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DISAPPROVAL OF THE SITE-WIDE CHARACTERIZATION REPORT

10/05/92

USEPA/DOE-FN
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LETTER

UNITED STATES ENVIRONMENTAL PRO[redacted]
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

3797

REPLY TO THE ATTENTION OF:

OCT 0 5 1992

Mr. Jack R. Craig
United States Department of Energy
Feed Materials Production Center
P.O. Box 398705
Cincinnati, Ohio 45239-8705

HRE-8J

RE: Disapproval of the Site-Wide Characterization Report

Dear Mr. Craig:

The United States Environmental Protection Agency (U.S. EPA) has completed its review of the Site-Wide Characterization Report (SWCR). The purpose of this document is to (1) provide a summary of site-wide data as of December 31, 1991; (2) provide a detailed evaluation of site-wide risk; and (3) to present the leading remedial alternatives based on best engineering judgment.

Although the SWCR appears to meet the intent of 1991 Consent Agreement, it requires substantial revision. Part I of the SWCR does not adequately present the data, and there appears to be much supporting data lacking in Part III. The risk assessment does not follow the approved risk assessment workplan and relevant U.S. EPA guidance. Also the procedures used to calculate background for various constituents do not follow approved workplan procedures.

U.S. EPA hereby disapproves the SWCR pending incorporation of the enclosed comments and revision of the document.

The SWCR is a an important document for not only estimating site-wide risk, but focusing further investigations. Therefore U.S. EPA requests a meeting with U.S. DOE as soon as possible to discuss the comments to expedite revisions to the SWCR.

(juniere) partial action response to L2005 (4745)

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Please contact me at (312) 886-0992 to arrange a meeting or if you have any questions regarding this disapproval.

Sincerely,

James A. Saric
Remedial Project Manager

Enclosure

cc: Graham Mitchell, OEPA-SWDO
Pat Whitfield, U.S. DOE-HDQ
Dennis Carr, WMCO

[redacted]

3797

[redacted]

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: September 30, 1992

SUBJECT: Review of the Draft Site-wide Characterization Report, Fernald Environmental Management Project (FEMP), Fernald, OH, August 1992

FROM: Pat Van Leeuwen, Toxicologist
Technical Support Unit

TO: Jim Saric
Project Manager

I have reviewed Part II, the Preliminary Baseline Risk Assessment, Sections 1 through 5, of the Draft Site-wide Characterization Report for the Fernald Environmental Management Project (FEMP), formerly the Feed Material Production Center, Fernald, OH. My review focused on the risk assessment report itself, and I have not extensively reveiwed other portions of the report or all 20 appendices (5 volumes in total) due to time constriants. These sections require further review. My lack of comment on these sections of the report does not constitute approval of these portions, and subsequent review is likely to uncover additional deficiencies.

I was disappointed to see that the extensive guidance and consultation provided on this site did not result in a more accurate and acceptable report. Many of the points addressed and agreed to in the Workplan for the site and its many revisions were not considered in this report. Thus, this report does not meet the criteria set forth by the Agency for site reports for this facility.

The areas in the draft Preliminary Baseline Risk Assessment in need of additional correction or revision are extensive. I have only touched on the highlights briefly below. If you or the contractors have any questions on these comments or any section of the risk assessment, please contact me at 886-4904.

1) <u>Summary Report, S-3</u> This is a stand alone report. All acroynms (i.e., RME, ILCR, etc.) should be written out before use in the text.

2) <u>Section 2.1.3, p 2-17, lines 31-34</u> What is the Risk-Based Quantitation Limit (RBQL) referred to here? How is

this limit derived? How is it to be used? What are the values of the RBQL for each chemical/radionuclide in each media?

3) Section 2.2.1, p 2-18; Appendix T We have discussed the use of the Upper Tolerance Limit (UTL) test, as described here to choose Chemicals of Concern, extensively. Comments and direction from Headquarters statistician, Paul White, has indicated that this approach is inconsistent with Agency guidance (RAGS, ref. EPA 1989b) and is unacceptable to EPA. The method described in Appendix T results in the use of background concentration levels which are often two or three times greater than the highest measured background values, or worse yet, national survey values. This is clearly not acceptable.

The values of the UTL derived in Appendix T (Table T-7) are not the same values used for some chemicals in Section 2 (see nickel, Tables 2-23, 2-25, 2-27, etc). The latter values are higher; no explanation is offered.

In Table T-4, background Upper Limit Concentration values are given as < 3 or < 1. Why wasn't a real value calculated? It is not appropriate to compare these values to measured values having three significany digits (i.e., data in Tables 2-12, 2-14).

4) Section 2.2.2, p2-20, lines 16-20 The elimination of chemicals with a ratio of Rij to Rj less than 0.01 is an example in RAGS, not guidance. Any such critera used for elimination of chemicals for consideration in the risk assessment must be approved by the Project Manager and the Risk Assessor. RAGS further states that a lower value is needed if site risks are expected to be high. Because of the risk level at the FEMP site, the ratio used may not be appropriate.

5) Section 2, Tables 2-4, 2-13, ... Several chemicals - i.e., ammonia, fluoride, nitrate - are listed as organics. These chemicals are inorganics. Please check all tables.

6) Section 2, Table 2-6 The Background value is given in pCi/g for surface water; the measurements are in pCi/L. Be consistent.

Table 2-12 (continuations) Ditto.

Table 2-13 (continuation) The Background values are given in pCi/g; the measurements are in mg/L. Obvious error.

7) Table 3-1, pp 3-11/12 Exposure pathway 16, inhalation of gases emitted to air, is eliminated on page 3-14, because exposure is too short term to be considered. Acute exposures to highly toxic volatile chemicals (i.e., benzene, vinyl chloride) can have significant adverse health effects. Rationale is not very sound.

8) Section 3.3.1.2, p 3-17 If containment of waste sources degrades "in the future", resulting in the release of higher contaminant levels, how are exposures to existing receptors

under the Current Land Use addressed? This has been a area of misunderstanding for some time. The risk assessment addresses Current Land Use and Future Land Use, not current conditions and future conditions. Loss of containment can occur anytime, given the No Action alternative, which is the basis for all risk assessments. The data in Table 3-3 would therefore be the most appropriate for evaluating the potential risks to an off-site farmer under the Current Land Use.

9) Table 3-3 What happened to benzo(a)pyrene in this table? BAP is a semi-volatile. Where are the other carcinogenic PAHs?

10) Section 3.3.2.1, p3-22, para 2 Approach is not very sound. As I understand it, an UTC, sometimes greater than the highest detected background value at the site and characterized as < 1 or < 3, was subtracted from the Upper Confidence Limit on the mean contaminant value, reported in 3-significant digits. So much for statictical approaches.

11) Tables 3-15/ 3-16 Lots of problems with parameter values given in these Tables, even after our extensive discussions. I was surprised to see that values we agreed to early on were not used in this report. Without the incorporation of acceptable EPA methodology and parameter values, the risk assessment has no meaning.

SA: Earlier discussions requested that values for body surface area for all age groups be made consistent with current guidance and refered the contractors to the OHEA document (OHEA-E-367), section 2.4 , for default values. To reiterate, the values incorporated in the table are not very conservative. Using values from OHEA-E-367, the Total body surface area for the child <6 yrs would range from 7000-8000 cm2, for the child/teen from 15,150-16,550 cm2 and for the adult from 20,000-23,000 cm2, using the 50th and 95th percentile values for the ages of concern. For the dermal contact with soil pathways, it is appropriate to include the hands, legs, arms, neck and head, for an exposure of 25% of total body surface area. The range of values for the child/teen and the adult for soil contact pathways should be 3800-4200 cm2 and 1750-2000 cm2, respectively. The EPA document "Dermal Exposure Assessment: Principles and Applications", EPA/600/8-91/011B, was suggested as guidance. It recommends the use of the 95th percentile values for the RME.

FI: Use of 0.1 for the trespass scenario is not defensible.

EF: The values used here often reflect the Central Tendancy (CT) not the RME - i.e., trespass scenarios. The standard trespass scenario in Region V is 52 days a year, 4 hours a day for the RME. Contractors were advised of Region V policy. The RME is the required calculation. The CT values are only used to express uncertainty in the exposure evaluation.

ED: Use of a residency time of 9 years reflects the CT, not the RME. Cannot compare and/or combine risks if some are CTs and some are RMEs. This risk assessment should not consider

the CT or the uncertainty in any detail, given the weak data base from which it was prepared. All carcinogenic risks/hazard indices should be reported for the RME.

IR: How was the IR of 0.01 g/d for the typical on-property resident derived? Value should be 0.1 g/d. The IR used for agricultural and construction workers is 480 mg/d, not 0.1 or 0.109. Need to consider additional exposure and incidential ingestion of dust for these receptors.

12) Calculation of volatiles released by household water use, p 3-70 The reference given on line 9 is incorrect; EPA 1991e is listed as HEAST 1991. HEAST does not contain models for this exposure. EPA does not use the Murphy 1987 model; it uses the model based on Andelman, which is more conservative. This model was provided to the contractor at one of the early meetings.

13) HI for Lead, p3-74, para 1, and elsewhere There are no toxicity values for lead; therefore it is not possible to calculate a HI for lead. The toxicity of lead should be evaluated using the Uptake Biokinetic Model or addressed qualitatively using EPA OSWER Directives.

The lead example as an air toxic is a poor example. Lead is only toxic by the inhalation pathway under extremely high exposure concentrations (industrial settings); the exposure route of concern for lead is incidential ingestion by children. Use another chemical as an example here.

14) Tables 4-1/4-2 (Toxicity Values) Pay attention to references here. Reference "a" (HEAST 1992) is most often cited, when the data source is IRIS. Tables need a thorough examination. There are no toxicity values for lead. IRIS and HEAST give RfCs for the inhalation route of exposure; these should not be converted to Rfds for inhalation. RfDs and RfCs are calculated using different assumptions. The SF for BAP should be used for all carcinogenic PAHs, following current Agency guidance. Carcinogenic PAHs should be considered as a group for risk assessment purposes.

15) Section 4-2, Tox Profiles No toxicological profiles are included for non-radionuclides. Profiles for highly toxic chemicals or for those for which there is a demonstrated risk at the site, should be included. These include, but are not limited to, benzene, chloroform, methylene chloride, arsenic, cadmium, chromium, silver, etc.

16) Section 5-1, p5-2, lines 8-13 This does not make any sense. You cannot have a "Unit Toxicity Factor" for non-carcinogen that includes a SF.

17) Section 5.1.2.1, p 5-4 It is not clear from the discussion presented here whether migration of contaminants from the South Plume or any other source are considered as potential well water contaminants to present off-site residents living in this area under the Current Land Use scenarios. Need to explain

and defend approach used in the Current Land Use scenarios. Risk should not be based on measurements taken in 1991, or earlier, but on potential for exposure, given no action and the current land use.

18) Tables 5-44/ 5-45/ 5-46 These tables provide an evaluation of the sources of risk at the site, but are inadequate for characterizing the overall risk to any receptor population from site contamination. Need a additional set of tables which combines all exposure pathways for the Maximumly Exposued Individual (MEI) for each receptor population identified in the risk assessment. For example, does the trespassing child also have additional exposures from groundwater, ingestion of meat, milk, etc. What is the total risk to an on-site farmer. The Tables report data for the CT (typical resident), without noting that this exposure is not comparable to other scenarios presented. Need to limit presentation to the RME for each receptor population and provide exposure evaluations for the MEI. Need to combine risks from Radionuclides and chemicals in one table.

19) Tables 5-50, 5-51 Receptor population not indicated on these tables; add label. Which HIs are additive - have the same target organ or effect?

20) Permeability Constants Where is the table of PCs used in this assessment? Values for PCs have not been reveiwed previously.

21) Dermal Exposure Pathways How were dermal exposures (water, soil, sediment) calculated? Intake calculations are not applicable to dermal exposures, and an Absorbed Dose should be calculated instead. Toxicity values given in IRIS and HEAST can not be combined with the Absorbed Dose to give a risk/HQ. Toxicity values must be adjusted using the oral absorption value for the chemical (need list of oral absorption values used for this adjustment and the adjusted tox values). Guidance is provided in RAGS, Appendix A, for making adjustments for dermal absorption pathways.

22) Appendix S, Calculation Methods The ILCR methods outlined in Appendix S, will give incorrect risk calculations. For example, it is assumed that there is a linear relationship between the exposure point concentration of a constituent in a given medium and the calculated health risk from exposure to the constituent in the medium, which is correct if you consider each exposure pathway separately. What is incorrect is the assumption that one unit risk factor (expressed here as a ILCR) can be calculated for a constituent in a given medium, and that the ILCR can be used for all exposure pathways to that medium. For example, in Table S-9, was the ILCR for benzene for the "Farmer using GM River" water, calculated using the parameter values for ingestion of river water as a source of drinking water, or using the parameter values for the inhalation of benzene during showering or using the parameter values for incidential ingestion during swimming, etc. The parameter values are different for each

exposure pathway. The toxicity values also differ for different routes of exposure for each chemical. If ILCRs are to be calculated, there must be a separate ILCR for each chemical in each medium and for each exposure pathway and each receptor population. This is more complex than the EPA method of calculating an intake value for an exposure pathway and specific receptor population, which is then combined with the chemical concentration in the medium and the toxicity value for that chemical for each route of exposure to give a risk values.

