose of the Table 2-5 is to present the calculated remediation levels values which are to be considered in addition to background values. It is noted that background concentrations

result in risk greater than 1 x 10^{-4}.

Action: Modify the text by inserting the following sentence after "...respectively." "The PRGs for Ra-226 and U-238 are indistinguishable from either the respective ARAR or background concentrations. Therefore, if ARAR or background concentrations were chosen as the remedial goal, there would not be an incremental risk due to the presence of Ra-226 or U-238."

Comment #2: **I think that the argument can be made that the PRGs proposed under this scenario would require remediation of soils to background, which may not be practical. However, the ARAR for Ra-226+ progeny is not risk-based and would actually increase the risk to greater than 10e^{-3}; its use may not be consistent with CERCLA guidelines.**

Response: FEMP agrees that the use of the ARAR for Ra-226 and progeny is not health-based and is not protective. This table of PRGs merely presents the information. In Section 2.2.3.1, Section 2.2.3.2 and Table 2-11, these points are considered in the selection of PRLs. The ARAR for Ra-226 was not used, but rather the PRG plus the background.

Action: The following statement previously added to the text will be deleted:

> **"Therefore, if ARAR or background concentrations were chosen as the remedial goal, there would not be an incremental risk due to the presence of Ra-226 or U-238."**

10) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 28 Code:
Original Comment #: 10

Comment: The mill tailings standards referred to here are not risk-based and are not considered protective for Superfund; Region V (Larry Jensen) has been working on new guidelines for clean-up of radionuclides in soil. Should discuss these also.

Response: FEMP agrees that these cleanup goals are not risk based and are not directly applicable to Superfund remedial goals. However, they do represent cleanup goals at other sites where radionuclides are COCs and represent what may be technologically feasible. They were presented to give the broad picture of remedial goals. At the present time the FEMP does not have a copy of these draft guidelines.

Action: No action.

Comment #2: **This discussion should point out that the mill tailings standards are not directly applicable to Superfund goals and that their application would result in an increased risk over background.**

Response: FEMP agrees that the mine tailings standards are not applicable to Superfund goals. These standards were not used in the selection of PRLs, see Table 2-11.

Action: The following clarification will be added to the text at Section 2.2.2.3, page 2-19, lines 29-30 (December 1993 version):

> **"Because the FEMP is on the NPL and subject to Superfund remediation standards and goals, use of these mill tailings standards would not be applicable because they are not risk-based and not considered protective. Use of these standards would result in an unacceptable increase risk over background conditions. However,. . . "**

11) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 11-15 Code:
Original Comment #: 11

Comment: The description of the recreational scenario presented here does not match the description presented on page 2-16, lines 3-14. Where are the Unit Risk Factor calculations for this exposure scenario? If not in the RI, reference the appropriate section in the FS,

Response: Agreed.

Action: Change 120 days on page 2-16, line 9 to 110 days.

Comment #2: I noticed that a lower EF value (110 days/year) was chosen rather than the original value of 120 days/year. What was the rationale for this choice?

Both U.S. EPA and Ohio EPA had noted in the prior review that the parameter values for the recreational scenario are not very conservative. U.S. EPA expected to see the development of the expanded trespasser scenario reflect a more conservative approach, as we discussed at the December 1, 1993 meeting. We did not expect that our agreement to a tiered approach and inclusion of an expanded trespasser scenario constituted acceptance of the minimal exposure values presented here.

A casual glance at any exposure pathway shows that the Expanded Trespass scenario does not represent much increase over the Current Land Use trespass scenario - e.g., a look at the Incidental Ingestion of Soil/Sediment pathway shows that the total soil ingestion (15.6 gm) of the adolescent in the Current Land Use Trespass scenario has been reduced to 13.2 gm in the Adolescent (Child) Expanded Trespasser scenario, so that the total exposure by ingestion for trespassers aged 6-50 represents only a 20% increase over the original exposure scenario. For non-carcinogens, this will result in a less conservative exposure and less risk.

Response: The value of 110 days for the youth portion of the Expanded Trespasser (Recreational User) has always been used for the Operable Unit 4 FS. The 120 day number in the text for the September submittal was a typo which was corrected for the December version.

In the December 1, 1993 meeting, it was agreed that OU5 would be looking at soil cleanup levels in more detail than OU4 and that they would consider additional receptors that would be reflective of various cleanup alternatives. We also agreed that the recreational user would be called an expanded trespasser because the OU4 FS and Proposed Plan contemplates a fence with "no trespassing" signs, etc. DOE committed to clearly describing the basis for the trespasser.

The expanded trespasser scenario was originally developed as a part of the proposed tiered evaluation of the site, as discussed in the December 1 meeting between DOE and EPA. This particular scenario was based on an exposure pattern that allows maximum use of the site without unacceptable risk (while maintaining limited access controls) but also allowing the development of final remediation levels that are achievable with current remedial technologies. This particular exposure pattern is conservative and Operable Unit 4 specific. The exposure assumptions made are based on an individual that would frequently enter the site for 2 hours/day, 110 days

per year, for 12 years as a youth and 1 hour/day, 40 days/year, for 32 years as an adult. Thus, the exposure scenario allows a cumulative lifetime exposure of 44 years from age 6 to age 50. This exposure scenario is comparable to an individual using a neighborhood park throughout their lifetime as a youth and adult.

Please find attached a position paper on the OU4 "Expanded Trespasser Receptor Scenario" (Attachment A). This position paper demonstrates that the PRLs for the expanded trespasser in the FS are adequately conservative and protective for Operable Unit 4. Furthermore, the Amended Consent Agreement permits the progressive definition of the RME outside the OU4 FS process without adversely impacting sitewide decision making.

Action: The following text will be added in Section 2.2.2.1, page 2-16, line 25, and Appendix D, Appendix D.II.1.0, line 30 (December 1993 version:

> "For the purposes of establishing PRGs for the Future Land Use With Continued Federal Ownership scenario, an on-property receptor was employed assuming a trespassing type exposure scenario which includes both adult and youth age groups. The exposure parameters established for this receptor, the expanded trespasser, are OU4 specific and will be re-evaluated and fully developed on a sitewide basis within the scope of the Operable Unit 5 Feasibility Study.
>
> The PRGs established to ensure protectiveness for the expanded trespasser scenario would also be protective of human health and the environment for the off-property farmer (all pathways). Evaluation of a more fully developed expanded trespasser scenario was truncated so as to allow for an achievable site wide risk based PRGs for soil. The scenario considered the earliest a youth would reasonably trespass was at age 7 and that an adult beyond age 50 would not be considered. For the 5.8 acres comprising OU4, however, the current expanded trespasser exposure assumptions are conservative. While it may be reasonable to assume that an expanded trespasser would spend at least 210 hours per year on the 1050 acre FEMP site, it is unlikely that the same receptor would expend the same duration in the boundaries of Operable Unit 4.
>
> Further reduction of PRGs for the OU4 expanded trespasser would provide no practical benefit. That is, in the case of OU4 the most pervasive contaminant of concern for subsurface soils within the OU4 boundary is Ra-226. Ra-226 concentrations were detected as high as 876 pCi/g in subsurface soils. The proposed remediation level (PRL) for Ra-226 (based on the current expanded trespasser) is 2 pCi/g (Background concentration of Ra-226 is 1.45 pCi/g). In no case was Uranium 238 detected in subsurface soil above 54 pCi/g as compared to the proposed remediation level for U-238 being 60 pCi/g. To achieve compliance with the PRL for Ra-226 (2 pCi/g) it will be

necessary to excavate and treat/dispose of approximately 30,000 yd^3 of contaminated soil within the OU4 boundary.

