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OHIO EPA'S COMMENTS ON THE RISK ASSESSMENT WORK PLAN ADDENDUM

11/19/91

OEPA/DOE-FO
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LETTER

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George V. Voinovich
Governor

November 19, 1991

Mr. Jack R. Craig
Project Manager
U.S. DOE - FMPC
P.O. Box 398705
Cincinnati, Ohio 45239

Dear Mr. Craig:

Attached are Ohio EPA's comments on the Risk Assessment Work Plan Addendum. Even with the large number of comments, we believe the document represents a good start for assessing risk at FEMP. Ohio EPA appreciates the efforts taken by DOE and their contractors this past summer to negotiate and resolve major risk issues.

However, Ohio EPA is concerned about issues raised in Section 10. The section appears to be outside the scope for a risk assessment work plan. Incorporating risk management issues into this work plan only clouds the issue of risk assessment methodology.

If you have any questions or want to have a meeting to discuss these comments please contact me.

Sincerely,

Graham E. Mitchell
Project Manager

GEM/bjb

cc: Kathy Davidson, OEPA
Jim Saric, U.S. EPA
Lisa August, GeoTrans
Ed Schuessler, PRC
Robert Owen, ODH

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OHIO EPA COMMENTS
RISK ASSESSMENT WORK PLAN ADDENDUM

General Comments

1. The Amended Consent Agreement (9/91) stated that the boundaries for operable units 1, 2, and 4 would be defined as approved in the RI/FS work plan addendum. No specific figures within the Risk Assessment Work Plan Addendum are called out to define these boundaries. DOE should explicitly propose operable unit boundaries within a section of this document and provide justification for the proposed boundaries.

2. Lack of Model Validation with Site Data - There is no feedback loop between the model results and measured field data. In particular, the groundwater flow and transport modeling can and should be validated to the extent possible. Similar to the uranium south plume modeling, comparison with historic data should be discussed and developed into the plan to improve model representation. The modeling work plan appears to understate the importance of a "reality check".

3. Too Much Emphasis on Vadose Modeling - There is too much reliance on the use of vadose modeling. Unsaturated flow and transport analysis is a difficult and challenging area that requires more than the simple discussion presented in the work plan. There is also little justification that vadose modeling is even required. Because steady-state flow in the vadose is assumed, and little attention is paid to degradation in the vadose zone, there does not seem to strong rationale for even including it in the analysis. In a one-dimensional representation, downward transport will reach steady-state conditions. This would result in a vertical concentration profile that parallels the moisture profile.

4. Selection of Parameter Values - In general, fate and transport models should be used to estimate upper-bound exposure point concentrations that may reasonably occur, in order to be consistent with the RME scenario. Parameter values used in fate and transport modeling should be selected with this in mind. Therefore, it may not be appropriate to use mean parameter values in most cases to reduce exposure point concentrations. Sensitivity analysis may be necessary to determine the impact that certain parameter values have on the results of the model. If significant differences in exposure point concentrations are obtained using a realistic range of model parameter values, then it may be appropriate to estimate exposure and risks based on a range of predicted exposure point concentrations.

Specific Comments

1. Page xvi, line 3: Typo - correct "dose' to read "does".

2. Page xviii, line 1: Change "hazardous waste" to "hazardous substance".

3. Section 1.7, pg. 7, line 22: Correct OU2 definition to agree with that in the Amended Consent Agreement (9/91). Change "sanitary waste landfill" to "solid waste landfill".

4. Section 1.7, pg. 11, line 6: In order to agree with the Comprehensive Site-Wide Operable Unit definition in the Amended Consent Agreement (9/91), ". . . , as required by CERCLA, the NCP, and applicable U.S. EPA policy and guidance" must be added to the end of the sentence.

5. Section 2.4, pg. 8, lines 17-19: The sentence suggests much of the data for the site has been presented in the RI/FS reports, yet only one operable unit RI has been submitted to the EPAs and it was not approved. The data may have been compiled in RI reports but these were never submitted. The paragraph should be rewritten.

6. Section 3,0, pg. 1, line 26: Describe the "DOE litigation studies" and include references for the studies.

7. Section 3, pg. 1, line 20: Addendum to the Workplan should reference the most recent draft of the QAPP.

8. Section 3.1, pg. 2, lines 10-11: DOE should not be using supplemental sources of background data. Background for the site should be established as an integral part of the RI process and completed under the RI/FS QAPP.