USDOE Fernald Environmental Management Project

Site-Wide Characterization Report
Remedial Investigation and Feasibility Study
Dated August 1992

Comments by
USEPA, Region 5, Radiation Section

GENERAL COMMENTS

Where appropriate, figures should be duplicated in the report rather than simply referenced. This is especially true when the figures are maps, for instance, showing the location of sampling points. It is difficult and time-consuming to try to go back and locate figures in different parts of the document.

SPECIFIC COMMENTS

1. Part I, Section 3.1.3.3, p. 3-38, paragraph 2
Please clarify what samples were taken at point W3. It is unclear how often grab samples were taken there from 1981 through 1984.

2. Part I, Section 3.1.3.3, p. 3-40, Figure 3-10
Figure 3-10 is missing from the report.

3. Part I, Section 3.1.3.3, p. 3-43, paragraph 1
It should be explained how specific W1 and W3 samples were "selected" to undergo more in-depth analysis.

4. Part I, Section 3.1.3.3, p. 3-43, paragraph 2
Please clarify what samples were taken for point W5. Weekly grab samples (from 1985 to 1989) are noted. However, it is also stated that weekly composites from W5 were analyzed (from 1985 to 1988), although no mention is made of collecting such samples.

5. Part I, Section 4.1.3.1, p. 4-40, paragraph 1
The trends in the data should be summarized in the text, although it is appropriate to provide the more detailed information in tables.

6. Part I, Section 4.1.3.4, p. 4-93, Figure 4-37
It is recommended that the letter "M" should be replaced by another reference symbol or used as a superscript. The present use could be confused with the use of "M" to mean 10^6.

7. Part I. Section 4.3.2, Page 4-334, paragraph 1
This section should include a discussion to clarify when data will be validated according to the specific radiological methodologies and requirements that are set forth in the Site-Wide CERCLA Quality Assurance Project Plan.

8. Part II, Section 5.2.1.4, p. 5-30, Table 5-9
The text of the section on sediment notes that dermal contact with sediment is one of the pathways evaluated. However, this pathway does not appear to be included with risks in Table 5-9. Please correct or clarify.

9. Part II, Section 5.2.2.5, p. 5-49, paragraph 1
This section states that the risks in this scenario (trespassing child when access controls are discontinued) are higher than for the scenario when access controls are in effect. However, the text then goes on to cite as risk estimates the exact numbers calculated for the scenario <u>with</u> access controls. Please justify why more in-depth calculations were not performed for this scenario in order to estimate <u>how much</u> greater the risks would be without access controls.

10. Part II, Section 5.3
Surface water sediments are not included in the discussion on risks under future land-use scenarios, although they are considered under current land-use scenarios. The surface water models noted appear to provide a means of modelling future contaminant concentrations in sediments. The omission of sediments from the discussion of risks should be justified.

11. Part II, Section 7.2.1, p. 7-10, Table 7-3
It should be stated why radionuclides are not considered as constituents of concern for FEMP waters.

12. Part II, Section 7.2.1, p. 7-11, paragraph 1
Supporting data or modelling results should be cited to support the conclusion that "FEMP impacts on Great Miami River sediments are also unlikely to be of concern due to dilution by the river."

13. Appendix P, Section P.4.0, p. P-4-1, paragraph 1
Results from modelling for the one-year, 24-hour storm event should be summarized here.

14. Part II, Summary, page S-4, para 4
Explain why cattle could not drink from Waste Pit 5.

15. Part II, Section 2.0, page 2-11, para. 1
This comment is generic. Once a list of contaminants of concern is developed for a particular media it should be used consistently for assessments in that media. For example, say contaminants A, B, and

C have high concentrations and D has a low concentration in well 1 while radionuclides B, C and D are found in well 2 in high concentrations and A has a low concentration. Then the proper list of contaminants for assessment for both wells is A, B, C and D. D should not be omitted for well 1 and A should not be omitted for well 2.

16. Part II, Section 2.1.1.5, page 2-13, para. 1
Further explanation should be given for use of 0-18 inches for exposure assessments. One ARAR will be 40 CFR 192 which uses 15 cm (6 inch) averaging areas. The proposal to use 18 inch averaging areas is in conflict with this ARAR. Further, averaging over deeper depths may tend to reduce near surface gamma exposure values.

17. Part II, page 2-14, para. 2 & 3
Explain why field radiation measurements and subsurface soil data are only used qualitatively.

18. Part II, Section 2.1.2
Background data taken during removal actions would indicate that it was taken from once contaminated areas. This is not a proper place from which to select background data because of the credibility of such data in representing the natural conditions. The fallback protocol of using background as zero may lead to overestimations of background. For series radionuclides, equilibrium can be used before assuming zero.

19. Part II, Table 2-2, page 2-16
The Myrick et al. paper is not an acceptable source for sediment and soil background data. It was taken along interstate highways, generally far removed from the local FEMP geology.

20. Part II, Section 2.2
Further justification should be given for bullet 2 since it appears to eliminate many potential contaminants of concern. Compare this to other common methods such as 2 or 3 times background or to low limit of detection type methods.

21. Part II, Table 2-3 to Table 2-28
Describe for these tables if these will be the only radionuclides used in the risk assessment. Specifically, clarify how series radionuclides will be handled. For example, in Table 2-6, since U-238 and Ra-226 concentrations are shown for the drainage ditches, describe how Th-230 concentrations will be handled since it is found between U-238 and Ra-226 in the Uranium Series.

Further, the background levels listed for some radionuclides are much higher than would be expected normally (e.g., Table 2-8). The use of the UCL to set background apparently biases the background level very high. This will tend to eliminate contaminants of concern and bias net concentrations low, thus underestimating risk. As before, justify the use of the UCL over the straight mean method.

Explain how radiological net values will be obtained. It appears that the background UCL will be subtracted from the sample UCL.

Describe how blank entries will be handled. For example, in Table 2-8, uranium is listed for the drainage ditches, but U-238 is not listed. Explain how the blank will be dealt with.

22. Part II, Table 2-3, page 2-21
Clarify what the blanks for silos 1 and 2 mean (e.g., Ac-227, Pa-231, Ra-224, Ra-228). It would seem reasonable that, given the presence of other radionuclides in their series, that they would have some measurable concentrations.

23. Part II, Table 2-10, page 2-30
Explain how for Waste Pit 4, Waste Pit 5 and the Clearwell there can be upper confidence limits on the mean but no means.

24. Part II, Section 3.1.4
Dermal exposure to radionuclides should be included in some of these scenarios, specifically where digging and swimming are likely. This is separate from any dermal uptake assumed.

25. Part II, Section 3.2.1, lines 23-27
Clarify whether this justification will apply if beta dermal exposure is considered.

26. Part II, Section 3.2.1, lines 19-23
Since radons have high risk factors, clarify what the threshold exposure duration to be used is.

27. Part II, Section 3.2.1, lines 27-30
Clarify whether ingestion of pond water by cattle has been considered for scenarios of loss of control. This might be from one of the waste pits such as Waste Pit 5.

28. Part II, Section 3.2.3
When it is stated that sufficient potable water is not available for a farm, clarify whether this assumes drinking water only for residents only or for all farm activities requiring potable water.

29. Part II, Section 3.3.1, lines 10-13
It was understood by EPA that, because of the difficulties at the K-65 silos, that an attempt would be made to use AMS data to estimated offsite radon-222 concentrations. This sentence seems to nullify that approach. Please clarify.

30. Part II, Section 3.3.1.2
With respect to the K-65 silos, it appears that an assumption will be made that there is no side or top containment to control fugitive dust and radon emission. Clarify if this will be assumed. If so, then Table 3-3 would appear to be substantially understated for radon.

31. Part II, Table 3-2, page 3-18
Common units for radionuclides in air are pCi/L rather than pCi/m^3. Clarify why pCi/L was not used to avoid confusion.

32. Part II, Section 3.3.2.1, page 3-20, lines 10-16
Use of concentrations alone may result in errors. The concentration in conjunction with the slope factor will determine the most significant contaminants. Use of concentration alone assumes equal slope factors, which is fallacious. Selection based upon concentration and slope factor should be considered for all media, not just groundwater.

Explain why one set of contaminants of concern was not used for all wells.

33. Part II, Section 3.3.2.1, page 3-20, beginning at line 31
Clarify how this process merges with the process of lines 10-16 on this same page. It appears that they are contradictory.

34. Part II, Section 3.3.2.2.
Explain how radiological ingrowth was considered for other than present scenarios. Such ingrowth might be most pronounced with Thorium Decay Series radionuclides.

35. Part II, Table 3-7, page 3-29
Explain why decay products of long-lived radionuclides are not listed in this table. Ingrowth periods should be long enough to produce some.

36. Part II, Table 3-11, page 3-47
Explain why decay products of long-lived radionuclides are not listed in this table. Ingrowth periods should be long enough to produce some.

37. Part II, Section 3.3.5.2, page 3-59, lines 15-16
Clarify why, if future pathways require use of soil plus sediment concentrations, only the soil concentration will be used.

38. Part II, Section 3.3.6, page 3-59, lines 33-35
Explain why only uranium is used for dust contamination when many more radionuclides, including uranium decay products, should be expected.

39. Part II, Table 3-13, page 3-62
Explain why they geometric mean is used for removable alpha when it has been practice throughout this document to use the UCL.

40. Part II, Section 3.3.7, page 3-63, lines 21-24
Explain why dose rates are measured above the pits, not at the edges. Clarify how high above the pits the measurements were made.

41. Part II, Section 3.6.1, page 3-73, lines 28-33
Clarify why other radionuclides that may contribute to inhalation

dose significantly, e.g., Ac-227 and Pa-231, are not listed here. They are listed in Table 2-3 as being present in Silo 3 and should be present in Silos 1 and 2. Rn-220 and Rn-219 might also be present if their precursors were airborne.

42. Part II, Section 3.6.5
Relying solely upon concentration as a determinant of significance will result in errors. This is equivalent to assuming equal slope factors. Consequently, there are radionuclides omitted from this list that could contribute significantly to risk.

43. Part II, Section 4.2.2, page 4-26, line 19
There is some evidence that longer lived radon-220 progeny migrate out of the lung to other organs.

44. Part II, Table 5-1, page 5-12, and Table 5-2, page 5-16
Explain why there are so few radionuclides listed in these tables. Clarify whether all the decay products of the three natural decay series have been included.

45. Part II, page 5-21, lines 1-8
It is not reasonable to assume Rn-222 and Ra-226 are in equilibrium in groundwater. For natural conditions, radon-222 has a range of a few hundred to a few thousand picoCuries per liter while radium-226 is seldom over 5 - 10 pCi/L. A factor of 100:1 would appear more likely. This would increase the estimated risk to 3×10^{-4}.

46. Part II, Table 5-4,footnote b, page 5-22
Establish the basis for this footnote with environmental data.

47. Part II, Section 5.2.1.3, line 12
Explain why a child is not the proper receptor for this scenario.

48. Part II, Section 5.2.1.4, line 3
Explain whether the dermal contact risk arises from gamma only or also includes beta.

49. Part II, Table 5-12
Explain whether risks in this table arise from decay products as well as the parent.

50. Part II, Section 5.2.2.6, page 5-50, lines 20-31
Considering the number of drinking water sources in the immediate area for cows, it is not unreasonable for them to return to Waste Pit 5 for water. Moreover, the site is in excess of 1000 acres, which is not such a small area for livestock production. It is not necessary to discredit the results, since Waste Pit 5 is recognized to be a highly contaminated area.

51. Part II, Table 5-28, page 5-64
The zero risk for the trespassing child on silo 1 or 2 does not seem plausible. Assuming that 10^{-6} risk is treated as indistinguishable from zero, then the risk drops 1000 to 10,000

times from the top of silos to the base. This drop off seems much too precipitous.

52. Appendix E, page -1-6, Table E-1-1
The conclusion for this appendix should note which radionuclides were included in the analysis and note which, potentially critical radionuclides, were not part of the analysis. This could include radiums (bone uptake) and lead-210 (vegetative uptake).

53. Appendix F, page F-10, Table F.3-1
The thorium isotopes listed comprise only 33% to 74% of the total thorium concentration. The uranium isotopes listed comprise 56% to <100% of the total uranium concentration. Explain what isotopes are present in the remaining fractions and clarify how these may impact the conclusions for these tests.

54. Appendix H, page H-11, Section H.3.0
Explain why 11 of the 302 biological samples were not analyzed.

This section should include a separate conclusions section. Section 5.0 can be referenced, even for more detailed discussion, but this section (H.3.0) should state conclusions.

Conclusions should note the radionuclides for which analysis was done and discuss the reasons certain, possibly critical radionuclides, were not analyzed for (e.g., why was radium, a bone seeker, not analyzed for).