In summary, the PRL for Ra-226 will drive the remediation of OU4 soils and in doing so, residual soils contaminated with Uranium will be at levels approaching background for those isotopes.

21) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: D.3.2.1 Page #: D-3-12 Line #: 10 Code: M
New Comment #: B
Comment: How was frequency of detection used in the selection of COCs for evaluation in the FS report? Was it used to reduce the list of CPCs considered in the Baseline Risk Assessment for this OU? A discussion of this point is lacking in this report.
Response: The text on page D-3-12, line 10 is a misstatement. The OU4 FS did <u>not</u> use frequency of detection as a COC selection criteria.
Action: The sentence on page D-3-12, line 10, has been deleted.

SECTION 2.2

U.S. EPA REGION V

COMMENTS ON THE CRARE

BY

PAT VANLEEUWEN

CRARE

3) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: App K Page #: K-2-3 Line #: Code:
Original Comment #: 3

Comment: Population Demographics. The discussion of population demographics on page K-2-3 proposes that the population density of the area will remain at the present levels for the 1000-year evaluation period. Other sections of the document propose no change in land use. This proposal is not realistic. The population growth and land use should be coupled to some reasonable growth and land use projections. The State should be able to provide more appropriate and acceptable assumptions.

Response: Disagree. For the purposes of the CRARE, the off-property resident farmer is the theoretical point of maximum fenceline impact for both air and groundwater COC modeling. Predicting the actual location of populations over the next 1000 years would at best be a guess. Even if the FEMP was surrounded on all sides by residential housing 100 years in the future, the risk would be no greater than that of the off-property resident farmer, since a farmer's exposure exceeds that of a resident.

Action: No Action.

Comment #2: Your response is logical. However, the comment was addressed at the second bullet under Demographics: "The population density will remain at present levels for the 1000-year evaluation period per Appendix I of this FS report." This assumption is not only unrealistic, it appears to be irrelevant. I don't see the need to include it here or in the FS report.

Response: Agreed. After further evaluation, the response to the original comment is unrealistic and irrelevant to the FS Report. Population densities are expected to change over the 1000-year evaluation. However, for the purpose of the CRARE, these changes were assumed to not be significant. In other words, land use will stay approximately the same and population densities would not experience order of magnitude growth.

Action: The text has been revised to make the statements more realistic and understandable. In addition, the text has been revised to indicate that two bullets under Demographics are Socioeconomic assumptions necessary to support the sitewide NEPA impact analysis. The text has been revised as follows:

"Socioeconomics

The following socioeconomic conditions have been assumed for the purposes of performing a sitewide impact assessment consistent with the NEPA:

- **During the 1000-year evaluation period, the surrounding land use would remain primarily agricultural.**
- **Population density changes for the 1000-year evaluation period are assumed not to be significant.**

Demographics "

6) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: K.3.3 Page #: K-2-14 Line #: 16-20 Code:
Original Comment #: 6
Comment: Farmer Soil Ingestion Rate. Comments on other Operable Unit 4 reports have already noted that the adult farmer ingestion rate of 480 mg/day while farming. I cannot derive the 180 mg/day value given here using the farm exposure parameter values listed. Some explanation/adjustment is required.
Response: See U.S. EPA (Saric) CRARE Comment #11-3.
Action: See U.S. EPA (Saric) CRARE Comment #11-3.
Comment #2: Regarding the response to U.S. EPA (Saric) CRARE comment #11-3, I did not see a reference to the discussion in Section K.3.3 in the footnotes to Table K.3-1. The problem with the discussion of the farmer exposure described in Section K.3.3, page K-3-12, was noted in the comments from the OU4 RI review: the exposure for the additional 250 days/year during the 50 year farming period is not included in the exposure description, leaving the reader to speculate how the total soil ingestion of 4560 gm was derived. I previously asked that this be corrected in the RI report. I assumed that it would also be corrected in all OU4 reports.
Response: Agreed.
Action: Add to the Footnotes, a footnote "e" as follows:

- **'IR for the farmer is based on the explanation found in Section K.3.3.**

In addition, the following sentence will be added to the text on page K-3-12, at the end of line 8 as follows:

> **"During the remaining 250 days a year spent on the property, the resident ingests soil at a rate of 0.1 g/day, adding another 1,250 grams of soil to the farmer's diet during this 50 years."**

13) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Page #: K-7-55 Line #: Code:
Original Comment #: 13
Comment: Toxicological Profiles. A) I have commented on omissions in tox profiles in prior OU4 reviews. Please review these. The Lead Tox Profile, page K-7-55, does not include a discussion of the EPA OSWER Directive on Lead Soil Clean-up Levels or the EPA Lead IEUBK Model, leading the reader to mistakenly conclude that the health effects of lead cannot be addressed in the risk assessment.

B) I did not see any Tox Profile for PAHs or the many COCs that were omitted as discussed above. These may need to be included.
Response: A) Agreed.
Action: A) Discussions have been added to the lead toxicity profile as requested.
Response: B) Since the CRARE is a postremediation document, it is reasonable to anticipate that most, if not all, of the COCs in the environmental media would be gone or isolated from the environment. Therefore, it is not appropriate to discuss the omitted COCs in the CRARE.
Comment #2: The inclusion to the leading profile is acceptable. Regarding the Tox Profiles for PAHs I am not certain I understand the elimination of PAHs in the final screening,

as it cannot be determined whether any or all PAHs will degrade. PAHs continue to be major COCs at most Superfund sites because they often do not degrade depreciable, especially if they are tightly bound to the soil or if other chemicals toxic to microorganisms are also present in the soil. The presentation here seems to indicate that PAHs need not be considered for remediation.

Response: It must be remembered that the CRARE starts after all remediation is complete, including groundwater remediation. This is at least 50 years in the future. The PAHs have been infrequently detected throughout the site at levels generally less than 10 mg/kg, although this was not used as a criteria of COC selection for the CRARE. The largest PAH UCL (Benzo(a)pyrene) for the 0 - 18 inch depth of surface soil from non-waste areas in the SWCR was 6.0 mg/kg. Many of the surface soils containing PAHs will have been removed and the level of PAH contamination will have been greatly reduced. In addition, the biodegradation over this period of time was estimated using conservative decay coefficients found in the literature. It was estimated that 99.9% of the PAHs would decay in this time period. Given the infrequent detection, the relative low levels and the biodegradation rates, the PAHs were screened out.