9. Section 3, pg. 5, line 31: Open literature sources for toxicity data must be checked by the Environmental Criteria and Assessment Office (ECAO) in Cincinnati.

10. Section 4, page 1, first bullet: Screening rad instruments which are not specific should also be mentioned.

11. Section 4.1, page 1, lines 23-24: If TICs appear often or TIC concentrations appear at high levels, then further evaluation of TICs is necessary, according to EPA (1989) guidance.

12. Section 4.2, pg. 1: This section appears to apply the guidance "Statistical Analysis of Ground water Monitoring Data at RCRA Facilities" to all media at the Site. This

section must describe how statistical evaluation of background will be accomplished for media other than groundwater.

13. Section 4.2, pg. 2, lines 5-7: DOE should incorporate Ohio EPA's policy "How Clean Is Clean" into the generation of tolerance intervals and the determination of background concentrations.

14. Section 4.2, pg. 2, lines 12-14: Three samples will not be adequate to characterize background and develop a tolerance interval. At a minimum DOE should collect 7 background samples (see Ohio EPA Policy, "How Clean is Clean").

15. Section 4.2, pg. 2, lines 15-16: The sentence states the background samples will be tested for normality. The paragraph fails to discuss what steps DOE will take if the data is found to be not normal. DOE should provide specific steps which will be taken.

16. Section 4.3, pg. 5, line 5-7: As stated in the RAGS (1989) document such exclusion must be approved by the EPA. These exclusions should be made on a chemical specific basis and submitted individually to the EPAs for approval.

17. Section 4.3, page 5, line 1-2: According to EPA (1989) guidance, one-half the Sample Quantification Limit (SQL) should be used as the surrogate concentration when the parameter is not detected.

18. Section 4.3, page 5, line 21-36: Most chemical distributions in nature tend to be lognormally distributed (Connor and Shacklette 1975, Dean 1981, Esmen and Hammad 1977, and Ott 1988). Therefore, normal statistics may not be appropriate for these comparisons. A test for normality should be performed. In addition, a more refined statistical test may be appropriate for comparing background concentrations such as Cochran's approximation to the Behrans-Fisher Student t-test. For lognormal distributions, the monitoring data should be log-transformed when performing the statistical test. 4

19. Section 4.3, pg. 7, lines 4-6: It should be noted that just because a contaminant is not a risk to human health it may present a risk to ecological receptors. Contaminants which present a risk to ecological receptors must be kept as contaminants of concern even if they pose little or no risk to human receptors. The NCP clearly provides for remediation based upon risks to the environment alone.

20. Section 5, pg. 1, line 24: "Is" should be "will be" since RI reports have not been prepared.

21. Section 5.1.1.3, pg. 3, Figure 5-1: Add a legend with scale and north arrow. Correct "Site Boundary" to "Property Boundary".

22. Section 5.1.3.2, pg. 14, line 15: Typo - correct "dispensable" to rad "dispersable".

23. Section 5.1.4, pg. 12, line 13: The 1990 census data should be used to help define potentially exposed populations.

24. Section 5, pg. 13, line 20-23: This sentence is incorrect. Suggested rewording - "The Great Miami River supports no commercial fisheries in the vicinity of the FEMP, but recreational fishing occurs downstream of the FEMP. A fishing advisory for PCBs in bottom feeding fish was issued in 1989 by the Ohio Department of Health based on data collected by Ohio EPA". The advisory is only for bottom feeding fish such as carp and catfish.

25. Section 5.1.4.1, pg. 13, lines 24-31: The paragraph should be corrected to state the Paddys Run Road Site and the Proctor and Gamble research facility are listed on CERCLIS. The paragraph should additionally state that the Paddys Run Road Site is undergoing a state-lead RI/FS and that the Proctor and Gamble research facility has undergone a Screening Site Inspection by the USEPA.

26. Section 5.1.4.1: The RAGS document discusses subpopulationswith respect to the site. DOE should not measure distances from the center of the FEMP but from the perimeter of the site, including the South Plume area.