55. Appendix R.1.0, page R-1-2, Section R.1
This discussion should include some mention of how the constituents of concern were selected in Tables R.1-1 and R.1-2. Clarify whether or not this is an abridged list and, if so, explain why and what things were left out.

Explain why the list in Table R.1-1 is shorter than the list in Table R.1-2.

56. Appendix R.2.0, page R-2-1, Section R.2
This discussion should temper the usability of the radon data based upon the difficulties encountered with K-65 measurements and projections after the bentonite was installed.

57. Appendix R.3.0, page R-3-1, Section R.3
Discussion should be made here or reference made to elsewhere in this document as to how the constituents of concern were selected, whether or not background is included, why there is not the same list in every table, why related radionuclides do not always appear together, and whether concentrations, compared isotopically to gross alpha and gross beta levels, do or do not account for all the radionuclides present. In the fourth case, for example, clarify why radium-228 is not listed in Table R.3-1 when thorium-228 is present. In the last case, clarify whether radium-226/228 + technetium-99 + uranium-234/235/236/238 sums to the gross alpha and gross beta concentrations measured. [redacted]

57. (cont.)

Explain how series radionuclides will be treated, if not already done elsewhere in this total document. Specifically, clarify whether only the listed radionuclides be used or whether estimates will be made for unlisted radionuclides. For example, if only thorium-228 were listed, explain how thorium-232, its precursor, would be treated.

58. Appendix R.4.0, page R-4-2, Section R.4.2.2, last sentence
Elaborate on how the comparison was made to determine that perched groundwater was not a significant source.

59. Appendix R.4.0, Tables R.4-1 to R.4-70 Discuss, as in the first set of comments in 6 above.

60. Appendix R.5.0, page R-5-1, Section R.5
Discuss here why data is combined, as with Pu-239/240 and U-235/236. Clarify how this can be valid when dose conversion factors will be isotopically unique.

61. Appendix R.5.0, Tables R.5-1 to R.5-42
Discuss, as in the comments in 6 and 8 above.

62. Appendix R.6.0, Tables R.6-1 to R.6-71
Discuss, as in the comments in 6, 8 and 10 above.

63. Appendix S, page S-1
It should be made clear that unit risk factors are derived based upon the latest EPA guidance and will be modified if this guidance changes.

64. Appendix T
The upper 95% confidence interval on the mean for radiological backgrounds **is not** correct. Background is based upon the mean by itself. This should be applied with all radiological backgrounds.

65. Appendix T, page T-2, Table T-1
Clarify the time period in October and December over which the radon measurements were made. The usability of a long-term average is much better than for a grab sample.

66. Appendix T, page T-13, Table T-8, footnote b
The conversions necessary for the U-235 series would be easier to make using 4.6% U-235 by activity rather than 0.72% by mass.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: **September 30, 1992**

SUBJECT: Site Wide Characterization Report
Fernald Environmental Management Project (FEMP), Ohio

FROM: Eileen Helmer, Ecologist
Superfund Technical Support Section

TO: Jim Saric, RPM
OH/MN Technical Enforcement Section

Section 6, Ecological Assessment

Page 6-1 line 12, pg 6-3 lines 17-19 - For any operable unit, suboperable unit or specific waste disposal area not already expected to be remediated to "low risk" contaminant levels, perform separate risk assessment calculations. For each area, perform these calculations using the mean and upper 95% confidence interval concentrations for that area for each contaminant of concern.

Page 6-9, Table 6-3 - The values used for "fraction ingested from contaminated source" should be further justified; compare these animals' home ranges to the total area of the FEMP site (since the site-wide mean was used in risk calculations). For those animals with home ranges smaller than the FEMP site, the "fraction ingested..." should be 1.0. That value for animals with home ranges larger than the site

Page 6-11, line 25 - For the data reported on omnivorous rodents, state which of the two values is muscle and which is whole body.

Appendix H - Please describe sample locations 28 (Table H-4) and 9A (Table H-5), and state whether there is any obvious reasons for their respective elevated uranium and mercury levels.

Page 6-25, lines 27-29, and page 6-32, lines 1-5 - For arsenic and mercury perform risk calculations with measured as well as estimated plant contaminant concentrations. Additional vegetation samples should be collected to confirm whether contaminant concentrations in plants were higher because the plant was in operation. Planning of this sampling effort must be coordinated with EPA.

Page 6-32, line 30 and page 6-35, line 12 - Please give home range

[redacted]

of white-tailed deer and raccoon in km^2, hectares or acres, or else state that this is the radius of the home range.

Page 6-33, Table 6-15 - It is not clear where soil to earthworm transfer coefficients of 1.0 were used instead of the literature values listed in Table 6-6 (page 6-15). Based on those values, a transfer coefficient of 1.0 is not always conservative (e.g. for zinc and cadmium), and this property should be highlighted in the text. Of the literature values cited, higher values in the literature for lead and zinc have been measured, which indicates the fair amount of variability in earthworm bioaccumulation of contaminants (e.g. see Environmental and Contaminant Toxicology Vol. 47:296-301).

Page 6-68, lines 21-25 - As stated in previous comments, the data collected on FEMP biota should not be relied upon. It was not collected in such a way as to show causal effect.

In light of the risk assessment which has been performed, and the results of area-specific risk analyses, field studies should be proposed which have stated objectives such as: to determine level of small mammal/earthworm exposure in a given area; infer ecologically safe clean up levels, etc.

Page 6-111, lines 24-30 - The toxicity tests discussed here only have meaning relative to the contaminant concentrations present in the samples tested. Please provide a discussion of those contaminant levels relative to the toxicity observed and relative to contaminant concentrations in the various waste disposal areas and other on-site soils, or normal effluent concentrations. If toxicity tests will be used in further field investigations, please provide a workplan which shows how samples will be selected which represent the different types/levels of on-site contamination.

Page 6-69, lines 6-14 - Please clarify why deer assimilation of radionuclides into muscle was calculated using plant to beef transfer coefficients.

Page 6-103, lines 4-30 - When discussing risk assessment results, describe specifically which contaminants show risk and why a certain element may be a site contaminant: describe its probable source and migration pathway. For example, describe which contaminants showed HI's greater than 1 for fox and hawk, and in lines 16-25, describe where elevated arsenic concentrations were derived.

Page 6-108, lines 4-23 - Provide a much expanded summary of radionuclide toxicity data used to determine exposure effect levels. A good way to do this is produce a summary table showing the following: test organism, exposure, effects (description plus levels: NOELs, LOELs and/or LD50s), and reference.

Page 6-110, lines 3-9 - Please provide the Osborne and Jones

document which describes the studies of American robins on the site.

Page 6-113, line 4 - Please address above-background mercury and arsenic concentrations in plants.

lines 9-10 - Please note that individual areas must be assessed separately, rather than using a site-wide mean.

Lines 26-32 - Field investigations thus far conducted are not adequate to make the statement that deleterious effects have not been observed in the field...please re-state. Some effects have in fact been observed in the field (e.g. the Robin study).

U.S. EPA COMMENTS ON THE CULTURAL RESOURCE SECTION OF THE SITE-WIDE CHARACTERIZATION REPORT

In order to locate potential archaeological sites eligible for nomination to the National Register of Historic Places, State Historic Preservation Officers (SHPOs) and the professional community recognize standard surface and subsurface methods for site identification. The report addresses compliance with the Ohio SHPO's request for an archaeological survey beyond the boundaries of the FEMP.

For areas within the boundaries of the FEMP it is stated that "remedial activity...will not affect any properties listed on or eligible for the NRHP". In order to verify this statement, documentation should be provide indicating that a systemic survey has already been completed within the FEMP boundary and that this evidence was reviewed by the SHPO indicating that there are no unknown sites potentially eligible for National Register of Historic Places (NRHP) status present within the area being considered for mitigation. Section 2.2.6.6. of the report indicates a high concentration of prehistoric mound sites, some on the NRHP, within close proximity to the FEMP; these sites should be located on Figure 2-32. Consequently, there appears to be a high potential for previously unknown sites to be on or under soils slated for clean up. The subsurface remnant of burial mounds, maybe of a particular concern because they may have had their surface evidence removed by earlier facility activities. Documentation should verify that this concern has been addressed.

Historic properties near the FEMP have been identified in the report. However, are there structures that are representative of the DOE mission still standing within the boundary of the FEMP? What is the position of the DOE

[redacted]

Historian and DOE Federal Preservation Officer (FPO) about the potential significance of any structures which might exist?

Documentation should be provided regarding a search for any treaties in place giving Native Americans rights to lands or resources in the project area.

The NHPA, American Indian Religious Freedom Act (AIRFA), Archaeological Resources Protection Act (ARPA), and Native American Graves Protection and Repatriation Act (NAGPRA) require consultation with Native Americans, in the case of FEMP-the Shawnee and Iroquois, regarding interest in historical areas, cultural sites and natural resources areas. Documentation should be provided regarding this consultation process and its results.

Previous and future field studies conducted at the FEMP could potentially result in the accumulation of artifacts. Under 36 CFR Part 79, Curation of Federally-Owned and Administered Archaeological Collections, proper storage conditions must be maintained. Documentation should be provided regarding artifact/record storage.

NAGPRA requires that artifacts and records be examined for possible repatriation to Native Americans. Documentation should be provided regarding an inventory of the FEMP collection and action taken under NAGPRA.

SITE-WIDE CHARACTERIZATION REPORT
TECHNICAL COMMENTS

GENERAL COMMENTS

1. The SWC does not include adequate interpretation of data. Section 4.0 of Part I includes a presentation of data (primarily in tabular form), Part II contains the risk assessment, and Part III contains the FS. However, the SWC contains no discussion of the nature and extent of contamination. As an example, the report should identify ground-water plumes, contaminant sources (to the extent practicable), and key data gaps that will need to be addressed in subsequent reports or investigations.

2. The HSL (hazardous substance list) and any other analytical grouping should be defined by listing specific analytical compounds. The HSL has not been used since 1988. The Site-Wide Characterization (SWC) should be evaluated to determine whether the appropriate reference is actually the HSL or other analytical groupings such as the target compound list (TCL), target analyte list (TAL), or Appendix IX constituents.

3. Many of the citations in the text referencing specific tables and figures do not correspond to the correct tables and figures. This is particularly evident in Section 4.0, which references tables in Section 3.0. These discrepancies should be corrected.

4. The rationale used to determine which analyses would be performed on various media during the various studies cited is unclear. Often, similar media from identical locations were analyzed for different contaminants over time, making direct comparisons difficult (the surface water investigations provide a good example). A thorough discussion of the rationale used to determine analytical schemes should be presented for each study discussed in the report. The report should also explain whether these studies met their individual objectives; if not, then data gaps should be clearly identified.

5. The description of various studies performed by U.S. Department of Energy (DOE) and its contractors does not indicate whether the DOE project plans and the subsequent reports were subject to external U.S. Environmental Protection Agency (U.S. EPA) or Ohio Environmental Protection Agency (OEPA) review or approval. This information should be provided for each report cited.

6. Cyanide analyses are not mentioned in many of the discussions of surface water and ground-water studies. It is not clear whether this is a simple omission or these analyses were not performed in accordance with the March 1988 quality assurance project plan (QAPjP). If these analyses were not performed, this issue should be evaluated as a potential data gap.

7. Pages 3-90 through 3-96 were not submitted with the original report. Therefore, these pages were not reviewed. Pages 3-90 through 3-96 should be submitted.

8. The titles of all figures and tables showing sampling locations should include sampling dates.

9. The adequacy of background surface water and sediment locations along the Great Miami River is suspect. The SWC often compares downstream results against background locations with higher radionuclide concentrations (refer to Table 4-11). Most background locations cited in the report are directly downwind of the Fernald Environmental Management Project (FEMP). The reasons for elevated background levels are not discussed. U.S. EPA believes that a data gap is evident. The results for background samples are often higher upstream of the site than downstream; this suggests that background locations have been contaminated by the site. DOE should provide further information on the elevated background concentrations. If an upstream contaminant source is apparent, it should be identified. If the results are due to natural variation, then appropriate supporting evidence should be provided.

10. Instead of referencing sampling location maps in Section 3.0, Section 4.0 should include isoconcentration or data presentation maps summarizing significant data. This may not be necessary for all media, but ground-water, surface water and sediment, surface soil, and subsurface soil results should be graphically displayed. In addition, it would be appropriate to include composite maps or graphs comparing results from successive sampling rounds to evaluate possible trends over time.

11. Many of the data tables in the text present what appear to be incomplete lists of analytes (particularly with regard to organics). It is not clear whether the analytes presented represent only those compounds detected in a more comprehensive analytical scan or whether these analytes presented represent all compounds analyzed for during a particular sampling round (see Tables 4-19 and 4-20). This issue should be clarified for each study cited in the report.

12. Many of the surface water and sediment studies discussed in the report use data from sampling points whose closest downstream locations are 3 or 4 miles downstream from the FEMP. Large reaches of the Great Miami River located immediately downstream of the FEMP were apparently not studied. This should be discussed as a possible data gap.