It is recognized that a PAH's biodegratation daughters could be more toxic than the original compound, as well as, the daughters could be less toxic. In addition, the specific mix of degradation daughters will be highly dependent on the local environmental conditions (i.e., bacterial strains, pH, O2 condition, etc.). Currently, there is inadequate information to make a judgement that the degradation products will be a public health concern in the future. The concern about PAHs at other Superfund sites is valid because of the concentrations (often > 1000 mg/kg with tar mats or pits), but the PAHs at the FEMP are isolated and at lower concentrations which also affects the biodegradation process. The effects of the biodegradation process is an issue worth exploring and future CRAREs, particularly Operable Unit 5, will investigate this issue further. A secondary issue is that many of the isolated hits of PAHs may be removed through soil removal and treatment for other contaminants.

Action: No Action.

ATTACHMENT A

EXPANDED TRESPASSER RECEPTOR SCENARIO

POSITION PAPER

EXPANDED TRESPASSER RECEPTOR SCENARIO
POSITION PAPER

The following evaluation is provided to be used as a "Risk Management" tool to assist in finalizing the exposure parameters for the RME receptor scenario for the expanded trespasser. Three alternative scenarios were considered for this evaluation primarily affecting the youth portion of expanded trespasser receptor as follows:

- Alternative A - increase exposure frequency (days/year) by 25% for the youth only;
- Alternative B - increase exposure frequency by 50% for the youth only; and
- Alternative C - increase exposure time (hours/day) by 50% for the youth only.

Table 1 presents a comparison of exposure parameters for the youth for the scenario put forth in the Feasibility Study, for the three alternative scenarios, and for the trespassing youth. Alternatives B and C are essentially the same but present changes in the exposure time rather than frequency. A comparison of these three scenarios show a cumulative hours exposed of 2,496 hours for the trespassing youth, 2,640 hours for the expanded trespasser (youth portion), and 3,312 hours for Alternative A, and 3,960 hours for Alternative B and C. Cumulative lifetime exposure time is an important factor to consider since many of the radionuclide remediation goals are driven by external radiation exposure, which is a function of the cumulative exposure time on site. The cumulative hours exposed for the youth in the Feasibility Study expanded trespasser scenario (2,640 hours) is approximately 6% higher than for the trespassing youth (2,496 hours). The cumulative hours exposed for the youth of Alternative A is approximately 33% higher than for the trespassing youth scenario, while cumulative hours exposed for the youth for Alternatives B and C are approximately 60% higher for the trespassing youth.

Table 2 presents a summary of the exposure factors for the alternative expanded trespasser scenarios, including the adult values, and for the trespassing youth. The cumulative hours exposed for both the youth and adult portions of the expanded trespasser in the Feasibility Study are 58% higher than for the trespassing youth. The cumulative hours exposed for Alternative A for the expanded trespasser scenario is 4,592 hours which is approximately 85% higher than the trespassing youth. For Alternatives B and C, the cumulative time exposed is more than twice the value assumed for the trespassing youth.

The exposure factors for the Alternative scenarios for the expanded trespasser scenario were put into an exposure model and risk-based preliminary remediation levels (PRLs) were calculated for four radiological constituents of concern: Ra_{226+5d}, Th_{228+7d}, Pb_{210+2d}, and U_{238+2d}. In addition, PRLs were calculated for the trespassing youth and provided for comparison in Table 3. The following observations were noted.

- The expanded trespasser, considering the youth and adult in the Feasibility Study, is more conservative than the current trespassing youth.

- Of the four radionuclides, the PRLs for $Ra_{226 + 5d}$, $Th_{228 + 7d}$, and $U_{238 + 2d}$ are primarily driven by external radiation exposure. $Pb_{210 + 2d}$, however, is influenced more by incidental ingestion.

- The PRLs were for $Ra_{226 + 5d}$ and $Th_{228 + 7d}$ are reduced to background for all Alternatives, including the scenario from the Feasibility Study.

A comparison of the PRLs presented in Table 3 for the expanded trespasser in the Feasibility Study suggest that the trespassing youth is adequately protected by all of the scenarios since the PRLs for the trespassing youth exceed those for all of the expanded trespasser scenarios.

To summarize, the expanded trespasser scenario (formerly the recreational scenario) represents the last scenario of a tiered approach for evaluating the feasibility of remediating a Superfund site. For those sites with more limited contamination, a tiered approach may include the following land use scenarios:

- agricultural land use (i.e., the RME farmer);
- residential land use (a scenario that would consider an individual with an exposure lasting approximately 30 years without considering exposure to farm-produced livestock or produce);
- industrial/commercial (i.e., an on-site worker); or
- recreational (development of a park with adults and children visiting on a seasonal basis).

The order of these scenarios is from most conservative (i.e., unrestricted future use or agricultural use) to least conservative (more restricted use or recreational), with the latter scenarios requiring some institutional controls preventing some unrestricted future use. A last alternative, restricted use or non-use, is only considered when there are no feasible alternatives for remediating the site to a level that would be protective of human health and the environment.

At the FEMP, all of these potential land use scenarios were considered. However, based on the environmental site setting (rural), and the persistence of the contamination present, only two of the four land uses scenarios seemed plausible for the FS: unrestricted future use (agricultural); or restricted use with future government control (i.e., recreational). However, the recreational scenario was changed to the expanded trespasser scenario to allow consideration of some institutional controls and to consider a fence and posted signs (items not present in a recreational area). The other two land use scenarios, residential or industrial, would require institutional controls, that prevent future agricultural use over 1,000 years, to ensure future protection of human health. Corresponding PRLs for these four scenarios

would be lowest for the agricultural scenario, slightly higher for the residential, and slightly higher again for the commercial/industrial scenario. However, the PRLs for even the commercial/industrial scenario (based on Superfund default exposure factors presented in Table 2) are still very low as compared to the expanded trespasser scenario. The commercial/industrial PRLs are provided for illustration in Table 3.

Furthermore, it should be noted that the PRLs currently identified in the FS would be protective of human health and the environment for the off-property farmer (all pathways) as well.

Additionally, practical consideration should be given to further reduction of PRLs from a technology and cost basis. Large scale continuous soil washing facilities have yet to be developed to efficiently remove uranium isotopes to levels below the proposed remediation goals. Treatability data for other radionuclides and the heavy metals is not available, but information from other Superfund sites suggests that background concentrations will not be achievable. The preliminary information indicates that there would be a least a 15-fold increase in the volume of soil that would have to be remediated to go from a level protective of the expanded trespasser to levels that approach background concentrations. Soil volumes that would be remediated to meet the PRLs for the expanded trespasser are in the hundreds of thousands of cubic yards. Based on these site-wide considerations, it was determined that it would not be desirable or technically feasible from either a treatment or a disposal standpoint to remediate to levels at or near background because of the extreme cost to the public.