27. Section 5.1.5, pg. 18, line 29: It is highly unlikely that striped bass (Morone saxatillis) were collected from the Great Miami River. Striped bass are not native to Ohio and have met with very limited stocking success in the State (Fishes of Ohio, Milton Trautman, 1981, Ohio State University Press). Hybrid striped bass have been stocked into the Ohio River. It is more likely that the fish actually collected were white bass (Morone chrysops), similar in appearance to the striped bass and native to Ohio. If voucher specimens were collected and archived, the specimens should be verified by an independent ichtylogist. 5

28. Section 5.2.1, pg. 20, line 3: Some sources might be in direct contact with groundwater. This scenario should be included in the potential water exposure pathways.

29. Section 5.2.2, pg. 21, line 19: The air exposure pathway should include all sources that may be releasing radon to the air. Data from other sources at the Site should be evaluated to determine if radon is released into the air.

30. Section 5.3: Two exposure routes that were not considered in the baseline risk assessment and perhaps should be evaluated include (1) dermal contact with sediments, and (2) incidental ingestion of surface water while swimming. The models and exposure parameters for these additional routes should be added to the report.

31. Section 5.4.1, pg. 32, Table 5-4: DOE should discuss the reason for choosing an adult as the RME for current situation, for OU 3. It is standard to use a child when calculating risk from soil ingestion.

32. Section 5.0, pg. 33, line 8-11: Please explain why the current situation RME for O.U.'s 2 & 3 only consider one exposure route. A trespasser in these areas, would most likely be exposed by more than one route (e.g. inhalation, dermal contact, direct radiation exposure, etc.).

33. Section 5.5, pg. 35, line 5: This section should describe how analytical results will be studied to determine if they are sufficient to conduct the quantitative evaluation of exposure pathways.

34. Section 6: Section 6 does not present a model for estimating exposure point concentrations for VOCs released from groundwater while showering. Inhalation of VOCs while showering may be an important exposure route.

35. Section 6.0, pg. 1, line 13: How were the models listed in Table 6-1 chosen? What was the criteria used in model selection? What if other models are found to be needed during the course of the assessment?

36. Section 6.0, page 1, line 20: How would one cross-check results from different models? As listed in the groundwater area, only one model is to be used. There appears to be too much focus on differences between models with little regard for true model verification or validation with field data.

37. Section 6, pg. 2: Why is SESOIL model listed, but not discussed in later sections?

38. Section 6.1, pg. 4, lines 2-10: The section fails to address the potential for waste to lie within the zone of saturation. This may be the case in some of the land disposal units, such as the lime sludge lagoons.

39. Section 6.1.1., pg. 4, line 30: It is unclear how a reaction path code will be used in conjunction with a fate and transport assessment. There are several codes that address geochemical mixing. One example, FASTCHEM, couples geochemical modeling and transport. (See Mangold and Tsang, 1991, for others.) The saturated-unsaturated flow field is simulated, defined into a number of stream-tubes and water chemistry is updated with space and time.

40. Section 6.1, pg. 4, line 26: The use of a solubility-limited source term could potentially lead to significant over estimation of the source concentration. Environmental measures of groundwater samples rarely display many of the organic compounds at or even near their solubility limits.

41. Section 6.1.1.1, pg. 6, line 10: Why is leachate A expected to be significantly different from leachate B? While this applies only to inorganics, of what significance is the change in water chemistry through the vadose zone? There seems to be too much focus on modeling and too little attention to field validation of this conceptual model.

42. Section 6.1.2.1, pg. 11, line 15: What are water and waterborne materials? Is this an indirect reference to dissolved (miscible) transport and non-aqueous (immiscible) transport processes?

43. Section 6.1.2.1, pg. 11, line 18: While gravity drainage is important, capillarity should also be mentioned here. Imbibition into dry soils can exceed gravity effects. Also it is capillarity that allows the perched zones to exist.

44. Section 6.1.2.1, pg. 11, line 20: The text now places greater reliability on measured leachate data and suggests that modeling (geochemical) will be reserved for constituents where data are not available. The document should be more direct and clear on this most important issue.

7

45. Section 6.1.2.1, pg. 11, line 22: It is not appropriate to use a one-dimensional representation in the vadose zone cutting through high and low permeability sections. This will lead to a conservative transport analysis. Because water will follow the path of least resistance (i.e., preferentially through high permeability zones), the model should follow these paths.

46. Section 6.1.2.1, pg. 11, line 32: There is no elaboration on the integration of the geochemical and flow models. What is implied here? Do you start with EQ3 analysis of the waste unit (leachate A), then simulate flow and transport through glacial overburden, follow with another EQ3 mixing and then continued transport to the water table?