13. Much of the data included in the various study summaries in Section 4.0 is not presented in tables, nor is the appropriate appendix referenced. All data discussed in the report should be included in tables or appendices, and the appropriate appendices should be referenced.

14. The report inconsistently and routinely compares data to known standards, background values, or applicable or relevant and appropriate requirements (ARAR). For instance, for on-site and off-site ground water, contaminant concentrations are compared to maximum contaminant limits (MCL), DOE dose-related exposure limits, method detection limits, or varying background criteria for the same media. The current format seems to represent the data in a biased manner, with the method of

comparing data being chosen without any apparent rationale. Specific regulatory criteria should be defined, the significance of these criteria should be explained, and the comparison of data should be consistent.

15. The report often uses annual average values instead of single rounds of ground-water data and compares these annual average values with one of the many "control" values. The use of the annual average value can be misleading because this approach ignores the potential for seasonal or transient variations in ground-water contamination. Although it may be appropriate to compare data using annual averages, the reader should be able to evaluate data for tends made apparent by seasonal sampling rounds. The report should evaluate data from individual sampling rounds and compare this data to annualized data in order to identify possible seasonal effects. The report should also compare data from successive sampling rounds to evaluate variation of contamination over time. This is important for predicting future contaminant trends, evaluating plume migration, and identifying continuing sources of release.

16. Various statistical methods have been applied to the analytical data without providing the rationale for this data manipulation. The statistical methods used should be referenced and should include statistical methods published in U.S. EPA Remedial Investigation and Feasibility Study (RI/FS) and risk assessment guidance documents.

17. Isoconcentration maps specific to individual operable units should be prepared for specific target compounds and suites of compounds, including total Volatile Organic Compounds (VOC). Such maps should be prepared for the various ground-water units and for surface soil.

18. The geochemistry of the subsurface media, including soils and ground water, should be discussed. The major ion and cation pairs should be evaluated for trends. For example, ground-water data should be evaluated using trilinear diagrams. Also, geochemical interaction of leachate and ground water in the subsurface soil should be discussed,

particularly its relation to fate and transport of site-related contaminants.

19. Many of the summaries of the various ground-water contamination studies are very limited in scope, typically describing only the average or range of concentrations detected during a given sampling round. The nature and extent of ground-water plumes associated with various waste units and operable units are rarely discussed in a coherent, easily understandable manner. Discussions based on detailed isoconcentration maps depicting the configurations of plumes over time should be included.

20. Details of how background concentrations in surface soils were established should be provided in the report.

21. Based on the data collected, the sections discussing subsurface soils should state, whether identified contaminant sources such as Silos 1, 2, and 3 are leaking contaminants to subsurface soils.

22. The migration pathways for contaminants are not well defined. In particular, the discussion of subsurface geology and hydrogeology is limited and general in nature. Cross sections should include detailed evaluations of the saturated and unsaturated horizons, particularly in areas of known contamination (the production area, the waste pit area, the K-65 silo area, the sewage treatment plant area, the south field area, and other impacted areas). The sources of contamination should be defined by detailing indicator parameters, and graphics should be provided that show the distribution of contaminants in affected media.

23. The risk assessment portion of the SWC generally complies with current risk assessment guidance and provides a thorough examination and summary of both the human and environmental risks associated with the site.

24. In the risk assessment, the human health risk exposure for lead in different media is determined through use of a reference dose (RfD)

calculated by the authors of the document. However, the U.S. EPA Uptake Biokinetic Model (Version 0.61) is currently the only acceptable method for assessing human health risk from lead exposure. The U.S. EPA Office of Health and Environmental Assessment has determined that there may not be any safe level of exposure to lead. For this reason an RfD for lead is inappropriate. Lead should be removed from the calculation of risk by the hazard index (HI) method and should be replaced with results from the Uptake Biokinetic Model.

25. In most instances, the total HI or cumulative cancer risk is not calculated for the total medium risk or total population or scenario risk per medium or for all media. Except for a limited number of instances, only the individual hazard quotients or cancer risk value for each analyte within a medium is provided. The absence of this information makes it difficult to assess risk for the medium or population or scenario in question.

26. The FS portion of the SWC identifies risk-based preliminary remediation goals (PRG). Some PRGs may require remediation of contaminated media to less stringent levels than those required by ARARs. For example, in Table 2-2, the risk-based PRG for 1,1,1-trichloroethane in the Great Miami River Aquifer is 0.7 milligrams per liter (mg/L). However, the MCL, which is an ARAR, is 0.2 mg/L. The report should indicate that a PRG cannot be less stringent than an ARAR unless an ARAR waiver is anticipated.

27. Section 3.0 of the FS includes final remedial technologies only in the identified Leading Remedial Alternative (LRA). It would normally be appropriate to include the screening process used to evaluate technology effectiveness, implementability, and cost. However, because the initial screening of alternatives (ISA) documents have previously provided this information, it would be appropriate to reference them and to include a summary of ISA findings.

28. Section 3.0 of the FS includes the LRAs without discussing the other possible Remedial Alternatives (RA). DOE should include information on the RA screening process, specifying the entire range of RAs and the reasons for choosing the LRA.

29. The LRA for Operable Unit (OU) 2 assumes RCRA capping without significant treatment of wastes. Recent findings indicate that there may be hot spots within the solid waste landfill and elsewhere in OU 2 requiring in-place treatment or excavation, treatment, and disposal in the on-site aboveground disposal facility. The LRA for OU 2 should include provision for treating and disposing of wastes; closure with in-place capping may not be adequately protective of human health and the environment.

30. The FS portion of the SWC does not meet the standard content criteria for an FS defined by U.S. EPA guidance. However, because the SWC is not meant to fulfill the scope of a site-wide FS, it would be appropriate to rename the FS and qualify the presentation accordingly.

31. The SWC should have consistent nomenclature. For example, Part I, Page 2-6, Line 4, and Figure 2-3, Page 2-4, use the term "Preparation Plant," but Figure 2-4, Page 2-7, and Page 2-1 refer to the same facility as the "Sampling Plant."

32. The SWC contains a great deal of sample analytical data for radionuclides. This is particularly evident in the summary of findings from investigations predating 1988. However, it appears that there may be data gaps with respect to the amount of data available for non-radionuclides such as metals or VOCs. As an example, the soil characterization study conducted by Roy F. Weston (Weston) focused on uranium distribution. DOE should address this issue when identifying potential data gaps.

33. Throughout Section 4.0, field screening data for radionuclides is presented along with laboratory-derived data. Based on a cursory review

of the data, U.S. EPA believes that there is poor correlation between the field instrumentation and laboratory analytical data. For example, results for surface water and sediment samples from the Clearwell and waste pit area often show nondetects or background readings for field radioactivity, but total uranium and isotopic data shows elevated values. The report should discuss this issue and its possible impacts on the quality of the data, especially considering the use of field instruments for screening samples to determine whether they should be analyzed in the laboratory.

34. It is evident that extensive radionuclide contamination has been identified in the perched water. The relevant data should be shown in figures. If discrete plumes can be identified they should included on figures and discussed.

SPECIFIC COMMENTS

1. <u>Executive Summary, Page ES-6, Line 13</u>. DOE states that the FEMP has only a slight effect on the uranium content of the Great Miami River because concentrations downstream of the FEMP discharge are only slightly greater than those upstream. U.S. EPA disagrees, noting that there is actually a twofold or threefold higher concentration in some downstream samples and that upstream concentrations are probably influenced by FEMP discharges. DOE should further support its statement or modify it appropriately.

2. <u>Executive Summary, Page ES-6, Line 20</u>. This sentence states that inorganic chemical concentrations in the Great Miami River are similar upstream and downstream of the FEMP and that they only occasionally exceed water quality criteria at the United States Geological Service (USGS) station in New Baltimore. The term occasionally should be defined, and the downstream distance of the New Baltimore station should be specified.

3. Executive Summary, Page ES-6, Lines 30 and 31. DOE uses the terms "several milligrams/l and several times this value." These terms should be specifically defined.

4. Executive Summary, Page ES-7, Paragraph 3. This paragraph discusses radiological constituents detected in background samples and in on-site perched ground water and the regional aquifer. The radiological constituents detected in background regional aquifer samples are not presented. This information should be included.

5. Executive Summary, Page ES-9, Paragraph 2. This paragraph discusses on-site and off-site total uranium concentrations in surface soil; however, this data is not compared to background total uranium concentrations. This information should be provided, and the discussion of on-site and off-site surface soil contamination should be expanded accordingly.

6. Executive Summary, Page ES-9, Paragraph 3. The upper range of concentrations noted for Technetium-99, 1.540 picoCuries per gram (pCi/g), should be 1,540 pCi/g.

7. Executive Summary, Page ES-23, Line 17. This line defines earthworms as insects. "Insects" are Class Insecta. "Earthworms" belong to Class Oligochaeta. This error should be addressed.

8. Section 1.2.1, Page 1-5, Figure 1-2. The boundaries of the burn pit are not defined. According to the figure, it appears that all areas not occupied by other pits may be part of the burn pit, which seems unreasonable. The figure and the text should be modified to clearly describe the burn pit.

9. Section 1.2.2, Page 1-9, Bullet 1. The locations of the K-65 Decant Sump Tank and the holding tanks should be shown in a figure accompanying the text.

10. Section 1.2.2, Page 1-10, Last Bullet. The locations of Plant 2/3 and the refinery referred to in the text should be clearly shown in a figure accompanying the text.

11. Section 2.1.2, Waste Generation Section. The discussion of waste generation is incomplete and does not conform to the schematic diagram in Figure 2-4. The text discusses many waste types that are not included in Figure 2-4, and some obvious waste types are not included in the text--for instance, the K-65 silo waste. This section should discuss all significant current and past wastes. Figure 2-4 should be revised and supplemented with additional figures, if necessary.

12. Section 2.1.2, Page 2-9, Lines 10 and 11. An empty drum washing station is discussed. This unit does not appear on any subsequent site figure. Additional information on this unit should be provided.

13. Section 2.1.3.1, Page 2-10, Table 2-1 and Line 21. The amounts of uranium and thorium contained in Waste Pit 3 and discussed on Line 21 do not correspond to the amounts described in Table 2-1. These discrepancies should be corrected.

14. Section 2.1.3.1, Page 2-10, Table 2-1 and Page 2-11, Line 2. The amounts of uranium and thorium contained in Waste Pit 4 and discussed on Page 2-11, Line 2, do not correspond to the amounts described in Table 2-1. These discrepancies should be reconciled.

15. Section 2.1.3.1, Page 2-11, Lines 1 through 7. The description of Waste Pit 4 should include the thickness of the clay liner.

16. Section 2.1.3.1, Page 2-11, Lines 8 through 17. The text indicates that water flows from Waste Pit 5 to the Clearwell under gravity. Considering the fact that Waste Pit 5 and the Clearwell are 1,000 feet apart, the text should also describe the means of conveyance--for instance, whether the water flows through closed pipes or in open trenches.

17. Section 2.1.3.1, Page 2-11, Lines 23 through 29. The text describes the burn pit. The text should state whether the burn pit is lined and covered to control runon or runoff.

18. Section 2.1.3.1, Page 2-11, Line 38. This sentence states that sediments were removed from the Clearwell on at least one occasion, but it is not clear where the sediments were taken and how they were disposed of. This information should be provided. Also, the text should state whether the Clearwell is lined.

19. Section 2.1.3.2, Page 2-12, Lines 6 through 11. This section discusses waste contained in the solid waste landfill, in five cells, and in an area east of the cells. the total waste volume is given as both 25,000 cubic yards and 25,000 cubic feet. This paragraph is unclear as to what units are being described and what the total volume of waste is. This discussion should be clarified. Also, the text should indicate the dimensions of the landfill and state whether it is lined.

20. Section 2.1.3.2, Page 2-12, Lines 18 through 26. The text should indicate the active life of the Lime Sludge Ponds.

21. Section 2.1.3.2, Page 2-12, Lines 20 through 29. The text describes the lengths of the lime sludge ponds as the same. However, the surface areas of the two ponds are different in Table 2-2. This discrepancy should be corrected.

22. Section 2.1.3.4, Page 2-14, Lines 25 through 32. The text should describe other characteristics of the silos and should provide information on the floor, liner, and leachate collection system, if any.

23. Section 2.1.3.4, Page 2-15, Table 2-3. This table uses tetrachloroethylene and perchloroethylene interchangeably. The table should consistently use one compound identification.

24. Section 2.1.3.4, Page 2-19, Lines 4 and 5. Settling and decanting operations are introduced here; however, the discussion is incomplete. DOE should fully discuss the decanting operation, including the Sump Decant Tank.

25. Section 2.1.4, Page 2-20, Lines 33 and 34. This section states that the FEMP generated RCRA D, F, P, and U wastes; however, Page 2-23, Paragraph 1, states that K wastes were also generated. This discrepancy should be addressed.

26. Section 2.1.4, Page 2-23, Lines 7 through 10. This section states that the liquid incinerator was used for the annual disposal of 900 pounds of K054 until its deactivation in 1986. K054 waste is no longer a listed RCRA waste. Also, it is not clear why the liquid incinerator was deactivated. This section should indicate what wastes were disposed of in the incinerator and should provide a brief summary of the historical operations of the incinerator.