DOE agrees in principal with USEPA in the application of consistently defined RME receptors uniformly to the FEMP operable units for each projected future land use. USEPA should recognize that the exposure parameters describing each receptor were developed and proposed by DOE as representing the most reasonable maximum exposure the FEMP site could support for a given future land use. DOE considers it important to recognize that the full development of each exposure pathway comprising each of the RME receptor scenarios are highly dependent on the distribution and areal extent of contamination. For Operable Unit 4, DOE identified proposed remediation goals for both the on-property and the expanded trespasser on the basis that the residual concentrations of contaminants were uniformly distributed across the Operable Unit 4 area, and on the assumption that this specific area was fully capable of supporting the development of each receptor scenario. Clearly, the probability that the 5.8 acre area comprising Operable Unit 4 would fully support these exposure scenarios cannot be considered reasonable. For example, while it may be reasonable to assume that an expanded trespasser would expend approximately 210 hours per year on the 1050 acre FEMP site, it is inconceivable that the same receptor would expend the same duration in the boundaries of Operable Unit 4, making the current expanded trespasser scenario inherently conservative in nature.

Based on the above discussion, DOE recommends no changes to the current RME receptor scenario as provided in the Feasibility Study Report for Operable Unit 4. The expanded trespasser is adequately conservative and as well the amended Consent Agreement permits the progressive definition of the RME outside the OU4 FS process without adversely impacting sitewide decision making.

TABLE 1
COMPARISON OF ALTERNATIVE EXPOSURE FACTORS FOR YOUTH PORTION OF EXPANDED TRESPASSER SCENARIO

Exposure Parameters	EXPANDED TRESPASSER SCENARIOS Feasibility Study Youth (7 to 18)	Alternative A[a] Youth (7 to 18)	Alternative B[b] Youth (7 to 18)	Alternative C[c] Youth (7 to 18)	Trespassing Youth (7 to 18)
Receptor Parameters					
Body Weight	43	43	43	43	43
Averaging Time – Noncancer (days)	4380	4380	4380	4380	4380
Averaging Time – Cancer (days)	25550	25550	25550	25550	25550
Incidental Ingestion of Soils					
Intake Rate (mg/day):	100	100	100	100	100
Fraction Ingested (unitless)	0.1	0.125	0.125	0.19	0.25
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Dermal Contact with Soils (chemicals only)					
Surface Area (m^3):	0.42	0.42	0.42	0.42	0.42
Adherence Factor (m^2):	1	1	1	1	1
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Inhalation of Particulates					
Inhalation Rate (m^3/hr):	0.83	0.83	0.83	0.83	0.83
Exposure Time (hr/day):	2	2	2	3	4
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Soil to Air Resuspension Factor[d] (g/m^3)	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06
External Radiation Exposure					
Shielding Factor (unitless):	0	0	0	0	0
Exposure Time (hr/day):	2	2	2	3	4
Exposure Frequency (days/yr):	110	138	165	110	52
Exposure Duration (years):	12	12	12	12	12
Conversion factor (yr/hours)	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04
Cumulative Hours Exposed:	2,640	3,312	3,960	3,960	2,496

Notes:

[a] Assumes 25% higher exposure frequency (days/year) for the youth.

[b] Assumes 50% higher exposure frequency (days/year) for the youth.

[c] Assumes 50% higher exposure time (hours/day) for the youth.

[d] Calculated based on air modeling results for OU4.

TABLE 2
SUMMARY OF ALTERNATIVE EXPOSURE FACTORS FOR EXPANDED TRESPASSER

Exposure Parameters	Feasibility Study Expanded Trespasser		Alternative A[a] Expanded Trespasser		Alternative B[b] Expanded Trespasser		Alternative C[c] Expanded Trespasser		Trespassing	Commercial / Industrial
	Youth (7 to 18)	Adult (18 to 50)	Youth (7 to 18)	Adult (18 to 50)	Youth (7 to 18)	Adult (18 to 50)	Youth (7 to 18)	Adult (18 to 50)	Youth (7 to 18)	Worker[e] (> 18 years)
Receptor Parameters										
Body Weight	43	70	43	70	43	70	43	70	43	70
Averaging Time – Noncancer (days)	4380	11680	4380	11680	4380	11680	4380	11680	4380	9125
Averaging Time – Cancer (days)	25550	25550	25550	25550	25550	25550	25550	25550	25550	25550
Incidental Ingestion of Soils										
Intake Rate (mg/day):	100	100	100	100	100	100	100	100	100	100
Fraction Ingested (unitless)	0.1	0.05	0.125	0.0625	0.125	0.0625	0.19	0.0625	0.25	0.5
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Dermal Contact with Soils (chemicals only)										
Surface Area (m^3):	0.42	0.575	0.42	0.575	0.42	0.575	0.42	0.575	0.42	0.575
Adherence Factor (m^2):	1	1	1	1	1	1	1	1	1	1
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Conversion factor (Kg/mg)	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06	1.00E−06
Inhalation of Particulates										
Inhalation Rate (m^3/hr):	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	2.5
Exposure Time (hr/day):	2	1	2	1	2	1	3	1	4	8
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Soil to Air Resuspension Factor[d] (g/m^3)	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06	2.20E−06
External Radiation Exposure										
Shielding Factor (unitless):	0	0	0	0	0	0	0	0	0	0
Exposure Time (hr/day):	2	1	2	1	2	1	3	1	4	8
Exposure Frequency (days/yr):	110	40	138	40	165	40	110	40	52	250
Exposure Duration (years):	12	32	12	32	12	32	12	32	12	25
Conversion factor (yr/hours)	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04	1.14E−04
Cumulative Hours Exposed:	2,640	1,280	3,312	1,280	3,960	1,280	3,960	1,280		
Total:		3,920		4,592		5,240		5,240	2,496	50,000

Notes:

[a] Assumes 25% higher exposure frequency (days/year) for the youth.

[b] Assumes 50% higher exposure frequency (days/year) for the youth.

[c] Assumes 50% higher exposure time (hours/day) for the youth.

[d] Calculated based on air modeling results for OU4.

[e] Based on default risk assessment guidance exposure parameters (EPA, 1992).

TABLE 3
SUMMARY OF RISK–BASED PRELIMINARY REMEDIATION GOALS[a] FOR ALTERNATIVE EXPANDED TRESPASSER SCENARIOS

Constituent	EXPANDED TRESPASSER SCENARIOS				Trespassing Youth	Commercial/ Industrial Worker[b]
	Feasibility Study	Alternative A	Alternative B	Alternative C		
Radionuclides (pCi/g)						
Ra_{226+5d}	0.37	0.32	0.28	0.28	0.58	0.029
Th_{228+7d}	0.4	0.34	0.3	0.3	0.63	0.031
Pb_{210+2d}	77	52	46	46	97	4.8
U_{238+2d}	59	50	44	44	91	4.4

Notes:

[a] Value is risk–based assuming a 10^{-6} risk level.

[b] Based on standard default exposure factors.

Alternative A: 25% increase in exposure frequency for youth (days/year) over feasibility study.
Alternative B: 50% increase in exposure frequency for youth (days/year) over feasibility study.
Alternative C: 50% increase in exposure time for youth (hours/days) over feasibility study.