47. Section 6.1.2.2, pg. 13, line 1: The models discussed are limited to one steady Darcy flux. Why is there no discussion of more detailed models such as SESOIL (Table 6-1)? The section seems to imply that vadose flow and transport modeling is comparable in difficulty and certainty as saturated models. Transport in the vadose will be significantly more difficult and subject to greater degrees of uncertainty. There is no substantiation that vadose modeling is required for the assessment. Based on the fact that contamination is known to exist in the saturated portion of the aquifer, why perform vadose modeling?

48. Section 6.1.3, pg. 13, line 21: What are water and waterborne materials?

49. Section 5, pg. 14, line 5: Ohio EPA requests a copy of the Flow and Solute Transport Computer Code Verification Report.

50. Section 6.1.3, pg. 14, line 24: While transport is dependent on the properties of the aquifer, there is equal and possibly greater dependence on the properties of the dissolved constituent. The plan should also address degradation (biological and radioactive decay) and sorption processes.

51. Section 6.1.4.1, page 14: There seems to be great emphasis on moisture content. The plan places great attention to this, but in the proposed modeling approach, this issue will be essentially lost. The steady Darcy flux approach in the vadose zone is dominated by uncertainty in the saturated hydraulic conductivity and assumed water flux (net recharge).

52. Section 6.1.1, Page 15: Provide values of dispersivity (longitudinal and transverse) to be used. It is not generally accepted to use the same dispersity in the vadose and saturated zones.

53. Section 6.1.4.2, pg. 16, line 24: There are numerous techniques for estimating the unsaturated hydraulic conductivity and moisture retention relationships. There are many articles appearing in Soil Science Society of

America. It is not appropriate to simply use values of conductivity from below the water table.

54. Section 6.1.4, pg. 18, line 1: If there is water ponded at ground surface, hydraulic greater than 1.0 can exist. It would not be conservative to simply assume that the gradient will not exceed 1.0.

55. Section 6.1.4.6, pg. 20, Table 6-3: a) The table fails to include a number of radionuclides known to be present on site (i.e., Ac-227, Pb-210, Rn-220). The table additionally fails to incorporate a number of inorganic contaminants at the FEMP. Table 6-3 should incorporate all radionuclide and inorganic constituents listed in table 4-2. b) A reference for the data in the table should be provided.

56. Section 6.1.4.6, pg. 19, line 14: Include Cleary et al. (1991) in the list of references.

57. Section 6.1.4.6, pg. 21, Table 6-4: The table should incorporate all organic constituents listed in Table 4-2.

58. Section 6.3.2, pg. 31, line 2: Reword the first sentence to make a complete sentence.

59. Section 7.1, pg. 2: The equation for estimating the 9th upper confidence limit (UCL) on the arithmetic mean concentration assumes that the chemical has a normal distribution. The equation presented in Gilbert (1987) (as cited in EPA [1989] guidance) for estimating the 9th UCL on the arithmetic mean, assuming a lognormal distribution, should be used when the chemical distribution is positively skewed. This approach may significantly change estimated exposure point concentrations.

60. Section 7.2: Exposure rates that were not considered in the baseline risk assessment and perhaps should be evaluated include: (1) dermal contact with sediments, (2) incidental ingestion of surface water while swimming, and (3) exposure to VOCs while showering (inhalation and dermal adsorption). The models and exposure parameters for these additional routes should be added to the report. 9

61. Section 7.1, pg. 3, paragraph 1 and 2: Please provide some justification for subtracting background concentrations of radionuclides but not chemicals.

62. Section 7.2, pg. 4: The averaging time for evaluating carcinogenic effects for all exposure pathways considered in the baseline risk assessment should be: 365 days x 70 years = 25, 550 days (not 24,500 days).

63. Section 7.2, pg. 7, line 8-9: It may not be appropriate to assume young children (i.e., 1 to 6 years) for evaluating exposure from incidental ingestion of soils while trespassing at the site under current land-use conditions. It may be more appropriate to assume older children for this pathway. Incidental ingestion of contamination on-site soils by young children may be appropriate for a residential scenario under future land-use conditions. For current land-use conditions, incidental ingestion of potentially contaminated household dust may be a more significant route to exposure to children in this study. If the air deposition pathway is significant, then such a pathway should be considered.