27. Section 2.1.5, Page 2-24. This section discusses the National Pollutant Discharge Elimination System (NPDES), but it does not provide any information on discharge limitations. This information should be provided.

28. Section 2.1.5, Page 2-24, Lines 22 and 23. This section states that 786 kilograms (kg) of uranium were discharged into the Great Miami River in 1990. The relationship of this discharge to FEMP's allowable uranium discharge limits should be addressed.

29. Section 2.1.5, Page 2-24, Lines 24 and 25. This section states that thorium and strontium were detected in the effluent at concentrations of less than three percent of the DOE guideline. It is not clear (1) whether these concentrations represent an annual average or a one-time measurement and (2) which DOE guideline is being referenced. This information should be provided.

30. Section 2.1.5, Page 2-24, Lines 28 and 29. This sentence states that storm water retention basin overflow is discharged to Paddy's Run during extreme storm events. The frequency of this type of discharge and a definition of "extreme" should be provided.

31. Section 2.2.2.3, Page 2-32, Lines 31 and 33. This sentence states that the three Southwestern Ohio Water Company wells have a significant influence on the infiltration rate from the Great Miami River. No other information is provided. This discussion should be expanded.

32. Section 2.2.3.3, Page 2-41, Lines 22 and 24. This sentence states that ground water from the southern and southwestern portions of the FEMP flows to the south-southwest; however, Figure 2-13 indicates that the ground water in this area flows to the southeast. This discrepancy should be reconciled.

33. Section 2.2.5.2, Page 2-62, Lines 7 through 12. These lines describe a "distinct habitat." DOE should clarify which of the habitats listed in the preceding sentence is being described.

34. Section 2.2.5.2, Page 2-65, Lines 26 and 27. This sentence states that terrestrial arthropods collected at the FEMP included a few gastropods. Gastropods are grouped in the phylum Mollusca, not Arthropoda. This error should be corrected.

35. Section 2.2.5.3, Page 2-66, Lines 29 through 31. This section states that a 1980 Ohio Environmental Protection Agency (OEPA) study found that the Great Miami River was capable of supporting a healthy fish community, "thereby attaining of CWA goals." It is not clear what is meant by "attaining of CWA goals." This text should be clarified.

36. Section 2.2.6.5, Page 2-99, Lines 27 and 28. The text indicates that the site uses ground water for industrial purposes. The specific use and classification of the site's drinking water supply should be

identified. DOE should also clearly identify the site's drinking water source. The water supply wells should be identified in Figure 2-29.

37. Section 3.1.1.1, Figure 3-1. The figure shows percent recovery values for samples collected from the silo. However, no scale is evident, and in some cases this is misleading. For instance, the bar graph for samples NW-1 and NE-1 seems to indicate that 100 percent recovery was accomplished; however, only 35 and 28 percent recovery, respectively, was achieved. This figure should be modified to show a scale for percent recovery.

38. Section 3.1.1.2, Page 3-8, Lines 3 through 10. This paragraph states that the contents of some tanks were agitated before sampling but that the contents of others were not. The rationale for these different sampling procedures should be provided.

39. Section 3.1.1.2, Page 3-10, Lines 4 through 11. This paragraph mentions the types of analyses performed on tank samples from various locations. The rationale for performing the various analyses is not provided. This information should be included in the discussion.

40. Section 3.1.1.3, Page 3-13, Lines 3 through 5. This section states that Pb-210 was considered an indicator for radioactive contamination in soil and ground water because it is a stable breakdown product of Ra-226, which is itself a breakdown product of U-238. The usefulness of Pb-210 as an indicator of radioactive contamination in soil and ground water is questionable because of (1) the negligible volume or percentage of Pb-210 expected to be in soil or ground water as a result of the radioactive decay of U-238 and (2) the differences in chemical mobility between Pb-210, U-238, and Ra-226. The discussion of the rationale for using Pb-210 as an indicator for radioactive contamination should be expanded further in the report.

41. Section 3.1.2, Page 3-14, Lines 18 and 19. This sentence states that the air pathway is considered to have the greatest potential for off-

[redacted]

site exposure of the public. A comparison to the exposure potential from ground water should be provided to support this statement.

42. Section 3.1.2.1, Page 3-15, Lines 2 through 4. This section states that substances such as nitric acid have been released to the atmosphere in relatively small amounts but that these substances are not monitored. Because of the large quantities of nitric acid used in various production processes and the lack of monitoring data, it is unclear how this statement can be made. This matter should be further explained.

43. Section 3.1.3.2, Page 3-22, Lines 30 and 31. This sentence mentions an unnamed ditch that drains the south area of the K-65 silos; however, this ditch is not shown in Figure 3-6 or 3-7. This omission should be addressed.

44. Table 3-6, Pages 3-24 and 3-25. Footnote d indicates that $Na_2S_2O_3$ was used as a preservative for organic samples only if residual chlorine was present; however, Table 3-6 does not indicate that residual chlorine was tested for. This discrepancy should be clarified.

45. Table 3-8. The detection limits listed for metals in water are often above MCLs(100 grams/liter for barium in water), and in many cases, the detection limits for metals in soil are extremely high. The usefulness of such data is questionable. This data should be evaluated and, if necessary, appropriately qualified. Also, the method "Exhibit D" for several parameters cannot be identified, and its associated reference (13) is not listed in the footnotes. DOE should clarify and complete the table.

46. Figures 3-8 and 3-10. These figures show surface water and sediment sampling locations on the Great Miami River and Paddy's Run. It is unclear why downstream sampling locations were placed so far from the FEMP (about 4 miles downstream from the FEMP outfall on the Great Miami River with no sampling locations between the off-site, upstream location and the downstream perimeter of Paddy's Run). The rationale for the

[redacted]

selection of these sampling locations and a discussion of the usefulness of the analytical data should be provided.

47. Table 3-10. Footnote a in this table states that sampling locations are shown in Figure 3-7, but sampling locations are actually shown in Figure 3-10. This discrepancy should be addressed.

48. Section 3.1.3.4, Page 3-46, Lines 23 and 31. Line 23 states that water and sediment samples were collected from the wet pits (Waste Pits 5 and 6 and the lime sludge ponds); however, Line 31 states that surface water samples were collected from waste pits 4, 5, and 6 and the clearwell. This discrepancy should be addressed.

49. Table 3-11, Page 3-47. The title of this table should provide the sample collection date. Also, the second entry in this table states that samples were collected in water 1 to 15 feet deep using a Wheaton sampler at a depth of 6 inches. This statement is confusing and should be clarified.

50. Section 3.1.3.5, Page 3-49, Lines 24 through 34. The rationale used to select specific analyses for drainage ditch and manhole water samples is unclear. Further discussion of this matter should be provided.

51. Figure 3-16. The lines in the legend denoting the production area boundary and the FEMP boundary are incorrect. These errors should be addressed.

52. Section 3.1.3.8, Page 3-54. This section describes the analyses performed on surface water samples. The analyses did not include tests for VOCs, semi-volatile organic compound (SVOCs), pesticides, or polychlorinated biphenyls (PCB). The rationale for not performing organic analyses on all samples should be discussed.

53. Section 3.1.3.8, Page 3-56, Line 2. The reference to Figure 3-9 is incorrect; the reference should be to Figure 3-10.

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54. Section 3.1.4.1, Page 3-61, Line 30. The number of wells identified here, 36, does not correspond to the number shown in Figure 3-20. This discrepancy should be corrected.

55. Section 3.1.4.2, Page 3-68, Line 27. The number of wells identified here, 21, does not correspond to the number shown in Figure 3-22. This discrepancy should be corrected.

56. Table 3-16, Page 3-74. This table indicates that monitoring wells 2, 6, and 20 were not sampled in 1988 or 1989. This table also indicates that the analyses of these samples did not include organic analyses. Further discussion of sampling locations and the analytical rationale is needed.

57. Section 3.1.4.2, Page 3-75, Lines 3 and 4. This sentence states that ground-water samples were analyzed for "toxic organic compounds." This term should be defined. Also, the 227 site wells and 36 private wells noted here are not shown in a figure.

58. Section 3.1.4.3, Page 3-75, Lines 30 and 31. This sentence states that monitoring well SW-2 had been previously sampled during Phase 1 or 2; however, the list of wells sampled during those phases (Lines 26 through 28) does not include SW-2. This discrepancy should be addressed.

59. Section 3.1.4.3, Page 3-77, Line 17. This sentence states that submersible pumps were used to purge and sample monitoring wells. It should be noted that submersible pumps are not recommended by U.S. EPA Region 5 for ground-water sampling, particularly when the samples will be analyzed for VOCs. Therefore, this data should be qualified.

60. Section 3.1.4.4, Page 3-80, Line 27. This sentence states that ground-water samples were collected with a pump when bailing was not possible. The type of pump used should be identified.

61. Section 3.1.4.6, Page 3-87, Line 33. This section states that selected off-property private wells were sampled. DOE should indicate whether the ground-water samples from private well samples were analyzed using methods capable of achieving low instrument detection limits, as required to determine compliance with drinking water standards.

62. Section 3.1.4.6, Page 3-97, Line 32. The text notes that certain samples "were analyzed for extended HSL parameters." DOE should define these parameters or reference the appropriate documents which describe the compounds included in this list.

63. Section 3.1.4.7, Page 3-102, Line 5. This brief section states that "significant changes of indicator parameters" were noted during the RCRA detection program. However, no details are provided. DOE should provide enough information or references so that the Assessment Program can be understood and placed in context.

64. Section 3.1.4.7, Page 3-102, Lines 12 and 13. This sentence states that "this program started in May 1988." It is not clear which program is being referred to, the Assessment Program or the Detection Program. This matter should be clarified.

65. Section 3.1.4.7, Page 3-102, Line 13. This sentence states that the results of the RCRA Assessment and Detection Programs are stored in the Fernald database. These results should be incorporated in the report.

66. Table 3-22, Page 3-108. The organization of this table is confusing. Specifically, it is not clear which locations were sampled on the various dates listed. This table should be clarified.

67. Section 3.1.5.2, Page 3-109, Line 16. This sentence states that care was taken to avoid fertilized areas during surface soil sampling. Further discussion should be provided regarding how it was determined whether soil sampling locations were located in fertilized areas.

68. Table 3-23, Page 3-113. This table indicates that parallel soil and vegetation samples were collected at location 12 in 1987; however, this table also indicates that no routine soil sample was collected at location 12. Also, the table's format suggests that parallel samples were not collected at locations 4, 5, and 17, but the sample numbers shown suggest otherwise. These discrepancies should be addressed.

69. Section 3.1.5.4, Page 3-114, Line 28. This sentence states that surface soil samples were collected from the K-65 trench; however, Figure 3-40 describes this area as the K-65 slurry line. This discrepancy should be addressed.

70. Section 3.1.5.4, Page 3-114, Lines 30 and 31. The locations described in this paragraph ("pilot plant tile," "old incinerator area," "prior location of the Cone house") either are not shown in the following figures (3-42, 3-43, and 3-44) or have different names in the figures. The text should be reconciled with the figures.

71. Figures 3-41 and 3-43. These figures show surface soil sampling locations in the fly ash piles and south field area. The boundaries of the fly ash piles should be shown in the figures.

72. Section 3.1.5.5, Page 3-121, Line 18. This sentence states that the FEMP RI/FS studies are described in Section 3.1.1.3; however, Section 3.1.1.3 only discusses K-65 silo sampling. This discrepancy should be addressed.

73. Section 3.1.6.1, Page 3-127, Lines 14 and 15. This section states that subsurface soil samples were collected using a 3-inch outside diameter, hollow-stem auger and a 24-inch drive, split spoon sampler. It is unlikely that a 3-inch outside diameter, hollow-stem auger was used for this type of sampling. This apparent discrepancy should be addressed.

74. Section 3.1.6.1, Page 3-130, Lines 13 through 28. The rationale used for selecting the various chemical analyses is not clear. Specifically,

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it is unclear why cyanide and many common VOCs were not analyzed for. The rationale for selecting the analyses performed should be provided.

75. Figure 3-55. The title of this figure is "Location of Permanent Transects at the FEMP." The title should provide more information regarding the types of transects depicted.

76. Section 3.1.7.1, Page 3-145, Line 29. This section states that the off-site or laboratory (rather than the field) method was used to define wetlands in the FEMP. It is not clear how this method could be used to identify jurisdictional wetlands where the seasonal high water table must lie within 6 inches of the surface for at least 1 week during the growing season. This matter should be explained.

77. Section 3.1.7.1, Pages 3-146 and 3-147. This section states that aerial photographs dating back to 1950, with special attention being paid to the most recent photograph taken in April 1988, were used to verify approximate wetland boundaries and to identify areas to be field-checked. The term "special attention" should be defined, and the text should clearly state whether aerial photographs taken before April 1988 were used to determine wetland boundaries and field-check locations. This is important because 1988 was a drought year; using only photographs taken at that time might not have allowed thorough identification of all wetlands.