SECTION 3.0

RESPONSE TO

REVISED COMMENT REVIEW

FOR OPERABLE UNIT 4

FS/CRARE

(February 10, 1994)

SECTION 3.1

U.S. EPA REGION V

COMMENTS ON THE FS

BY

PAT VANLEEUWEN

RESPONSE TO REVISED COMMENTS REVIEW FOR OPERABLE UNIT 4 FS/CRARE, FEBRUARY 10, 1994

FEASIBILITY STUDY

7) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Table 2-5 Page #: 2-19 Line #: Code:
Original Comment #: 7

Comment: What is the basis for the PRGs for the carcinogenic PAHs? Are they based on Benzo(a)pyrene? There are no toxicity values for the dermal exposure pathways for PAHs. Describe how these values were calculated and modified to include dermal considerations.

Response: They were based on benzo(a)pyrene. They will be re-calculated to be based on the TEF values.

Action: Recalculations of PRGs.

Comment #2: **The original comment here was not a request for a recalculation, but for a description of the methodology used to calculate the PRGs for PAHs and how dermal considerations were incorporated in the calculation. The text gives a detailed description of the approach for radionuclides, lead and PCBs, but does not address PAHs. My understanding is not furthered by the recalculation.**

Response: Originally the PRGs for PAHs used a conversion of oral SFs to calculate the dermal contribution for the PRGs. However, for the December 1993 submittal, this methodology was abandoned to be consistent with the U.S. EPA comments, on the April 1993 Operable Unit 4 Remedial Investigation Report. Therefore, the PAH PRGs were re-calculated without using the dermal contribution.

It has been suggested that the oral SF be multiplied by two to account for the lack of a dermal pathway. If this approach was to be adopted, the maximum impact would be to reduce the PAH PRGs by a factor of two.

This is not a serious problem for Operable Unit 4 because once the top six inches of surface soil will be removed, there will not be a potential exposure to PAHs as no PAHs were detected in the subsurface soils. Therefore, a change in PRGs will not cause a change in the remedial action or remedial risk.

Action: The following text will be added on page 2-19, after line 3:

> **"The PRGs for the PAH compounds were calculated using the Toxic Equivalence Factor (TEF) approach as detailed in the Operable Unit 4 Baseline Risk Assessment. In this approach, the Slope Factor for benzo(a)pyrene was multiplied by the individual TEF for each PAH. This was done for the oral and inhalation pathways where slope factors were available. The dermal pathway of exposure was not considered for PRGs because of guidance from U.S. EPA which suggests it is inappropriate to derive dermal slope factors from oral slope factors for the PAH compounds, because PAHs are also contact carcinogens and the endpoint skin cancer is different for dermal**

exposure to these compounds. The risks from dermal exposure is considered to be at least as great as the risk from oral exposure. This is consistent with the approach used in the Operable Unit 4 Baseline Risk Assessment."

Comment #3: We need to get something straight regarding the dermal assessment of PAHs. In my April 1993 comments on the OU 4 RI report, I indicated that the dermal assessment of PAHs was inappropriate. I did not say that the dermal exposure to PAHs could be ignored - either in the risk assessment or in the development of PRGs. These are very potent contact carcinogens and to ignore this pathway of exposure represents an irresponsible approach. I suggested that the TEF approach could be used for the oral assessment (this was eagerly accepted as it reduced the risk!), and that risk from the dermal exposure to PAHs should not be calculated but should be considered to be at least as great, and perhaps greater than the risk from the oral exposure (this was used to blow-off the dermal contribution from PAH exposure). This response is not acceptable to EPA.

We are now left with trying to explain why the PRGs for PAHs did not include the dermal exposure pathway. The only true explanation is that it was not done correctly! The supplied text fails miserably in explaining the process. The following changes to the text will make it acceptable:

The first three sentences are acceptable, delete the remaining text (starting with "The dermal pathway. . ." and replace it with the following text:

> "The PRG calculation did not include a quantitative evaluation of the dermal pathway of exposure because guidance from U.S. EPA suggests that it is inappropriate to derive dermal slope factors from oral slope factors for carcinogenic PAHs because these compounds are potent contact carcinogens, and the endpoint, skin cancer, is different for the dermal pathway. Thus extrapolation of a dermal slope factor from the oral slope factor may not be protective. The risk from dermal exposure to carcinogenic PAHs (and also the impact of this pathway on the PRG calculation) can be considered to be at least as great, if not greater, than the risk from oral exposure to the compounds."

This change can be allowed for this OU report; however, it is assumed that the dermal exposure from PAHs will be addressed correctly in all future OU reports.

Response: Agreed.

Action: The following text has been revised on page 2-19, after line 3 as follows:

> "The PRGs for the PAH compounds were calculated using the Toxic Equivalence Factor (TEF) approach as detailed in the Operable Unit 4 Baseline Risk Assessment. In this approach, the Slope Factor for benzo(a)pyrene was multiplied by the individual TEF for each PAH. This was done for the oral and inhalation pathways where slope factors were available. The PRG calculation did not include a quantitative evaluation of the dermal pathway of exposure because guidance from U.S. EPA suggests that it is inappropriate to derive dermal slope factors

from oral slope factors for carcinogenic PAHs because these compounds are potent contact carcinogens, and the endpoint, skin cancer, is different for the dermal pathway. Thus, extrapolation of a dermal slope factor from the oral slope factor may not be protective. The risk from dermal exposure to carcinogenic PAHs (and also the impact of this pathway on the PRG calculation) can be considered to be at least as great, if not greater, than the risk from oral exposure to the compounds."

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-22, 2-23 Line #: Calculations Code:
Original Comment #: 8

Comment: I know it does not matter whether you calculate the soil PRG based on an Air PRG (do Air calculation first) or calculate the soil PRG based on the total unit risk. However, the methods used for the calculation of the soil PRGs for the on-site farmer and the off-site farmer should be identical for clarity. Not everyone will understand your logic. Please revise the off-site farmer calculations to be consistent with the other scenario calculations presented.

Response: The method of calculating the PRGs was changed. In addition, all parameter changes resulting from comments on the Baseline Risk Assessment were incorporated into the calculations. As a result, the presentation of PRG calculations was changed.

Action: The presentation of PRG calculations will be changed.

Comment #2: **After reviewing the revised table 2-5, I am now truly confused. The PRGs in this draft sometimes differ from those presented in the prior draft by orders of magnitude, e.g., the new PRG for 1 or 2-butanone (at the HI - 0.2 level) is 15 mg/kg for the future resident farmer, while the PRG in the previous draft was 0.21 mg/kg. Large differences are also apparent for Pb-210, antimony, barium, chromium, benzo(a)pyrene, and some other contaminants in this exposure scenario; large differences can also be seen in other exposure scenarios. What changes in the risk calculations were made in this scenario (I see only the addition of two new exposure pathways) and other scenarios to result in orders of magnitude difference in the calculated PRGs? Such changes in methodology warrant further review.**

Response: **All PRGs were re-calculated incorporating the methodology and exposure parameter changes used for the Operable Unit 4 Baseline Risk Assessment in response to EPA comments. The methodology changes included not using the unit risk approach previously used to calculate the PRGs. Part of the reason for the changes was the recognition of errors in the previous calculations. These changes have been checked by hand calculation verification and separate spreadsheet calculations.**

Specific changes that caused these deviations were changes in dermal exposure factors, errors in dermal absorption coefficients for metals, specific spread sheet errors for individual chemicals such as 2-butanone, and typographical errors. The Pb-210 was a typographical error. In some cases as for barium, more than one change had a multiplying effect.

