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DISAPPROVAL OF THE OU4 REMEDIAL INVESTIGATION REPORT

06/23/93

USEPA/DOE-FN
72
COMMENTS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

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9-84433
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JUN 24 1 49 PM '93

REPLY TO THE ATTENTION OF:

JUN 23 1993

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 OU 4
Remedial Investigation Report

Dear Mr. Craig:

The United States Environmental Protection Agency (U.S. EPA) has completed its review of the Operable Unit (OU) 4 Remedial Investigation (RI) Report. Although the RI Report appears to have been prepared in accordance with U.S. EPA guidance, there are numerous deficiencies that must be addressed.

Specific areas of concern include numerous inconsistencies between the document and various tables, data validation, and the failure to investigate the drum staging area and the drum handling building. Also U.S. EPA has several comments on the baseline risk assessment regarding the calculation of chemicals of potential concern, and failure to follow the risk assessment work plan.

Therefore, U.S. EPA disapproves the OU 4 RI Report pending incorporation of responses to the attached comments. Considering U.S. EPA's extensive comments, and the fact that this Report is a primary document as defined in the 1991 Amended Consent Agreement, U.S. EPA recommends a meeting to discuss the comments as soon as possible.

(Allen(R)
[redacted] action
response to
DOE-1688-93
(6179)

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Please contact me at (312/FTS) 886-0992 if you have any questions.

Sincerely,

James A. Saric
Remedial Project Manager

Enclosure

cc: Graham Mitchell, OEPA-SWDO
Pat Whitfield, U.S. DOE-HDQ
Nick Kauffman, FERMCO
Jim Theising, FERMCO
Paul Clay, FERMCO

bcc w/o attachments:
William Muno->Norm Niedergang->Kevin Pierard, WMD
Brian Barwick, ORC
Cheryl Allen, OPA

bcc w/attachments:
Gene Jablonowski, ARD
Pat VanLueween, HSRL-5J
Jean Michaels, PRC

Comments on the Draft "Remedial Investigation Report for Operable Unit 4"

U.S. EPA Region 5 Radiation Section

May 1993

Commenting Organization: U.S. EPA, Radiation Section
Section #: 3.1.2 Page #: 3-6 Line #: 21 Code: C
Original Comment #: 1
Comment: As part of the summary of the physical characteristics of the waste residues within Silos 1 and 2, contour maps indicating the bentonite thickness, a plot of the difference between the baseline waste surface data and the bentonite surface data, should be provided. This would provide a graphic representation of the nature and extent of thin bentonite coverage.
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: 4.2.2.1 Page #: 4-68 Line #: 32 Code: C
Original Comment #: 2
Comment: Please clarify the assertion that the ratios of the various constituents of Boring 1622 are very similar to silo residues, as well as the claim that these ratios are constant. The Silo 1, Zone C radiological concentrations appear to have a different ratio distribution than that of the concentrations of Boring 1622, Sample 99623; indicating the possibility of leaching of contaminants from the base of the Silo 1.
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: 4.6.1 Page #: 4-132 Line #: 8 Code: C
Original Comment #: 3
Comment: Please state how it can be confirmed that Sr-90 and Tc-99 are not present in Silos 1 and 2 if RI/FS analysis for these radionuclides in silo residues was not performed.
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: 5.3.2 Page #: 5-11 Line #: 17 Code: C
Original Comment #: 4
Comment: Please explain how the data from the surface soil and the first 5 feet of berm fill were "combined".
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: 5.4.1 Page #: 5-23 Table #: 5-2 Code: E
Original Comment #: 5
Comment: Table 5-2, Estimated Airborne Concentrations of Suspended Species from Operable Unit 4 - Current Source Term Scenario, should be corrected to indicate radionuclide concentrations in "pCi/l" and confirm that the proper values are listed. The errors in footnote usage should also be corrected.
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: D.3.1.2 Page #: D-3-7 Line #: N/A Code: M
Original Comment #: 6
Comment: In the discussion of potential release mechanisms in OU4, please explain the basis for the assumption that the bentonite clay layer will remain intact in the event of silo dome collapse in the future source-term scenario. While the average bentonite thickness for the silo residue cover is around 30 inches, portions of this cover thin to as little as 0.4 inches at the top of the highest mound of silo residue. Areas of such light bentonite cover seem susceptible to breakthrough and erosion that would expose the silo residues, possibly allowing the resuspension of contaminants, increased infiltration of water into the silo residues, and the leaching of contaminants into rainwater ponding in the failed silos.
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: E.1.6.1.1 Page #: E-1-9 Line #: 31 Code: M
Original Comment #: 7
Comment: The average daily radon headspace concentration data for the month of December 1992 does not appear representative of the annual average radon concentrations for the Silo 1 and 2 domes. Page 3-8 of the K-65 Silo Removal Action - Bentonite Effectiveness Evaluation, December 17, 1992 presents post-bentonite headspace concentrations monitored from July 20, 1992, to September 15, 1992; the stated mean values for Silos 1 and 2 were **45,081 pCi/l** and **219,585 pCi/l**, respectively. This 219,585 pCi/l mean value for Silo 2 is about 73% higher than the 126,922 pCi/l mean value stated in the OU4 RI. Using radon measurement data for only one month, especially a cold month as December, is not representative for an entire year as colder temperatures tend to dampen radon emanation from materials such as soils and clays. Average daily radon concentration data used in the OU4 RI should reflect annual conditions and Table E.1-4, Radon Release Rates and Emission Flux from all Sources in Operable Unit 4, should be revised appropriately.
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: E.1.6.1.1 Page #: E-1-11 Line #: 6 Code: M
Original Comment #: 8
Comment: No indication is made as to how the silo headspace differential pressure measurement data, discussed in Section 2.4.2, is integrated into the determination of breathing rates for the silos, please clarify.
Response:
Action:

Commenting Organization: U.S. EPA, Radiation Section
Section #: E.1.6.1.1 Page #: E-1-11 Line #: 8 Code: M
Original Comment #: 9
Comment: It is not clear how the Silo 1 and 2 temperature monitoring data was used to derive the average daily temperature variation and establish the initial headspace temperature for the silos.
Response:
Action:

OPERABLE UNIT 4 REMEDIAL INVESTIGATION REPORT
TECHNICAL COMMENTS

GENERAL COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #1
Comment: During the April 1993 Operable Unit 4 (OU4) site meeting, the U.S. Department of Energy (DOE) indicated that the environmental media associated with the K-65 Drum Staging Area would be investigated as part of the OU4 remedial investigation (RI). The OU4 RI report gives no indication that this area has been investigated as a potential source of OU4 contamination. The report should identify this issue as a remaining data gap or explain why surface and subsurface media have been screened from investigation.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #2
Comment: The area where the K-65 Drum Handling Building and associated storage tanks were located do not appear to have been investigated as potential source areas. A review of surface soil, subsurface soil, and groundwater sampling locations indicates that this area has not been sampled. DOE should identify this issue as a potential data gap or explain why this area has been screened from investigation.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #3
Comment: Page 1-34, Lines 1 to 2 indicates that decant liquids were removed from Silo 3; however, all previous and subsequent discussions of Silo 3 processes and associated waste suggest that Silo 3 wastes were pneumatically emplaced and that no liquids were or are present in the silos. The presence of liquid waste in Silo 3 has great significance since remedial investigation/feasibility study (RI/FS) investigations have proceeded under the assumption that liquids were not present in Silo 3. Subsurface borings adjacent to or below the silo were not performed and Page 1-38, Lines 20 to 21 indicates that the base slabs of Silo 3 are cracked and deteriorated. DOE should thoroughly address whether the lack of Silo 3 subsurface sampling of soils and perched groundwater represents a data gap.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2 Pg. #: NA Line #: NA Code:
Original General Comment #4
Comment: Section 2 provides an overview of the various OU4 investigations and corresponding data and data uses. While most of the data used to support the RI appear to have been generated during the various RI investigations, much of the data were generated during removal actions (RA) and characterization investigation study (CIS)/environmental survey (ES) studies. DOE should more clearly present the data limitations and OU4 RI use of the RA/CIS/ES data, particularly with regard to the CIS/ES radiological data.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2 Pg. #: NA Line #: NA Code:
Original General Comment #5
Comment: The discussion in Section 2 of the various studies used to support the OU4 RI should clearly indicate which data were collected, analyzed, and validated under the approved Quality Assurance Project Plan (QAPjP). For instance, Page 2-27, Lines 9 to 10 states that the samples submitted for Hazardous Substance List (HSL) organic and inorganic analyses were analyzed in a manner consistent with U.S. EPA Contract Laboratory Program (CLP) procedures. The extent to which this data is usable in the context of the RI is unclear.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2 Pg. #: NA Line #: NA Code:
Original General Comment #6
Comment: Many of the figures in Section 2 do not indicate the sampling dates or the studies under which the sampling was performed. The figures should be revised to include this information.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2 Pg. #: NA Line #: NA Code:
Original General Comment #7
Comment: Metals (including radionuclides) are the primary contaminants of concern at the Fernald Environmental Management Project (FEMP). The discussions of the various groundwater sampling activities conducted to support the RI (Section 2) should clearly indicate, for each study (and sample if applicable), whether groundwater samples were filtered or unfiltered prior to analysis. This information should also be provided in the data tables presented in Section 4.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3 Pg. #: NA Line #: NA Code:
Original General Comment #8
Comment: DOE should indicate whether the recently acquired data regarding the geology and hydrogeology of the glacial overburden, particularly with regard to the lacustrine/deltaic sand body underlying much of OU4, have been presented in the OU4 RI report.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 9 Pg. #: NA Line #: NA Code:
Original General Comment #9
Comment: The discussion of the OU4 geology and hydrogeology in Section 3.5.4 does not include calculations for the vertical and horizontal groundwater flow velocities in the perched groundwater or the Great Miami Aquifer (GMA). These calculations should be included in the OU4 RI report.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #10
Comment: EPA did not perform a rigorous review of the fate and transport modeling in Appendix E because the future land use and current source term scenario resulted in risks greater than the target risk range and a hazard index greater than 1. In addition, using the future land use scenario and incorporating the modeling results to create a future source scenario greatly increases the risk, while the hazard index remains above 1. Therefore, the model does not need to be further refined to support the estimation of future risk.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.11 Pg. #: NA Line #: NA Code:
Original General Comment #11
Comment: The discussion of radiological surface soil contamination does not include lead-210 and polonium-210, which were apparently not analyzed for. These radionuclides are considered indicator parameters for OU4 because they are daughters of radon. Due to the large volumes of radon emissions from the silos in the past, these contaminants are expected to be widespread in surface soils. Furthermore, DOE's conclusions regarding radionuclide surface soil contamination are vague, suggesting that the minor contamination currently characterized may be from waste sources outside OU4 (Page 4-51). The lead-210 and polonium-210 data would "fingerprint" much of the OU4 related surface soil contamination. This is a major omission and should be identified as a data gap.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 7.6 Pg. #: 7-26 Line #: NA Code:
Original General Comment #12
Comment: According to the last technical meeting on OU4, non-removal actions were not going to be considered in the FS. This paragraph indicates non-removal actions are being considered making data gaps and deficiencies of much greater concern. This should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 7 Pg. #: NA Line #: NA Code:
Original General Comment #13
Comment: Section 7 should contain a table listing preliminary remediation goals (PRG) for the chemicals of potential concern (CPC). The levels of contamination in each medium should then be compared to the PRGs. It is not clear whether action is needed for all media, including surface soil, subsurface soil, perched groundwater, silos and contents, decant sump tank or radon treatment system units. This section could be greatly improved with the addition of specific remedial action objectives (RAO) per RI/FS guidance for each medium, CPC, and PRG. The RAOs are too general to be useful.
Response:
Action:

OPERABLE UNIT 4 REMEDIAL INVESTIGATION REPORT
TECHNICAL COMMENTS

SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section: Executive Summary Pg. #: ES-2 Line #: 3-4 Code:
Original Specific Comment #1
Comment: This section describes the environmental media associated with the OU4 RI. Groundwater in the GMA is not included and should be added to the discussions.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section: Executive Summary Pg. #: ES-5 Line #: 24-25 Code:
Original Specific Comment #2
Comment: The text states that elevated contaminant concentrations in subsurface soils were "conspicuous by their absence at depths of more than a few feet below the silos." This is misleading since only one soil sample was collected below Silo 1 and none were collected below Silos 2 and 3. This conclusion lacks supporting data and should be removed from the text.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section: Executive Summary Pg. #: ES-6 Line #: 1-3 Code:
Original Specific Comment #3
Comment: The text summarizes surface water and sediment contamination in the vicinity of OU4; however, potential sources of this contamination are not discussed. This information should be presented in the Executive Summary.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.2.1.3 Pg. #: 1-19 Line #: 11-15 Code:
Original Specific Comment #4
Comment: This section discusses the concrete trench that contained the piping used to transfer waste to Silos 1, 2, and 3 from the FEMP refinery. The integrity of this trench is not discussed with regard to its potential as a source for surface or subsurface contamination. This should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.2.2.1 Pg. #: 1-28 Line #: 10 Code:
Original Specific Comment #5
Comment: The text describes the operations of the K-65 Drum Handling Building and indicates that silo decant liquids were stored in a filtrate storage tank. The text should indicate whether this storage tank was above or below the ground. Its former (or current) location should also be indicated on the appropriate figures.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Pg. #: 1-30 Line #: 16-17 Code:
Original Specific Comment #6
Comment: This sentence incorrectly converts 0.5 kilogram (kg) to 4 pounds (lb). The text should be corrected to indicate that 0.5 kg is equivalent to 1.1 lb.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 1.2.2.3 Pg. #: 1-34 Line #: 1-2 Code:
Original Specific Comment #7
Comment: This sentence indicates that decant liquids have been removed from Silo 3. The procedures associated with this operation (removal, transfer, storage, and disposal) should be discussed. It is not clear whether the decant sump tank associated with Silos 1 and 2 was used for OU3 decant liquids. This omission should be addressed because the discussions regarding contamination associated with the decant sump tank and its sources are based on the assumption that only decant liquids from Silos 1 and 2 were handled by this tank.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.5.2.1 Pg. #: 2-28 Line #: 14 Code:
Original Specific Comment #8
Comment: The RI report states that 24 systematic soil samples were collected from Paddys Run but does not provide the locations. The locations should be presented on a figure within the RI.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.5.2.1 Pg. #: 2-28 Line #: 17-18 Code:
Original Specific Comment #9
Comment: The RI report refers to four samples exhibiting unusual gamma activity levels but does not provide the locations of these samples. These locations should be provided on a map.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.5.2.2 Pg. #: 2-30 Line #: 4 and 9 Code:
Original Specific Comment #10
Comment: The RI report refers to several sediment samples but does not provide the location of these samples. The locations should be provided on a map.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.5.2.3 Pg. #: 2-31 Line #: 4 Code:
Original Specific Comment #11
Comment: The sediment samples described in this section are located so far up and down gradient of the silos that they can be affected by several source areas. The RI should acknowledge this as a data gap. Therefore, the described sediment samples are inadequate to determine if the silos are the source of surface water or sediment contamination.
Response:
Action:

##
Commenting Organization: U.S. EPA Commentor: Saric
Section #: 2.6.4 Pg. #: 2-40 Line #: 5-7 Code:
Original Specific Comment #12
Comment: The text states that the 36- to 42-inch sample set represents the till and glaciofluvial sediments which are at the maximum depth of significant weathering. However, the text and cross sections provided in Section 3 indicate that this weathering extends to 20 feet below ground surface (bgs). This discrepancy should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Pg. #: 2-47 Line #: 9-10 Code:
Original Specific Comment #13
Comment: The text states that the described subsurface soil sample locations are shown on Figure 2.5. Figure 2.5 shows CIS surface soil locations. This discrepancy should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Pg. #: 2-47 Line #: 24-28 Code:
Original Specific Comment #14
Comment: The first bullet states that soil samples were submitted for "full radiological analyses" while the following bullets describe additional radionuclides analyzed for. The additional radionuclides include lead-210 and polonium-210. It is not clear why these radionuclides are not included in the "full radiological analyses" since they are considered indicator parameters for OU4. The term "full radiological analyses" should be defined.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Pg. #: 2-50 Line #: 32-33 Code:
Original Specific Comment #15
Comment: This bullet states that one objective of the OU4 groundwater investigation is to determine the rate and direction of groundwater flow in the GMA. However, it is not clear whether determining the rate and direction of groundwater flow in the perched groundwater is an objective of the OU4 RI. This issue should be clarified.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.1.1 Pg. #: 3-1 Line #: 31-33 Code:
Original Specific Comment #16
Comment: These lines indicate that Silo 4 contains infiltrated rainwater. DOE should indicate whether the other three silos are suspected (or known) to have received infiltrated rainwater.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 3-2 Pg. #: 3-7 Line #: NA Code:
Original Specific Comment #17
Comment: The volumes of total waste and bentonite appear to be inaccurate and transposed between columns. The table should be checked for accuracy.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 3-7 Pg. #: 3-17 Line #: NA Code:
Original Specific Comment #18
Comment: None of the contour lines are labeled, making the usefulness of this map limited. Contour lines should be labeled for every 5 feet in elevation change.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 3-4 Pg. #: 3-23 Line #: NA Code:
Original Specific Comment #19
Comment: The mineralogic data contained in Table 3-4, as currently presented, is not very useful. Stratigraphic units or sample depths should be provided along with the sample numbers. Averages for the stratigraphic units should also be presented.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 3-5 Pg. #: 3-24 Line #: NA Code:
Original Specific Comment #20
Comment: A footnote should be added to the Iron and Manganese columns indicating that the results are for leachable surface coatings.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 3-13 Pg. #: 3-40 Line #: NA Code
Original Specific Comment #21
Comment: This figure presents a generalized preconstruction geologic map of the FEMP. A description of the geologic unit represented by the cross-hatched pattern in the upper reaches of Paddy's Run should be included in the legend. Also, the presentation of the surface expression of the recessional and terminal moraines is confusing. The map should clearly indicate the locations and widths of the moraines.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.5.3 Pg. #: 3-41 Line #: 4-35 Code:
Original Specific Comment #22
Comment: This section reports hydraulic conductivity values in gallons per day per square foot (gpd/ft^2) and in feet per day (ft/day). Hydraulic conductivities should be reported in consistent units.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 3-16 Pg. #: 3-45 Line #: NA Code:
Original Specific Comment #23