64. Section 7, pg. 9, line 8: Please define the variable (Biv[1]) and provide a reference for this equation.

65. Section 7.2, pg. 12: The equation for estimating exposure from direct contact with water is incorrect (the equation presented in EPA [1989] also was incorrect). The units for the permeability constant are "L/cm^2 /hr" (not cm/hr), and the conversion factor of "1 L/1000 cm^3 should be dropped from the equation. The permeability constant for water is 8.4 X 10^{-4} L/cm^2Hr. Thus, the equation presented in Section 7.2 on page 12 would underestimate this exposure route by a factor of 1000.

66. Section 7.2, pg. 13: The "Standard Default Exposure Factors" document (EPA 1991c, as cited in this report) should be included in the heirarch presented on page 13.

67. Page 13, line 15: The default exposure assumptions recommended by U.S. EPA are to be used only in the absence of site-specific information. It would be incorrect to use default values if documented site-specific values were available.

10

68. Section 7.2, pg. 14, line 20-23: An assumed skin surface area for young children should be used in order to evaluate exposure from direct contact with soil. Total body surface areas may be appropriate for only certain exposure pathways such as showering or swimming. The surface areas of only portions of the body (e.g., a portion of the total surface area of the arms, hands, legs and feet) should be used when evaluating exposure from direct contact with sediments and/or soils.

69. Section 7.2.2.1, pg. 14, lines 20-23, Surface Area: This data is available in the EPA RAGS, 1989 document. According to the document hierarchy shown on page 13, information from the RAGS documents should be used for surface area.

70. Section 7.2, pg. 15, line 21-22: Mean value ingestion rates for children are not consistent with the RME approach. Upper-bound ingestion rate values should be used where available.

71. Section 7.2, pg. 20, line 30-34: Skin permeability constants (PC) presented in the Superfund Exposure Assessment Manual (EPA 1988) have not been peer reviewed, and according to EPA (1989) guidance, should not be used in baseline risk assessments. In addition, the units presented in EPA (1988) and EPA (1989) are incorrect, as previously discussed (correct units: $L/cm^2/day$). The PC for water (8.4×10^4 $L/cm^2/day$) should be used to evaluate the permeability of chemicals in water, unless a higher chemical-specific PC is available in the literature.

72. Section 7, pg. 28, line 7: Provide a reference for equation (7-27) and for equation (7-31) on Page 30.

73. Section 7.4.2.1, pg. 28, lines 14-22: DOE should consider the groundhog (Marmota monax) as a terrestrial indicator species. Groundhogs are likely to receive one of the greatest exposure to contaminants both under current and future scenarios. Groundhogs would be exposed both through the consumption of vegetation and the direct exposure to wastes, contaminated soils, and gamma radiation.

74. Section 7.4.2.1, pg. 28, lines 21-22: A total of nine radioactive and four HSL samples seems grossly inadequate to develop or verify any model for the exposure of terrestrial animals.

75. Section 7.4.2.1, pg. 29, lines 5-7: The use of plant-to-beef transfer ratios for all herbivores requires additional justification and verification. Will this transfer ratio be used for the white-footed mouse? If so, DOE will need to collect verification samples to support this model.

76. Section 7.4.2.1, pg. 29, lines 11-18: The use of the 11 muscle as the location of contaminants is unacceptable. Different contaminants have different receptor organs where contaminants accumulate. This is especially obvious for

the radionuclides. DOE should discuss within the text the most likely receptor organs for the different contaminants of concern and provide justification for the use of muscle only.

77. Section 7.4.2.1, pg. 29, lines 19-22: The use of muscle for the sole source to carnivores is not well justified. Carnivores will consume more than just muscle. Consumption will include viscera and bones. It should be noted that rodents commonly consume the carrion bones and dropped deer antlers. If bones and antlers may be a receptor location for contaminants, these may be significant sources to small rodents.

78. Section 7.4.2.1, pgs. 29-30, lines 30-32: Soil ingestion along should not be used as the primary route of exposure for robins. Robins are known to consume large quantities of earthworms. Earthworms may uptake various contaminants from the soil as well as be affected by the toxicity of such contaminants. The USEPA guidance document "Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference, 1989" discusses the use of earthworm toxicity tests. It is likely that a body of reference material is available on the uptake or organic contaminants by earthworms. Additional data may be available through DOE studies concerning the uptake of radionuclide by earthworms. If sufficient literature is not available concerning the uptake of site contaminants by earthworms, DOE should develop an investigation to provide this information.