Action: **None**

Comment #3: The response provided did not clarify the issue. I still do not know any more than I did before. What changes were made in the dermal exposure factors that resulted in a change in the PRGs by two orders of magnitude? Which entry for PB-210 was a typographical error - the old value or the new one? As the original exposure factors,

dermal absorption coefficients, etc. were reviewed, the changes should also be reviewed. Please provide a list of all changes made to this (final) stage of the report which have resulted in an adjustment to the PRG calculation, and indicate how the PRG was impacted by the change.

Response: Agreed.

Action: A list of the changes to the PRGs and their causes will be generated and provided to U.S. EPA within 30 days.

9) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 24 - 27 Code:
Original Comment #: 9

Comment: There seems to be a major problem here. I am concerned with the calculation of PRGs that are "2.6 and 36 times less than background." Risks from exposure to radionuclides were to be based on concentrations above background, so PRGs based on these same concentrations should not present unrealistic levels of attainment.

Response: The intent of this statement is to show that the calculated PRGs for the RME on-property resident farmer are indistinguishable from background concentrations. The purpose of the Table 2-5 is to present the calculated remediation levels values which are to be considered in addition to background values. It is noted that background concentrations result in risk greater than 1×10^{-4}.

Action: Modify the text by inserting the following sentence after "...respectively." "The PRGs for Ra-226 and U-238 are indistinguishable from either the respective ARAR or background concentrations. Therefore, if ARAR or background concentrations were chosen as the remedial goal, there would not be an incremental risk due to the presence of Ra-226 or U-238."

Comment #2: **I think that the argument can be made that the PRGs proposed under this scenario would require remediation of soils to background, which may not be practical. However, the ARAR for Ra-226+ progeny is not risk-based and would actually increase the risk to greater than $10e^{-3}$; its use may not be consistent with CERCLA guidelines.**

Response: **FEMP agrees that the use of the ARAR for Ra-226 and progeny is not health-based and is not protective. This table of PRGs merely presents the information. In Section 2.2.3.1, Section 2.2.3.2 and Table 2-11, these points are considered in the selection of PRLs. The ARAR for Ra-226 was not used, but rather the PRG plus the background.**

Action: **The following statement previously added to the text will be deleted:**

> **"Therefore, if ARAR or background concentrations were chosen as the remedial goal, there would not be an incremental risk due to the presence of Ra-226 or U-238."**

Comment #3: The response to this comment is acceptable.

10) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 28 Code:
Original Comment #: 10

Comment: The mill tailings standards referred to here are not risk-based and are not considered protective for Superfund; Region V (Larry Jensen) has been working on new guidelines for clean-up of radionuclides in soil. Should discuss these also.

Response: FEMP agrees that these cleanup goals are not risk based and are not directly applicable to Superfund remedial goals. However, they do represent cleanup goals at other sites where radionuclides are COCs and represent what may be technologically feasible. They were presented to give the broad picture of remedial goals. At the present time the FEMP does not have a copy of these draft guidelines.

Action: No action.

Comment #2: This discussion should point out that the mill tailings standards are not directly applicable to Superfund goals and that their application would result in an increased risk over background.

Response: FEMP agrees that the mine tailings standards are not applicable to Superfund goals. These standards were not used in the selection of PRLs, see Table 2-11.

Action: The following clarification will be added to the text at Section 2.2.2.3, page 2-19, lines 29-30 (December 1993 version):

> **"Because the FEMP is on the NPL and subject to Superfund remediation standards and goals, use of these mill tailings standards would not be applicable because they are not risk-based and not considered protective. Use of these standards would result in an unacceptable increase risk over background conditions. However,. . . "**

Comment #3: The response to this comment is acceptable.

11) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: 2.2.2.3 Page #: 2-23 Line #: 11-15 Code:
Original Comment #: 11

Comment: The description of the recreational scenario presented here does not match the description presented on page 2-16, lines 3-14. Where are the Unit Risk Factor calculations for this exposure scenario? If not in the RI, reference the appropriate section in the FS,

Response: Agreed.

Action: Change 120 days on page 2-16, line 9 to 110 days.

Comment #2: I noticed that a lower EF value (110 days/year) was chosen rather than the original value of 120 days/year. What was the rationale for this choice?

Both U.S. EPA and Ohio EPA had noted in the prior review that the parameter values for the recreational scenario are not very conservative. U.S. EPA expected to see the development of the expanded trespasser scenario reflect a more conservative approach, as we discussed at the December 1, 1993 meeting. We did not expect that our agreement to a tiered approach and inclusion of an expanded trespasser scenario constituted acceptance of the minimal exposure values presented here.

A casual glance at any exposure pathway shows that the Expanded Trespass scenario does not represent much increase over the Current Land Use trespass scenario - e.g., a look at the Incidental Ingestion of Soil/Sediment pathway shows that the total soil ingestion (15.6 gm) of the adolescent in the Current Land Use Trespass scenario has been reduced to 13.2 gm in the Adolescent (Child) Expanded Trespasser scenario, so that the total exposure by ingestion for trespassers aged 6-50 represents only a

20% increase over the original exposure scenario. For non-carcinogens, this will result in a less conservative exposure and less risk.

Response: The value of 110 days for the youth portion of the Expanded Trespasser (Recreational User) has always been used for the Operable Unit 4 FS. The 120 day number in the text for the September submittal was a typo which was corrected for the December version.

In the December 1, 1993 meeting, it was agreed that OU5 would be looking at soil cleanup levels in more detail than OU4 and that they would consider additional receptors that would be reflective of various cleanup alternatives. We also agreed that the recreational user would be called an expanded trespasser because the OU4 FS and Proposed Plan contemplates a fence with "no trespassing" signs, etc. DOE committed to clearly describing the basis for the trespasser.

The expanded trespasser scenario was originally developed as a part of the proposed tiered evaluation of the site, as discussed in the December 1 meeting between DOE and EPA. This particular scenario was based on an exposure pattern that allows maximum use of the site without unacceptable risk (while maintaining limited access controls) but also allowing the development of final remediation levels that are achievable with current remedial technologies. This particular exposure pattern is conservative and Operable Unit 4 specific. The exposure assumptions made are based on an individual that would frequently enter the site for 2 hours/day, 110 days per year, for 12 years as a youth and 1 hour/day, 40 days/year, for 32 years as an adult. Thus, the exposure scenario allows a cumulative lifetime exposure of 44 years from age 6 to age 50. This exposure scenario is comparable to an individual using a neighborhood park throughout their lifetime as a youth and adult.

Please find attached a position paper on the OU4 "Expanded Trespasser Receptor Scenario" (Attachment A). This position paper demonstrates that the PRLs for the expanded trespasser in the FS are adequately conservative and protective for Operable Unit 4. Furthermore, the Amended Consent Agreement permits the progressive definition of the RME outside the OU4 FS process without adversely impacting sitewide decision making.