78. Section 3.1.7.2, Page 3-165, Lines 29 and 30. This sentence states that "fish were collected from four sites each on Paddy's Run and the Great Miami River, and from a small drainage pond north of the production area (Figure 3-61)." This is the first mention of the drainage pond in the report, but its location is not shown in Figure 3-61. Complete descriptions, including the depth, surface area, and flow characteristics, of all on-site surface water bodies (ditches, streams, ponds, and wetlands) should be included in the report, and all surface water body locations should be shown in figures.

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79. Section 3.1.7.2, Page 3-167, Lines 22 through 36. This paragraph and the following analytical parameter list are very confusing. Specifically, it is not clear what was analyzed for in the various samples collected. The specific analyses conducted and the rationale used to select these analyses should be provided.

80. Section 3.1.7.3, Page 3-168, Lines 10 and 11. This sentence states that the FEMP main effluent line is a permitted discharge regulated by a NPDES permit and DOE orders. The text should clearly state which DOE orders regulate specific contaminants and which contaminants are regulated under the NPDES permit.

81. Section 3.2.1.4, Page 3-186, Lines 9 through 13. This paragraph states that "leachate" contaminant concentrations within the glacial overburden (as opposed to contaminant concentrations within each waste area) were used as initial contaminant concentrations in the fate and transport model. It seems likely that this approach would greatly reduce the estimated contaminant dose received at the human receptor sites. The rationale for using this approach should be explained further.

82. Section 3.2.1.4, Page 3-186, Lines 32 through 34. This paragraph states that concentrations of organic compounds in leachate were determined using surface water or perched ground water when Toxicity Characteristic Leaching Procedure (TCLP) results were not available. This approach would likely underestimate the leachate concentrations. It is not clear why leachate was not sampled directly. Also, given the number of analyses performed for the FEMP, it is unclear why the necessary TCLP analyses were not performed. DOE should address this issue as a potential data gap.

83. Section 3.2.1.4, Page 3-187, Lines 7 through 9. The meaning of this sentence is unclear. It should be rewritten for clarification.

84. Section 3.2.4.2, Page 3-192, Line 23. This sentence states that the prevailing winds used in the conceptual model are from the northwest.

Figure 2-5 indicates that the prevailing winds are from the southwest. This discrepancy should be reconciled.

85. Section 4.1.1, Page 4-1, Lines 20 and 21. The text should state what types of VOCs were detected and at what levels.

86. Section 4.1.1, Page 4-1, Lines 22 and 23. The text should include a statement specifying the percentage of areas sampled that showed above background levels of contamination. Also, the text should include a summary of what is considered background and how background was established.

87. Tables 4-1 and 4.2. These tables list the frequency of detection (the number of times a specific analyte was detected divided by the number of analyses performed) for elements detected at least once; however, the number of analyses performed is not presented for elements not detected. This information should be provided. Also, the entries for thorium-228 and thorium-232 in Silos 1 and 2 have mean concentrations less than the lower limits of the ranges. DOE should address this discrepancy.

88. Table 4-2. This table presents analytical data for Silos 1 and 2 cumulatively and for Silo 2 alone. Almost without exception, inorganic data for Silo 2 shows much higher concentrations than does the cumulative inorganic data for Silos 1 and 2. Conversely, the cumulative organic data for Silos 1 and 2 shows much higher concentrations than does the organic data for Silo 2 alone. All data for Silos 1 and 2 should be presented independently.

89. Table 4-2, Page 4-7. This table indicates that Silos 1, 2, and 3 contain substantial levels of VOCs and SVOCs; however, total organic carbon (TOC) values are shown as nondetects for Silos 1 and 2. These discrepancies should be reconciled.

90. Table 4-2, Page 4-7. This table indicates that trichloroethane was analyzed for. This is apparently a typographical error. The report

should indicate whether 1,1,1-trichloroethane or trichloroethene was analyzed for. Also, this table indicates that the compound was analyzed for only once while other VOCs were analyzed for as many as 13 times. The report should provide more detailed regarding the analytical rationale, particularly with regard to frequency of analysis and suites of compounds analyzed for.

91. Section 4.1.1.2, Page 4-8, Line 8. The text states that inorganic constituents were detected at levels above background. However, background levels are not defined here or in a table. DOE should define the background levels.

92. Section 4.1.1.2, Page 4-8, Line 11. This sentence states that VOCs including Aroclor-1254 were detected. Aroclor-1254 is a PCB. This discrepancy should be addressed.

93. Section 4.1.1.2, Page 4-8, Lines 15 and 16. The text should explain why both grab and composite samples were collected.

94. Section 4.1.1.3, Page 4-8, Lines 16 through 18. This sentence states that radionuclide data is shown in Tables 4-3A and 4-3B. Table 4-3B contains only metals data. This discrepancy should be addressed. Also, the term "detectable level" should be defined, specific radionuclides detected and the levels at which they were detected should be identified.

95. Tables 4-3B and 4-3C. These tables contain many "blank areas." The significance of these "blank areas" should be discussed.

96. Section 4.1.1.4, Page 4-18. DOE should provide a graphic representation of the data in Tables 4-4 and 4-5 that identifies areas of low, medium, and high concentrations.

97. Section 4.1.1.4, Page 4-18, Lines 11 through 14. This paragraph discusses background data for radon and thoron and then states only that

the highest thoron concentrations were detected in 1992. Radon is not discussed further. A more detailed discussion of radon and thoron data should be presented.

98. Table 4-6, Page 4-22. This table indicates that the average Rn-222 value in the old Plant 5 Warehouse is 94.5 pCi/L; however, the average Rn-222 plus Rn-220 value is reported as 76.25 pCi/L. This discrepancy should be addressed.

99. Section 4.1.2, Page 4-23, Lines 9 and 10. DOE should include a statement of what the percentage of radon emission reduction was after bentonite was placed in the silos.

100. Section 4.1.2, Page 4-23, Lines 16 through 19. This sentence states that in 1990, the concentrations of airborne radionuclides emanating from the FEMP were well below the DOE Derived Concentration of 100 millirems per year. The 1990 data should also be compared to background levels or promulgated standards.

101. Table 4-7, Page 4-24. This table lists estimated radionuclide airborne emissions for 1988 through 1990. This table does not include radon or thoron. The data for radon and thoron should be added to the table.

102. Table 4-8, Page 4-25. This table gives uranium concentrations in air for 1988 through 1990. The table should indicate which station locations represent upwind or background locations.

103. Table 4-10, Page 4-28. This table contains two subscripts (e and f) that are not defined in the footnotes below the table. This omission should be addressed.

104. Section 4.1.3.1, Page 4-30, Line 9. The text uses Station W1 for background values for the Great Miami River. However, the wind rose diagram (Figure 2-5) shows frequent winds in that direction. The surface soil data (Section 4.1.5, especially Figure 4-6) shows that air

emissions (Table 4-7) have produced measurable contamination in the vicinity of Station W1. DOE should select a true background site for the Great Miami River and should consider Section W1 as possibly contaminated by air emissions and associated surface runoff.

105. Section 4.1.3.1, Pages 4-30, Line 20. The text notes that the concentrations of Technetium-99 was lower at the downstream location than at the upstream location. In fact, Technetium-99 was found at the background location at 60 times the downstream concentration. This data suggests that the FEMP has impacted the upstream location and that it should not be used as a background location. DOE should either provide evidence of a viable upstream source or re-evaluate the use of this sampling point as a background location.

106. Section 4.1.3.1, Pages 4-30 through 4-39. The usefulness of the surface water and sediment data presented here is not clear. The nearest downstream sampling locations are 4 miles downstream from the FEMP. The rationale for designing this type of sampling scheme and the usefulness of this data should be further discussed in the text.

107. Section 4.1.3.1, Page 4-30, Lines 7 and 8. This sentence states that the surface water and sediment sampling programs record the effect of routine discharges of treated effluent into the Great Miami River. The river also periodically receives untreated surface water runoff during large storm events. This fact should be noted in the text.

108. Section 4.1.3.1, Page 4-30, Line 10. Figure 3-10 states that the sample data presented was collected from 1976 to 1990, but the title of Section 4.1.3.1 says 1977 to 1991. This discrepancy should be addressed.

109. Section 4.1.3.1, Page 4-30, Line 10. This sentence states that background conditions for surface water and sediment were established at Station W-1. The usefulness of background data from this location is highly questionable because it is directly downwind of the FEMP.

Background data may be biased high from (1) deposition of airborne particulates directly onto surface water and sediment at this location and (2) discharge of overland surface water runoff containing airborne particulate-derived contaminants deposited in this portion of the drainage basin. Table 4-11 provides many examples of the background concentrations of radionuclides at Location W1 exceeding the concentrations detected at downstream locations. The appropriacy of using locations in this area as background locations should be completely addressed in the report.

110. Section 4.1.3.1. Not all sampling locations referenced in this section and in Tables 4-11 through 4-14 are shown in Figure 3-10 as the text indicates. This discrepancy should be addressed.

111. Table 4-14. This table does not provide specific details regarding sampling locations. The appropriate station locations and figures showing these locations should be cited in the table. Also, the row showing Radium-223 data indicates that no samples were collected; however, a concentration range is cited. This discrepancy should be reconciled.

112. Section 4.1.3.1, Page 4-40, Line 12. The concentration of uranium at Ross Bridge is identified as 10 micrograms per liter (μg/L). U.S. EPA notes that this concentration is higher than the values for Paddy's Run. DOE should discuss the possible reasons for uranium contamination in the upstream sample, including the possibility that FEMP emissions may have affected this area.

113. Section 4.1.3.1, Page 4-40, Line 16. The phrase "declined to background at sample location R-3" should be clarified. Sampling location R-3 is upstream of the confluence with Paddy's Run.

114. Section 4.1.3.1, Page 4-40, Lines 28 through 34. None of the data presented in this paragraph appears in tables, nor is it referenced in an appendix. This omission should be addressed.

115. Table 4-17, Page 4-45. This table indicates that samples R1 through R4 were collected in March 1986; however, the discussion on Page 4-40, Line 11, states that these samples were collected in 1985. Also, this table is referenced in Section 4.1.3.1, which is titled "Great Miami River"; however, data for Paddy's Run is also presented in this table. These discrepancies should be addressed.

116. Section 4.1.3.1, Page 4-48, Line 1. This sentence states that PCBs detected in sediments of the Great Miami River are probably associated with a PCB spill that occurred in Dayton, Ohio, in 1987; however, the studies cited in this section were conducted in 1985 and 1986. Therefore, this conclusion is unfounded and should be deleted or further supported.

117. Section 4.1.3.1, Page 4-48, Line 9. This sentence makes reference to the upstream sampling location. It is not clear whether this is a reference to a background location. This sentence should be clarified.

118. Section 4.1.3.1, Page 4-48, Lines 12 and 13. The percentages by which the uranium concentration increased should be stated. The concentration of Thorium 227 should also be stated.

119. Section 4.1.3.1, Page 4-48, Line 18. DOE references previously identified background levels. The background levels should be clearly defined and included in the corresponding tables.

120. Table 4-19, Page 4-49. The meaning of the first row of data, titled "Radioactivity (μR/hr)" is not clear. All the data entries in this row read "BKG." This part of the table should be clarified.

121. Table 4-20, Pages 4-51 and 4-52. Total uranium, metals, and organics were not sampled for at the background locations, making the comparisons with downstream locations unrealistic. The implications of these omissions should be expanded. Also, the background radioactivity levels

referenced here seem to be for ambient air. This matter should be clarified.

122. Section 4.1.3.1, Page 4-54, Lines 25 through 28. This paragraph should provide a more thorough description of the sampling locations and dates and the analyses performed for the study discussed.

123. Section 4.1.3.1, Page 4-54, Lines 32 and 33. This sentence states that the range of downstream uranium concentrations was about two times higher than that of upstream concentrations. Table 4-23 indicates that the mean total uranium concentration was three times higher than the upstream concentrations and that the range was as much as five times higher. This discrepancy should be addressed.

124. Table 4-22, Page 4-55. This table does not include a description of the superscripts used in the table. Also, concentration units are not provided for many of the compounds listed. These omissions should be addressed. Also, this table lists the chronic aquatic life criterion of zinc as greater than the acute criterion. DOE should check its sources and correct the table.

125. Section 4.1.3.1, Page 4-57, Line 1. This sentence states that, apart from uranium and its isotopes, only three radionuclides were detected. Table 4-23 indicates that five other radionuclides were detected. This discrepancy should be reconciled.

126. Section 4.1.3.1, Page 4-57, Lines 12 and 13. This sentence states that no heavy metal concentrations are elevated in river water at downstream stations relative to observed concentrations at background stations. Given the problems mentioned above regarding selection of background sampling locations and the great distance between the site and downstream locations, this conclusion is probably premature and should be reconsidered.

127. Section 4.1.3.2, Page 4-57, Line 26. DOE includes Station W9 as an upstream sampling location. The fact that Station W9 is on FEMP property and could be affected by site contamination should be noted.