79. Section 7.4.2.2, pg. 30, lines 24-26: Do the constants provided by Killough and McKay (1976) incorporate the exposure via contaminated sediments to organisms, such as the muskrat? The contribution of contaminated sediments to the exposure of aquatic organisms should be discussed in this paragraph.

80. Section 8.0, pg. 2, line 16: PRP-derived Rfd's should be submitted for verification by ECAO prior to their use in a risk assessment.

81. Section 8.3, pg. 3: Describe the methods used to derive the NOEC and LOEC values. How will ecological population impacts be evaluated using the NOEC and LOEC approach?

12

82. Section 8.2: How will carcinogenic PAHs be evaluated in the baseline risk assessment? Will toxicity equivalency factors (TEFs) be used to estimate benzo(a)pyrene equivalents?

83. Section 8.2, pg. 3, line 5: Define what constitutes an "environmentally significant isotope of uranium."

84. Section 9.0, page 1, line 10: Given the long time-frame required for remediation of the FEMP site,new guidance (e.g. RAGS Parts B and C) should be utilized as it becomes available. Also, please state how you intend to consider draft guidance.

85. Section 9.0, pg. 1, lines 13-14: New guidance that is published prior to the ROD will have to be incorporated into decisions for remediation. DOE should consider how new guidance will be incorporated into decisions following the completion of the risk assessments. Is it DOE's intention to incorporate new guidance within a document during the revision/response to comments period? It is likely that a number of comments on the document will arise from new guidance which has been issued.

86. Section 9.2, pg. 3, line 24-25: If the Hazard Index (HI) exceeds unity, then the HI should be summed by target organ, as recommended in EPA (1989) guidance.

87. Section 9.0, pg. 7, lines 8-15: DOE should incorporate the fish collection methodology currently employed by the Ohio EPA Fish Evaluation Group. Use of this methodology would allow for direct comparison to the extensive data base Ohio EPA has on stream/river fish communities within the state. Data collected under this methodology is readily incorporated in the Index of Biotic Integrity for community comparisons. Information on the Ohio EPA methodology is available from: OEPA, Division of Water Quality Monitoring and Assessment, 1800 WaterMark Drive, P.O. Box 1049, Columbus, Ohio 43266-0149. The document is titled: Biological Criteria for the Protection of Aquatic Life, Volumes I-III.

88. Section 9.5, pg. 7, line 26: Correct the typographical error where the phrase "both qualitative and quantitative evaluation of uncertainties" is repeated.

89. Page 9, line 1: Hazard Indices greater than one should be split out according to critical effect. 13

90. Section 10.0, General Comment: This section appears to be outside the scope for a risk assessment work plan. Incorporating risk management issues into this work plan only clouds the issue of risk assessment methodology.

91. Section 10.1.1, pg. 3, lines 17-25: This paragraph fails to address the issue presented on the previous page concerning the ability of ARARs to be protective of human health and the environment in the presence of multiple contaminants and pathways. 40 CFR 300.430(e)(2)(i)(D) states "In cases involving multiple contaminants or pathways where attainment of chemical specific ARARs will result in cumulative risk in excess of 10^{-4}, criteria in paragraph (e)(2)(i)(A) of this section may also be considered when determining the cleanup level to be attained." The FEMP obviously has multiple pathways and multiple contaminants which result in a cumulative risk in excess of 10^{-4}.

92. Section 10, pg. 3, line 27: While it's true that some ARAR's are based on "technical limitations", some of these limitations are inherent to the media they are set for. For example, MCL's consider the limitations on municipal distribution systems. A compound may be readily treated (e.g. lead) but may be reintroduced through distribution. Therefore, strict occurrence with MCL's may not be appropriate for this site.

93. Section 10, pg. 3, line 29: By the same logic, if attainment of MCL's results in an exceedance of the allowable dose limit, remedial goals should be reevaluated to ensure compliance with the requirements of CERCLA.

94. Section 10.1.2, pg. 5, line 4: Change the third sentence to read "While preliminary remediation goals and final remediation goals will be risk-based, other factors will be considered in the development of the finals goals."

95. Section 10.1.2, pg. 7, lines 3-15: This paragraph attempts to compare "apples to oranges". The NCP discusses excess lifetime cancer risks while the calculations in this paragraph discuss the risk of cancer related deaths. Thus, neither set of assumptions presented in this paragraph meet the goal of the NCP. It is no surprise that the risk estimates are unequal. The paragraph should be deleted or reworded.