Action: The following text will be added in Section 2.2.2.1, page 2-16, line 25, and Appendix D, Appendix D.II.1.0, line 30 (December 1993 version:

> "For the purposes of establishing PRGs for the Future Land Use With Continued Federal Ownership scenario, an on-property receptor was employed assuming a trespassing type exposure scenario which includes both adult and youth age groups. The exposure parameters established for this receptor, the expanded trespasser, are OU4 specific and will be re-evaluated and fully developed on a sitewide basis within the scope of the Operable Unit 5 Feasibility Study.

The PRGs established to ensure protectiveness for the expanded trespasser scenario would also be protective of human health and the environment for the off-property farmer (all pathways). Evaluation of a more fully developed expanded trespasser scenario was truncated so as to allow for an achievable site wide risk based PRGs for soil. The scenario considered the earliest a youth would reasonably trespass was at age 7 and that an adult beyond age 50 would not be considered. For the 5.8 acres comprising OU4, however, the current expanded trespasser exposure assumptions are conservative. While it may be reasonable to assume that an expanded trespasser would spend at least 210 hours per year on the 1050 acre FEMP site, it is unlikely that the same receptor would expend the same duration in the boundaries of Operable Unit 4.

Further reduction of PRGs for the OU4 expanded trespasser would provide no practical benefit. That is, in the case of OU4 the most pervasive contaminant of concern for subsurface soils within the OU4 boundary is Ra-226. Ra-226 concentrations were detected as high as 876 pCi/g in subsurface soils. The proposed remediation level (PRL) for Ra-226 (based on the current expanded trespasser) is 2 pCi/g (Background concentration of Ra-226 is 1.45 pCi/g). In no case was Uranium 238 detected in subsurface soil above 54 pCi/g as compared to the proposed remediation level for U-238 being 60 pCi/g. To achieve compliance with the PRL for Ra-226 (2 pCi/g) it will be necessary to excavate and treat/dispose of approximately 30,000 yd^3 of contaminated soil within the OU4 boundary.

In summary, the PRL for Ra-226 will drive the remediation of OU4 soils and in doing so, residual soils contaminated with Uranium will be at levels approaching background for those isotopes.

Comment #3: The second paragraph in this response does not reflect the discussion on Monday, February 7, 1 994. The second paragraph should be deleted and replaced with text which reflects the following:

"The evaluation of a fully developed trespasser scenario was abandoned in favor of a truncated scenario, which considered only exposure to a youth, 7 - 18 year of age, and an adult, 18 - 50 years of age, as it was determined that the expansion of the trespass scenario, either by age or by time spent on OU 4 would result in the development of a PRG which was not technically or economically feasible. It should thus be realized that this scenario describes an activity pattern and total exposure which may not be protective of human health under all circumstances. The PRGs established for this limited expanded trespasser scenario would be protective of human health for the off-property farmer (all pathways)."

Response: Agreed.
Action: The following text has been modified in Section 2.2.2.1, page 2-16, line 25, and Appendix D, Attachment D.II.1.0, line 30 (December 1993 version), as follows:

"For the purposes of establishing PRGs for the Future Land Use With Continued Federal Ownership scenario, an on-property receptor was employed assuming a trespassing type exposure scenario which includes both adult and youth age groups. The exposure parameters established for this receptor, the expanded trespasser, are OU4 specific and will be re-evaluated and fully developed on a sitewide basis within the scope of the Operable Unit 5 Feasibility Study.

The evaluation of a fully developed trespasser scenario was abandoned in favor of a truncated scenario, which considered only exposure to a youth, 7 - 18 years of age, and an adult, 18 - 50 years of age, as it was determined that the expansion of the trespass scenario, either by age or by time spent on OU 4 would result in the development of a PRG which was not technically or economically feasible. It should thus be realized that this scenario describes an activity pattern and total exposure which may not be protective of human health under all circumstances. The PRGs established for this limited expanded trespasser scenario would be protective of human health for the off-property farmer (all pathways).

For the 5.8 acres comprising OU4, however, the current expanded trespasser exposure assumptions are conservative. While it may be reasonable to assume that an expanded trespasser would spend at least 210 hours per year on the 1050 acre FEMP site, it is unlikely that the same receptor would expend the same duration in the boundaries of Operable Unit 4.

Further reduction of PRGs for the OU4 expanded trespasser would provide no practical benefit. That is, in the case of OU4 the most pervasive contaminant of concern for subsurface soils within the OU4 boundary is Ra-226. Ra-226 concentrations were detected as high as 876 pCi/g in subsurface soils. The proposed remediation level (PRL) for Ra-226 (based on the current expanded trespasser) is 2 pCi/g (Background concentration of Ra-226 is 1.45 pCi/g). In no case was Uranium 238 detected in subsurface soil above 54 pCi/g as compared to the proposed remediation level for U-238 being 60 pCi/g. To achieve compliance with the PRL for Ra-226 (2 pCi/g) it will be necessary to excavate and treat/dispose of approximately 30,000 yd^3 of contaminated soil within the OU4 boundary.

In summary, the PRL for Ra-226 will drive the remediation of OU4 soils and in doing so, residual soils contaminated with Uranium will be at levels approaching background for those isotopes.

21) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: D.3.2.1 Page #: D-3-12 Line #: 10 Code: M
New Comment #: B
Comment: How was frequency of detection used in the selection of COCs for evaluation in the FS report? Was it used to reduce the list of CPCs considered in the Baseline Risk Assessment for this OU? A discussion of this point is lacking in this report.
Response: The text on page D-3-12, line 10 is a misstatement. The OU4 FS did not use frequency of detection as a COC selection criteria.
Action: The sentence on page D-3-12, line 10, has been deleted.
Comment #3: The response to this comment is acceptable.

SECTION 3.2

U.S. EPA REGION V

COMMENTS ON THE CRARE

BY

PAT VANLEEUWEN

CRARE

3) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: App K Page #: K-2-3 Line #: Code:
Original Comment #: 3

Comment: Population Demographics. The discussion of population demographics on page K-2-3 proposes that the population density of the area will remain at the present levels for the 1000-year evaluation period. Other sections of the document propose no change in land use. This proposal is not realistic. The population growth and land use should be coupled to some reasonable growth and land use projections. The State should be able to provide more appropriate and acceptable assumptions.

Response: Disagree. For the purposes of the CRARE, the off-property resident farmer is the theoretical point of maximum fenceline impact for both air and groundwater COC modeling. Predicting the actual location of populations over the next 1000 years would at best be a guess. Even if the FEMP was surrounded on all sides by residential housing 100 years in the future, the risk would be no greater than that of the off-property resident farmer, since a farmer's exposure exceeds that of a resident.

Action: No Action.

Comment #2: Your response is logical. However, the comment was addressed at the second bullet under Demographics: "The population density will remain at present levels for the 1000-year evaluation period per Appendix I of this FS report." This assumption is not only unrealistic, it appears to be irrelevant. I don't see the need to include it here or in the FS report.

Response: Agreed. After further evaluation, the response to the original comment is unrealistic and irrelevant to the FS Report. Population densities are expected to change over the 1000-year evaluation. However, for the purpose of the CRARE, these changes were assumed to not be significant. In other words, land use will stay approximately the same and population densities would not experience order of magnitude growth.