128. Section 4.1.3.2, Page 4-73, Lines 13 and 20. The presentation of data here and in Table 4-31 is misleading. Table 4-31 combines data for sampling points W-5 (background), W10, and W11 to indicate area concentrations between the FEMP's northern boundary and its confluence with the Storm Sewer Outfall Ditch (SSOD). Background sample results should be clearly defined and shown separately. In this case, and in many others, the data would be better represented in a figure.

129. Section 4.1.3.2, Page 4-79, Line 2. DOE uses the term "upstream" instead of "background" to define results for location W-5. The report should clearly indicate the relevance of comparative sampling points described as "upstream" or "background."

130. Section 4.1.3.2, Table 4-33, Page 4-80. The gross alpha results for the single downstream sample are listed as a range of 16.0 pCi/g and a mean of 6 pCi/g. DOE should correct this discrepancy.

131. Section 4.1.3.3, Page 4-84, Line 15. The text states that "No above background levels of inorganic chemicals were noted." Background levels should be clearly defined and included for direct comparison.

132. Section 4.1.3.4, Page 4-84, Line 29. DOE uses a comparative standard of 550 pCi/L for data comparison here. The rationale for comparison should be provided. This standard is at least 50 times the background level and seemingly irrelevant. In addition, the results for sampling locations DD07 and DDACT3 in Table 4-36 actually exceed this standard, which is not stated. The data should be compared to background levels.

133. Table 4-36, Page 4-85. This table indicates that the heavy metals cadmium and mercury as well as many radionuclides and organics were not analyzed for. The rationale for this omission should be presented.

134. Section 4.1.3.4, Page 4-91, Lines 1 through 11. This discussion provides a very limited summary of the surface water data collected during the study. The discussion, particularly with regard to sampling locations and contaminant concentrations, should be expanded.

135. Table 4-37, Page 4-92. See General Comments No. 6 and 12 with regard to uranium isotopes, metals, and organics.

136. Table 4-38, Page 4-94. The units given in this table for organics are wrong; "gR/kg" should be corrected. The report should clearly indicate what these units are and why, if they represent grams per kilogram, they are so high.

137. Section 4.1.3.4, Page 4-100, Lines 1 through 22. None of the data summarized in these paragraphs is presented in tables, and no sampling locations are cross-referenced with corresponding figures. Concentrations of uranium-238 are cited, but their corresponding sampling locations are not (Line 5). These omissions should be addressed.

138. Section 4.1.3.5, Page 4-41, Lines 3 through 8. None of the manhole sampling data presented in this section is presented in a table, and no appendix is referenced. This omission should be addressed.

139. Section 4.1.3.5, Page 4-101, Line 6. The DOE standard noted here, "600 pCi/L," is inconsistent with that used on Page 4-89. As noted earlier, the relevance of this comparison is questionable; the result should be compared to the background level.

140. Section 4.1.3.5, Page 4-101, Line 13. This sentence states that "higher than average values" for specific analytes were observed. It is not clear whether the term "higher than average" refers to a statistical mean or a background level. This sentence should be clarified.

141. Section 4.1.3.6, Page 4-101, Lines 30 through 32. This sentence states that the sampling of surface water and sediments not included in sampling efforts for the Great Miami River, Paddy's Run, and the SSOD has focused on characterizing the conditions in the immediate vicinity of waste management units. This implies that many other on-site surface water bodies and surface drainages have not been investigated. A complete inventory of these site features should be presented along with clear discussion of the characterization activities performed for them.

142. Section 4.1.3.6, Page 4-102, Lines 31 and 32. This sentence states that organic compounds were "typically not present." This sentence is vague. The text should clearly state whether organics were detected, and a thorough discussion of relevant data should be provided.

143. Section 4.1.4.1.1, Page 4-104, Lines 22 through 27. A great deal of data is summarized here that is difficult to evaluate without corresponding figures. For this section and subsequent ground-water discussions, significant data should be plotted on figures.

144. Section 4.1.4.1.1, Page 4-105, Lines 18 through 23. The text suggests that another source of elevated radionuclides is evident. To allow evaluation of this hypothesis, more information needs to be provided. At a minimum, the information should be provided in figures.

145. Section 4.1.4.1.2, Page 4-105, Lines 25 through 28. This paragraph states that iron and manganese concentrations exceeding the secondary maximum concentration limits (MCLs) are typical for the area. A thorough discussion of iron and manganese concentrations in background locations should be presented, and these concentrations should be compared to FEMP ground-water monitoring data to support this assertion.

146. Section 4.1.4.2.1, Page 4-108, Lines 10 and 11. This sentence states that only Wells 12, 15, and 17 had annual total uranium concentration averages exceeding the background concentration of 2 pCi/L; however, Table 4-42 indicates that Well 34 had an annual total uranium

concentration average of 2.8 pCi/L in 1990. This discrepancy should be addressed. Also, the following paragraph compares total uranium concentrations with the 22-pCi/L DOE drinking water guideline, not the proposed MCL.

147. Section 4.1.4.2.1, Page 4-108, Lines 23 through 35. This section discusses data for over 150 wells, yet the information is presented only in tabular form. Without graphical display of the data, it is difficult to evaluate the discussion. Significant data, particularly data indicative of a plume, should be plotted figures.

148. Table 4-42, Page 4-110. Footnote b refers the reader to Figure 3-16 for well locations. This figure shows the locations of production area manholes. This discrepancy should be addressed.

149. Section 4.1.4.2.2, Page 4-111, Lines 24 through 31. This section discusses "major radionuclides of concern." The report should fully describe and justify how radionuclides were placed in such a category. Also, this section compares these "major radionuclides of concern" with "DOE guidelines." Throughout this report, all data should be compared to background levels and applicable standards. DOE standards should be used for comparison only when applicable U.S. EPA guidelines or regulations do not exist.

150. Section 4.1.4.2.3, Page 4-115, Line 4. Well 3066, which could not be located in a figure, appears to be northwest of the facility and not "northeast" as indicated in the text. The location of the well should be clarified and included in a figure.

151. Section 4.1.4.2.3, Page 4-115, Lines 11 through 17. The discussion of data for on-property wells is inadequate. The data is presented in Table 4-45 as average values for each indicator parameter; the averages include all data from all wells. The data should be presented individually by well, and the change over time (1984 to 1990) should be discussed.

152. Section 4.1.4.2.4, Page 4-115, Line 29. This sentence makes reference to the 13 "traditional" on-property wells. This term should be defined.

153. Table 4-45, Page 4-116. This table provides an explanation in the footnotes for superscript d; however, subscript d does not appear in the table. Also, superscript e appears in the table but is not defined in the footnotes. These discrepancies should be resolved.

154. Section 4.1.4.3, Page 4-118. The introduction to this section should provide a thorough description of the RCRA monitoring system. The introduction should identify the wells in the system and should provide a map showing their locations. Also, significant results should be shown in figures.

155. Section 4.1.4.3.1, Page 4-122, Lines 6 through 8. This paragraph states that Radium-228 is an alpha decay product of Thorium-232 and that the elevated concentration of Radium-228 in Well 1022 is a result of this phenomenon. However, this argument cannot be used to explain the elevated levels of Radium-228 in Well 1021 because Thorium-232 was not detected in this well. This line of reasoning needs to be further supported or removed from the text.

156. Section 4.1.4.3.1, Page 4-122, Lines 23 through 25. This sentence lists wells with concentrations of total uranium "less than or close to background." This sentence implies that some of the wells in the list contain total uranium at levels above background concentrations. It is not clear what "close to background" means. This type of data treatment is potentially misleading and should not be used.

157. Section 4.1.4.3.4, Page 4-131, Lines 2 through 4. This sentence states that a number of other organic compounds were detected but provides no further explanation. This discussion should be expanded to identify the other compounds.

158. Section 4.1.4.3.4, Page 4-131, Lines 24 through 30. VOCs were evidently detected in many wells during this investigation. If a plume is evident in the sand and gravel or perched aquifer, it should be defined and shown in a figure.

159. Table 4-50, Page 4-133. The reported concentrations for phenols and trichloroethene (0.006 μg/L and 0.0044 μg/L, respectively) in Monitoring Well 2004 are several orders of magnitude below contract laboratory program (CLP) contract required quantitation limits (CRQLs). These concentrations should be double-checked for accuracy.

160. Section 4.1.4.4.1, Page 4-138, Lines 26 through 28. This sentence states that a water sample collected from the oil-fire pond revealed the highest total uranium concentration found in any water sample from the area. No further information is provided. The exact sampling location, sample number, and concentration should be provided.

161. Section 4.1.4.4.1, Page 4-142, Line 4. According to the discussion, radionuclides were repeatedly detected in 31 wells. The frequency of detection is fairly high. The discussion should be modified to discuss the frequency of detection and the repeated detection of radionuclides.

162. Table 4-51. Total uranium is misspelled throughout this and subsequent tables. This error should be corrected.

163. Table 4-53, Page 4-145. The upper tolerance limits (UTL) for barium, lead, and nickel are above existing MCLs. The use of such high UTLs is misleading and may lead to incorrect risk assumptions and inaccurate data reporting. This issue should be discussed.

164. Section 4.1.4.4.1, Page 41-152, Lines 25 through 35. These paragraphs provide a very limited discussion of the organic contamination. This discussion should be expanded.

165. Page 4-158. This page was not submitted with the draft report and thus was not reviewed.

166. Section 4.1.4.4.2, Page 4-159, Lines 19 through 28. This paragraph suggests that nitrate and ammonia concentrations differ in the various Great Miami Aquifer tributaries because of differences in the amount of chemical reduction occurring. The possibility that these differences are related to agricultural activities should be explored.

167. Section 4.1.4.4.2, Page 4-160, Line 24. This sentence states that "statistically elevated" uranium concentrations were found in ground-water samples from various locations. A definition of the term "statistically elevated" should be provided.

168. Section 4.1.4.4.2, Page 4-160, Lines 31 through 33. This sentence presents data for a well that displayed "consistently elevated uranium concentrations." This implies that wells showing occasional elevated concentrations are not discussed in the report. This issue should be clarified.

169. Table 4-60, Pages 4-176 and 4-177. This table presents UTLs for inorganic compounds. Many of the UTLs are above existing MCLs. This matter should be further discussed.

170. Section 4.1.5.3, Page 4-195, Lines 17 and 18. This sentence states that different laboratories were used to analyze the samples in 1985 and 1986 and that this may account for the differences seen in the analytical results. In the absence of any proof, this type of speculation should be removed from the report.

171. Section 4.1.5.3, Page 4-195, Lines 26 and 27. This sentence states that all but three off-property sampling locations displayed uranium concentrations within the range considered background for Ohio. All data should be compared to background conditions established in the FEMP area.

[redacted]

172. Section 4.1.5.3, Page 4-195, Lines 31 through 33. This sentence states that when sampling and analytical uncertainties were considered, the uranium concentrations in three of the remaining 10 locations were within background range. The phrase "sampling and analytical uncertainties" should be explained along with the procedures used to identify these uncertainties and remove them from the data.

173. Figure 4-7 and 4-8. The sampling location numbers should be provided in these figures.

174. Figure 4-8. According to this figure, the sampling locations farthest upstream are located adjacent to the FEMP; no background stations are shown that would allow upstream versus downstream comparisons. The data presented indicates decreasing invertebrate community indices for Paddy's Run as this stream flows through the FEMP. Therefore, an indication of the upstream (background) water quality would be useful. This data should be provided.

175. Section 4.1.7.2, Page 4-309, Lines 33-35. This sentence states that no consistent differences in uranium concentrations have been observed between produce samples collected adjacent to the FEMP and at reference locations; however, all the data for corn and tomatoes presented in Table 4-85 shows significant elevations in uranium concentrations compared to the data for the reference locations. This discrepancy should be addressed.

176. Table 4-84, Page 4-310. This table presents average uranium and fluoride concentrations in grass and forage at varying distances from the FEMP over time; however, results are presented as single averages from samples collected between 0.10 and 40 kilometers away from the FEMP. The usefulness of data presented in this manner is questionable. A justification for this type of data treatment should be provided in the report.

[redacted]

177. Section 4.1.7.2, Page 4-313, Lines 4 through 8. This sentence states that the high uranium concentrations in milk samples collected near FEMP in 1989 and 1990 were incorrect because other samples had concentrations below detection limits and because air monitoring equipment detected no uranium releases from the FEMP. This rationale for discounting the milk sample data is questionable. The text should state whether the air monitoring equipment can be guaranteed to detect such releases.

178. Section 4.1.7.2, Page 4-313, Lines 10 through 12. This sentence states that "there were not consistent differences among the three sample locations, although fish collected from the outfall and downstream stations showed markedly higher uranium concentrations than those from the upstream location in 1988." Also, the data presented in Table 4-87 indicates similar uranium concentration increases at this location in 1985 and 1989. This sentence appears to be contradictory and should be clarified.

179. Summary, Page S-1, Line 19. In view of the incomplete nature of the data and the partial validation of the available data, the results should be qualified in the introduction. Section 1.3 has language that can be adapted to this purpose.