96. Section 10.1.2, pg. 7, lines 16-19: This paragraph adds little to the section and should be deleted. Risk assessments have been and will continue to be used in determining absolute concentrations for cleanup. 14

97. Section 10.1.2, pg. 8, lines 4-13: DOE's interpretation of the statement in this paragraph is unfounded and not applicable to the FEMP due to "extenuating circumstances such as exposure to multiple contaminants." The NCP is

clear in its requirements for protection of human health and the environment and the attainment of the acceptable risk range.

98. Section 10.1.2, pg. 8, lines 15-20: DOE is drawing premature conclusions in this paragraph. The NCP requires that attainment of an acceptable risk range thus precedence is not needed. Cleanup should be to a level as close to the acceptable risk range as is technically feasible, not just to ARARs. If technology allows, cleanup must meet the acceptable risk range as defined in the NCP.

99. Section 10.1, pg. 8, line 14-20: Absolute conclusions with regard to the selection of final remediation goals may be premature in this case given the potential for exposure to multiple chemicals of potential concern. It is recommended that health-based remediation goals should be presented along with ARARs in the FS in order that the regulatory agencies can select appropriate final remediation goals.

In addition, risk-contour plots also may be helpful in identifying areas that may require remediation at the site. Such an analysis would take into account the problems associated with exposure to a chemical mixture. For example, the total carcinogenic and noncarcinogenic risks associated with use of groundwater could be estimated for each sample location. These risks could be contoured using a kriging software package and displayed graphically. Areas that exceed a given target risk level (e.g., 10^{-4}) could easily be identified using such an approach.

100. Section 10, pg. 12, line 12: U.S. Department of Labor statistics are national averages which do not consider attempts made to minimize construction risks. Since the FEMP site has a well developed Health and Safety Plan, risk factors from the U.S. Department of Labor may overestimate construction risks. Information on construction risks at Superfund sites should be sought.

101. Section 10, pg. 14, line 13: Since much of the waste material requiring disposal will be considered low-level and a low-level waste repository may be sited in Ohio, the assumption of a 4440 mile trip for disposal seems high. Also, final disposition of these materials should be considered a one-way trip.

15

102. Section 10, pg. 19-27: This sort of calculation is premature given that the alternatives haven't even been described yet.

103. References: A number of citations are out of alphabetical order. This section needs a good editorial review to make it more useful to the reader.

REFERENCES CITED IN COMMENTS

Connor, J.J., and H.T. Schacklette, 1975. Background Geochemistry of Some Rocks, Soils, Plants, and Vegetables in the Conterminous United States, USGS, U.S. Department of the Interior, Washington, DC.

Dean, R.B., 1981. Use of Log-Normal Statistics in Environmental Monitoring, In: Chemistry in Water Reuse, Vol. I Ann, Arbor Science, Publishers, Inc. (Chapter 11).

Environmental Protection Agency (EPA), 1988. Superfund Exposure Assessment Manual, Office of Emergency and Remedial Response, OSWER Directive 9285-1.

Environmental Protection Agency (EPA), 1989. Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part A), Interim Final, OSWER Directive 9285-01a, December 1989.

Environmental Protection Agency (EPA), 1991. Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors," OSWER Directive 9285-03, Washington, DC, March 25, 1991.

Esmen, N.A., and Y.Y. Hammad, 1977. Log-normality of Environmental Sampling Data, J. Environ. Sci. Health.A12 (1&2): 29-41.

Gilbert, R.O., 1987. Statistical Methods for Environmental Pollution Monitoring, Van Nostrand Reinhold, New York.

Land, C.E., 1981. Confidence Intervals for Linear Functions of the Normal Mean and Variance, The Annals of Math Statistics, 42: 1187-1205.

Land, C.E., 1975. Tables of Confidence Limits for Linear Functions of the Normal Mean and Variance, Mathematical Statistics, Vol. III, pp. 385-419.

Mangold, D.C. and C. Tsang, 1991. A Summary of Subsurface Hydrological and Hydrochemical Models, Review of Geophysics (29)1: 51-79.

Ott, W.R., 1988. A Physical Explanation of the Log-normality of Pollutant Concentrations, Presented at the 81st Annual Meeting of APCA, Dallas, TX, June 19-24, 1988.