Action: The text has been revised to make the statements more realistic and understandable. In addition, the text has been revised to indicate that two bullets under Demographics are Socioeconomic assumptions necessary to support the sitewide NEPA impact analysis. The text has been revised as follows:

"Socioeconomics

The following socioeconomic conditions have been assumed for the purposes of performing a sitewide impact assessment consistent with the NEPA:

- **During the 1000-year evaluation period, the surrounding land use would remain primarily agricultural.**
- **Population density changes for the 1000-year evaluation period are assumed not to be significant.**

Demographics "

Comment #3: The response to this comment is acceptable.

6) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: K.3.3 Page #: K-2-14 Line #: 16-20 Code:
Original Comment #: 6
Comment: Farmer Soil Ingestion Rate. Comments on other Operable Unit 4 reports have already noted that the adult farmer ingestion rate if 480 mg/day while farming. I cannot derive the 180 mg/day value given here using the farm exposure parameter values listed. Some explanation/adjustment is required.
Response: See U.S. EPA (Saric) CRARE Comment #11-3.
Action: See U.S. EPA (Saric) CRARE Comment #11-3.
Comment #2: Regarding the response to U.S. EPA (Saric) CRARE comment #11-3, I did not see a reference to the discussion in Section K.3.3 in the footnotes to Table K.3-1. The problem with the discussion of the farmer exposure described in Section K.3.3, page K-3-12, was noted in the comments from the OU4 RI review: the exposure for the additional 250 days/year during the 50 year farming period is not included in the exposure description, leaving the reader to speculate how the total soil ingestion of 4560 gm was derived. I previously asked that this be corrected in the RI report. I assumed that it would also be corrected in all OU4 reports.
Response: Agreed.
Action: Add to the Footnotes, a footnote "e" as follows:

- **'IR for the farmer is based on the explanation found in Section K.3.3.**

In addition, the following sentence will be added to the text on page K-3-12, at the end of line 8 as follows:

> **"During the remaining 250 days a year spent on the property, the resident ingests soil at a rate of 0.1 g/day, adding another 1,250 grams of soil to the farmer's diet during this 50 years."**

Comment #3: The added text is acceptable with the following correction: "diet" should be changed to "intake".
Response: Agreed.
Action: The text has been modified to read "intake".

13) Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: Page #: K-7-55 Line #: Code:
Original Comment #: 13
Comment: Toxicological Profiles. A) I have commented on omissions in tox profiles in prior OU4 reviews. Please review these. The Lead Tox Profile, page K-7-55, does not include a discussion of the EPA OSWER Directive on Lead Soil Clean-up Levels or the EPA Lead IEUBK Model, leading the reader to mistakenly conclude that the health effects of lead cannot be addressed in the risk assessment.

B) I did not see any Tox Profile for PAHs or the many COCs that were omitted as discussed above. These may need to be included.
Response: A) Agreed.
Action: A) Discussions have been added to the lead toxicity profile as requested.

Response: B) Since the CRARE is a postremediation document, it is reasonable to anticipate that most, if not all, of the COCs in the environmental media would be gone or isolated from the environment. Therefore, it is not appropriate to discuss the omitted COCs in the CRARE.

Comment #2: The inclusion to the leading profile is acceptable. Regarding the Tox Profiles for PAHs I am not certain I understand the elimination of PAHs in the final screening, as it cannot be determined whether any or all PAHs will degrade. PAHs continue to be major COCs at most Superfund sites because they often do not degrade depreciable, especially if they are tightly bound to the soil or if other chemicals toxic to microorganisms are also present in the soil. The presentation here seems to indicate that PAHs need not be considered for remediation.

Response: It must be remembered that the CRARE starts after all remediation is complete, including groundwater remediation. This is at least 50 years in the future. The PAHs have been infrequently detected throughout the site at levels generally less than 10 mg/kg, although this was not used as a criteria of COC selection for the CRARE. The largest PAH UCL (Benzo(a)pyrene) for the 0 - 18 inch depth of surface soil from non-waste areas in the SWCR was 6.0 mg/kg. Many of the surface soils containing PAHs will have been removed and the level of PAH contamination will have been greatly reduced. In addition, the biodegradation over this period of time was estimated using conservative decay coefficients found in the literature. It was estimated that 99.9% of the PAHs would decay in this time period. Given the infrequent detection, the relative low levels and the biodegradation rates, the PAHs were screened out.

It is recognized that a PAH's biodegradation daughters could be more toxic than the original compound, as well as, the daughters could be less toxic. In addition, the specific mix of degradation daughters will be highly dependent on the local environmental conditions (i.e., bacterial strains, pH, O2 condition, etc.). Currently, there is inadequate information to make a judgement that the degradation products will be a public health concern in the future. The concern about PAHs at other Superfund sites is valid because of the concentrations (often > 1000 mg/kg with tar mats or pits), but the PAHs at the FEMP are isolated and at lower concentrations which also affects the biodegradation process. The effects of the biodegradation process is an issue worth exploring and future CRAREs, particularly Operable Unit 5, will investigate this issue further. A secondary issue is that many of the isolated hits of PAHs may be removed through soil removal and treatment for other contaminants.

Action: No Action.

Comment #3: I understand that PAHs are not Chemicals of Concern for the CRARE as they are present in the surface soil in OU 4 and the CRARE assumes that the surface soil has been removed. However, they are COCs for the FS and thus should have a Tox Profile.

I am having a real problem with the elimination of PAHs as COCs in OU 4 using Frequency of Detection or biodegradation. The only valid elimination pathway for PAHs in this OU is removal of the contaminated medium - i.e., surface soil. As we have previously discussed, the PAHs are not toxic in themselves - it is the metabolites produced in the body that are toxic. Degradation in soil, if it takes place at all and there are lots of conditions necessary to produce significant degradation, results in the

formation of these same toxic compounds, especially if sufficient quantities of oxygen are present in the soil. I have not seen any studies that demonstrate that the soil on the FEMP site will will result in complete degradation (not partial degradation to more toxic compounds). Therefore, until it can be shown that the PAHs at Fernald will degrade to a safe level, they should not be removed from any OU report through a screening based on degradation, and Tox Profiles should be included in the report.

Response: Section D.3.3 of the FS references the toxicity assessment performed in the Operable Unit 4 Baseline Risk Assessment. The text will be modified to clarify that the toxicity profiles for all COCs which are presented in Section D.4.2 of the OU4 Baseline Risk Assessment have been considered by the OU4 FS.

It should be reiterated again that FREQUENCY OF DETECTION WAS NOT USED AS A MEANS OF ELIMINATING COCs! Also, since the CRARE is an iterative document, future CRAREs will further evaluate PAHs, their degradation products and the resultant contribution to risk.

Action: Appendix D, Section D.3.3, Sentence 3, will be modified to read as follows:

> "The toxicity assessment contains a compilation of toxic and carcinogenic effects of all COCs based on the detailed toxicity profiles presented in the RI Baseline Risk Assessment Report for Operable Unit 4, Section D.4.2."

In addition, future CRAREs will further evaluate PAHs, their degradation products, and the resultant contribution to risk.

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