180. Summary, Page S-7, Line 17. As in the Executive Summary, earthworms are called insects. This should be corrected.

181. Section 2.1.3, Page 2-17, Line 27. This bullet discusses criteria for including nondetect results in sample averages. DOE's procedure is acceptable. However, the risk-based quantitation limits should be extended from chemicals to radionuclides using the same procedures and the same sources for risk values.

182. Section 2.2.2, Page 2-20, Lines 1 through 20. This text discusses a concentration-toxicity screen for eliminating chemicals from further consideration as threats to human health or the environment. U.S. EPA is not convinced that the data for the FEMP includes so many chemicals

that some should be dropped before actual risk-based calculations are done. Furthermore, the last sentence misstates the criterion for elimination of chemicals as given in the cited guidance. The sum of all eliminated chemicals, not each individual eliminated chemical as stated by DOE, must be no more than 1 percent of the total risk. U.S. EPA recommends calculation of all risks from all contaminants present at or near the FEMP.

183. Section 2.3, Page 2-20. The tables in this section contain just the chemicals and radionuclides retained as constituents of concern. U.S. EPA recommends that these or supplementary tables list all constituents reported in at least one sample but rejected as not being of potential concern and the reason for this rejection.

184. Section 2.3, Page 2-25, Table 2-6. It is doubtful that the "background" data for the Great Miami River (Sampling Point W1) represents true background condition. Additional information should be provided to support DOE's contention.

185. Section 2.3, Pages 2-38 and 2-40, Table 2-13. On these pages, nitrate is listed under "Organics." DOE should list it under "Inorganics" as is done on Page 2-37.

186. Section 3.1.2.2, Page 3-5, Line 8. This section discusses critical subpopulations within 5 miles of the FEMP. Because there are multiple sources within the FEMP, DOE uses the center of the entire facility as the basis for measuring distances. This is contrary to the method used in the Hazard Ranking System (40 CFR 300, Appendix A), which measures distances from the boundaries of the source areas. At the FEMP, the source areas are the operable units including the South Plume, which extends well beyond the fence line. DOE should redraw its radii and, if necessary, include additional sensitive receptors in this discussion.

187. Section 3.3.1.1, Page 3-17, Line 24. The text states that evaluation of risks from hazardous chemicals is unnecessary because the estimated

exposures are much lower than the current ambient air quality standards. This reasoning is questionable because lead is the only on-site hazardous chemical with an ambient air quality standard. However, the conclusion is correct because risk calculations for persons exposed for a lifetime to such maximum point concentrations are well below the levels of concern. DOE should revise its reasoning and should include an example of the risk calculations for these data.

188. Section 3.3.2.1, Page 3-20, Line 27. The text states that well locations are shown in Figures 5-4 and 5-5. However, those figures show only 10 of the 21 wells cited in text. DOE should modify the figures to show all the well locations or reference suitable figures in Part I.

189. Section 3.3.2.1, Pages 3-23 through 3-28, Tables 3-5 and 3-6. In these tables, a number of analytes (such as thorium and carbon disulfide) are listed without exposure point concentrations. If an analyte was not detected above the background level in any relevant wells, then the line should be deleted. If any analytes were detected, the data should be included here and in succeeding calculations. DOE should revise these tables accordingly. This comment also applies to Table 3-9 and other tables on later pages.

190. Section 3.3.2.2, Page 3-30, Lines 5 and 6. In the modelling of future ground-water concentrations, DOE omits modelling for concentrations equivalent to a 10^{-7} cancer risk, a 20 percent hazard quotient, or less. These cutoff criteria are acceptable for single chemicals, but not for mixtures of many chemicals as are found at the FEMP. The most appropriate criteria are a 10^{-8} cancer risk and a 1 percent hazard quotient, which would be consistent with DOE's exclusion of pathways contributing less than 1 percent of the risk. DOE should revise its criteria and recalculate results as necessary.

191. Section 3.4, Pages 3-66 through 3-69, Tables 3-15 and 3-16. These tables contain many undefined acronyms (IR, ET, EF, ED, BW, AT7, FI, SA, PC, AF, ABS, DR, and possibly others). DOE should define these acronyms

in the footnotes. If an acronym is used in other contexts, it should be included in the list in the prefatory material.

192. Section 3.4, Pages 3-66 through 3-69, Tables 3-15 and 3-16. An inhalation rate of 0.83 cubic meters per hour (m^3/hr), which is equivalent to 20 m^3/day, is used here for all adult exposures. This is reasonable for day-long exposures including rest and sleep. However, it seems likely that shorter exposures such as those for a delivery man and a scavenger would involve significant manual labor and a consequent increase in respiratory volume. Therefore, U.S. EPA recommends using a greater inhalation rate, perhaps 2 m^3/hr, for these exposures. DOE should revise the parameters and recalculate results as necessary.

193. Section 3.4, Page 3-68, Table 3-16. The adult ingestion rate for soil or sediment is incorrectly listed as 0.01 grams per day. The correct rate is 0.1 gram per day [U.S. EPA, 1991, Human Health Evaluation Manual, Standard Default Exposure Factors. OSWER Directive 9285.6-03 (March 25)]. All calculations using 0.01 grams/day should be redone.

194. Section 3.4, Pages 3-68 and 3-69, Table 3-16. The adult residential exposure is incorrectly listed as 9 years. The correct adult residential exposure is 24 years (U.S. EPA, 1991). All calculations using 9 years should be redone.

195. Section 4.1.1, Page 4-1, Line 25. This text cites the Health Effects Assessment Summary Table (HEAST) (SWC reference: EPA, 1992) as the primary source of reference doses (RfD). Line 32 repeats the citation for slope factors of chemical carcinogens, and Line 5 on page 4-16 repeats the citation for radionuclides. However, U.S. EPA guidance (SWC reference: EPA, 1989b) gives HEAST as the secondary source for these toxicity values and gives the Integrated Risk Information System (IRIS) as the primary source. Although the 1991 and earlier editions of HEAST included the toxicity values in IRIS, the cited current edition of HEAST merely refers the reader to IRIS. DOE should change the text to

reflect guidance priorities for the toxicity values and should confirm that the tabulated values reflect these priorities.

196. Section 4.1.1, Page 4-2, Table 4-1. The headings do not indicate whether the chronic or subchronic RfDs are listed. Also, a spot check of the table against HEAST (SWC reference: EPA, 1992) revealed discrepancies, including the sources of the values for boron and cadmium and the valency of chromium. DOE should ensure that chronic RfDs are given and clearly labeled. Also, all values here and in Tables 4-2 and 4-3 should be checked against the references.

197. Section 4.1.1, Pages 4-2 through 4-4, Table 4-1. Incorrect RfDs are listed for chromium, lead, and 1,1,2,2-tetrachloroethane. In addition, an RfD and an RfC were calculated for cobalt. Although references are provided for the data used in these calculations, the calculation including the uncertainty factors and rationale for the selection of the critical studies and critical effects as the basis for the RfD and RfC should also be provided.

198. Section 4.1.3, Page 4-16, Line 8. The text cites Table C in HEAST as the source for radionuclide slope factors. In the 1992 edition of HEAST cited by DOE, these slope factors are given in Table 4. DOE should correct the error.

199. Section 5.2.1.1, Pages 5-13 through 5-15, Figures 5-1 through 5-3. The numerals in these contour plots are not clear. The line between the "2" and "10" contours could be "5", "6", or "9." DOE should redraw the figures using a larger type size and, if possible, a different font. This recommendation also applies to Figures 5-6 through 5-8 but not to Figure 5-9.

200. Section 5.2.1.3, Page 5-26, Line 17. The text says that the Great Miami River data for the location upstream of FEMP's effluent outfall is assumed to represent background levels. This assumption is not sound and should be reconsidered.

201. Page 5-75, Figure 5-10. This figure, and its accompanying text (Page 5-73, Paragraph 1) are intended to describe the change in cancer risk over time resulting from radiologic contamination of the ground water. However, this figure is confusing in its present form. Cancer risk increases as the values change from 2E-2 to OE+O. Cancer risk decreases as the values change from 2E-2 to 2E-6. It would seem that the correct Y-axis for this graph should show a maximum risk value of 2E-2 as shown, but that the risk should decrease to either 2E-4 or 2E-6. This apparent discrepancy should be addressed.

202. Section 5.4, Pages 5-103 through 5-109. Only uncertainties relating to overestimation of risk are discussed. Uncertainties that contribute to underestimation of risk should also be discussed. These include (1) lack of risk values for all contaminants in all media and (2) use of the additivity assumption, which ignores synergistic activity of chemical and radiological toxicity. These type of uncertainties should be added.

203. Section 6.3.2.1, Page 6-4, Line 26. The estimate of contamination intake given here is incomplete for ground-dwelling rodents, lagomorphs, and other mammals. These species contact near-surface soil in their burrows, especially when digging, and ingest some when grooming. DOE should include this intake in its estimate, including propagation up the food chain.

204. Section 6.3.2.1, Page 6-16. The uncertainty factors used to modify toxicity values for the ecological risk assessment include 0.2, which is used to convert lowest observed effect levels (LOEL) to no observed effect levels (NOEL). However, in the development of RfCs and RfDs for the human health risk, a conversion factor of 0.1 is used for this extrapolation. The use of the different extrapolation factor should be justified. In addition, for the purposes of justification, a reference should be provided for the use of 0.2 to extrapolate oral 50 percent lethal dose (LD_{50}) values to acute NOEL values.

205. Section 6.3.2.2, Page 6-17, Line 19. This equation for converting activity to dose contains an unidentified numerical factor. DOE should define this factor or provide a reference for deriving it.

206. Page 6-18, Table 6-7A. Typographical errors appear in this table that should be corrected. For example, 0.1 is the species factor for cobalt, not the human uncertainty factor, and 0.00026 is the wildlife NOEL rather than the acute-to-chronic factor for cobalt.

207. Page 6-19, Table 6-7B. Incorrect RfDs and uncertainty factors are listed for barium, beryllium, and nickel. Typographical errors appear in the entry for cobalt similar to those indicated above. These errors should be corrected.

208. Section 6.4.2.2, Page 6-65, Table 6-23. The entries on this page of the table seem to be misaligned. DOE should correct the alignment.

209. Section 1.1, Page 1-1, Line 28. This discussion of the objectives of the LRAs omits one significant factor. A standard doctrine of health physics is called ALARA for "as low as reasonably achievable." This doctrine is explicitly required of medical facilities in 10 CFR 35.20 and is implicit elsewhere in the regulations. Although the LRAs given here appear to be in accordance with ALARA, DOE should include a brief discussion of this doctrine and its applications to the LRAs for the various operational units (OU).

210. Section 2.2.1, Pages 2-15 through 2-20, Table 2-2. This table lists various federal water quality standards, including MCLs. However, it omits the latest list of MCLs announced in the Federal Register in July 1992. DOE should include these new values and should change "proposed" to "final" in the table.

211. Section 3.1, Page 3-1, Lines 35 through 37. The statement, "Stable waste materials such as concrete construction rubble and debris will be crushed and sent directly for disposal," indicates that the stable waste

would be disposed of without being tested for residual contamination. The SWC should indicate that waste materials will be sent directly for disposal only if they are not contaminated above the levels of concern. In addition, the report should clarify whether the stable materials would be disposed of in an on- or off-site disposal facility.

212. Section 3.2, Page 3-3, Lines 28 and 29. This statement should indicate whether waste oils were contaminated with radionuclides if this information is available.

213. Section 3.4, Page 3-7, Lines 37 and 38. This statement should indicate whether the stabilized waste will be disposed of in an on- or off-site facility.

214. Appendix A, Page A-9, Table A-1. The text of footnotes c and d is scrambled. DOE should correct the text of both footnotes.

215. Appendix C, Section C.1.3, Page C-1. The text discusses the population within a 5-mile radius of the FEMP but does not give the origin of the radii. As detailed above, the origin should be the boundary of the FEMP or the boundary of the South Plume where it extends beyond the fence line.

216. Appendix N, General. The methodology for calculating and using risk-based quantitation limits for chemicals should be extended to radionuclides. This appendix uses the obsolete 1991 edition of HEAST, but that is acceptable because it was apparently prepared before the 1992 edition became available. However, DOE should do future risk assessments for the FEMP using the most recent edition of HEAST.

217. Appendix R, General. There are some obvious gaps in this appendix, beginning with the third entry (thorium-228) in Table R.1-1. Two samples contained this radionuclide at concentrations of 411 pCi/g and 638 pCi/g; the other 11 samples contained none. However, the mean concentration is given as 285.77 pCi/g with no indication of how this value was calculated. Similarly, there is no explanation of how the 95

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percent upper confidence intervals were calculated, a matter complicated by the presence of both normal and lognormal distributions in this appendix. DOE should include a detailed discussion of the methodology used to generate these numbers in the introductory part of the appendix. This recommendation also applies to Appendix T.

218. Appendix S, General. This appendix gives a single example of calculations but no details for the other types of data. As with Appendixes R and T, DOE should include the formulas for all calculations, and should identify all pathways, all scenarios, and all types of risk (noncarcinogenic, chemical carcinogenic, and radionuclide carcinogenic).