Comment: The groundwater contour maps presented as Figures 3-18 and 3-19 indicate that recharge from Paddy's Run is farther north than indicated on Figure 3-16. Figure 3-16 should be modified to be consistent with the interpretations of Figures 3-18 and 3-19.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 3-19 Pg. #: 3-49 Line #: NA Code:
Original Specific Comment #24
Comment: The nature and causes of the trough-like depression in the upper GMA just north of OU4 should be discussed in the RI report.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.5.4.1 Pg. #: 3-59 Line #: 6-7 Code:
Original Specific Comment #25
Comment: The text indicates that the depths reported in Table 3-12 are not true depths but rather the distance at which the samples were taken along the borings. Table 3-12 should be revised to give true depths (or elevations) of the soil samples.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.5.4.2 Pg. #: 3-59 Line #: 26-29 Code:
Original Specific Comment #26
Comment: The text summarizes the glacial lacustrine deposits. The terminology is confusing. It is not clear whether the discussion refers to the fine grained lacustrine deposit, the coarser deltaic unit, or both. The discussion should be clarified.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Pg. #: 4-1 Line #: 20-25 Code:
Original Specific Comment #27
Comment: The text states that the ratio of activity concentrations between uranium-238 and radium-226 or between uranium-238 and thorium-230 can be used to "fingerprint" the K-65 and mixed oxide silo wastes, and that these ratios can be used to determine whether observed soil contamination originated from the silos. However, DOE acknowledges (in Section 4.2.3.1) that the soil and groundwater mobilities of uranium, radium, and thorium isotopes differ greatly. This phenomenon tends to negate DOE's assertion that the observed soil isotopic ratios can be used to identify sources, especially at depth. Unless specific isotopic retardation factors are use to calculate anticipated concentrations in soil and groundwater, direct comparisons of isotopic ratios in environmental media to silo wastes should be avoided.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Pg. #: 4-1 Line #: 32-33 Code:
Original Specific Comment #28
Comment: The text states that compounds associated with silo waste include kerosene. The specific organic compounds expected to be present in silo residues and contaminated media due to the presence of kerosene should be described.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 4-1 Pg. #: 4-3 to 4-5 Line #: NA Code:
Original Specific Comment #29
Comment: The reported background concentrations of several metals (arsenic, beryllium, cadmium, lead, nickel, and selenium) in groundwater are above maximum contaminant levels (MCL). This situation is highly unlikely and was noted in previous U.S. EPA reviews of the site-wide characterization report and the OU2 RI report. DOE should justify its insistence on using statistical outliers to calculate background concentrations while routinely dismissing such outliers observed in site environmental media.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 4-1 Pg. #: 4-3 to 4-5 Line #: NA Code:
Original Specific Comment #30
Comment: Table 4-1 should be checked for accuracy. It is unlikely that aluminum and zinc are not present in background groundwater samples.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 4-4 Pg. #: 4-14 to 4-16 Line #: NA Code:
Original Specific Comment #31
Comment: When compared against the oil and grease and HSL organic results, the total organic carbon (TOC) values reported for Silos 1 and 2 indicate that a large amount of carbon in the silo residues is unaccounted for. This is particularly evident in Silo 2 where average TOC values are 6,000 milligrams per kilogram (mg/kg), average oil and grease values are 301 mg/kg, and HSL organic values are negligible. DOE should further explain these observations since an understanding of the organic composition of the silo wastes will be required when selecting the remedy,
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.1.1.2 Pg. #: 4-20 Line #: 23-24 Code:
Original Specific Comment #32
Comment: The text indicates that the toxicity characteristic leaching procedure (TCLP) extracts of silo residues were analyzed for radiological constituents. This information should be discussed in this section of the RI report since the radiological constituents in the silo leachate are the primary source term for OU4.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.1.2 Pg. #: 4-27 Line #: 14-15 Code:
Original Specific Comment #33
Comment: The text states that the analytical results of a single decant sump tank sludge sample are included in Appendix A. They are not. This information should be discussed in the RI report, and the data should be included in Appendix A.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 4-14 Pg. #: 4-30 Line #: NA Code:
Original Specific Comment #34
Comment: The analytical results reported for sodium are in error (millions of part per million) and should be corrected.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.1.2.1 Pg. #: 4-31 Line #: 20-26 Code:
Original Specific Comment #35
Comment: The text suggests that the presence of strontium-90 and technetium-99 in the decant sump tank liquids results from either laboratory contamination or sample preservatives. However, in all other instances throughout Section 4, DOE claims that the presence of these radionuclides in environmental media is from atmospheric fallout. It seems more likely that the presence of these radionuclides in the decant sump tank liquids represents the infiltration of meteoric water. DOE should address the inconsistent interpretation.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.1.2.2 Pg. #: 4-32 Line #: 6-14 Code:
Original Specific Comment #36
Comment: DOE claims that the results of the TCLP analyses on silo residues compare favorably with the analyses of the decant sump tank liquids, thereby confirming that silo leachate is the source of the tank liquids. While most of the data seem to confirm this, the anomalous lead results should be further explained since lead is the most leachable metal in the silo residues.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.1.1 Pg. #: 4-47 to 4-62 Line #: NA Code:
Original Specific Comment #37
Comment: The surface soil data indicate that little, if any, surface soil sampling was performed downwind (east and northeast) of Silos 1 and 2. This suggests that surface soil contamination in these areas has not been characterized. DOE should address this data gap.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 4-6 Pg. #: 4-48 Line #: NA Code:
Original Specific Comment #38
Comment: Figure 4-6 contains several errors. Surface soil sample location SS-46-204 is depicted at two distinct locations. Also, data from sample locations SL-46-326 and SL-46-327 are not included in Table 4-22. These discrepancies should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 4-7 Pg. #: 4-52 Line #: NA Code:
Original Specific Comment #39
Comment: Figure 4-6 should indicate the source of the uranium-238 data.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.1.1 Pg. #: 4-51 Line #: 21-22 Code:
Original Specific Comment #40
Comment: DOE states that the radionuclide surface soil data indicates that contaminant concentrations decrease rapidly with depth. The data do not appear to show any discernable trends with depth. This discrepancy should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Section 4.2.1.1 Pg. #: 4-47 Line #: 26-32 Code:
Original Specific Comment #41
Comment: DOE states that CIS off-site laboratory data in Table 4-22 are similar. This is not the case. Radiological data from the off-site laboratory detected radium-226 and uranium-238 at levels twice as high as the on-site laboratory. This discrepancy should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Figure 4-8 Pg. #: 4-56 Line #: NA Code:
Original Specific Comment #42
Comment: This figure shows eight surface soil locations with no corresponding sample numbers or analytical results. They are simply labeled NA (not available). This unnecessary information should be removed from the figure.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.1.2 Pg. #: 4-59 Line #: 15-22 Code:
Original Specific Comment #43
Comment: This paragraph apparently discusses sediment contamination in the OU4 drainage ditch. This discussion is more appropriate in Section 4.4.1. Also the word "southwest" on line 17 should be changed to "southeast."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 4-26 Pg. #: 4-60 to 4-62 Line #: NA Code:
Original Specific Comment #44
Comment: This table and the corresponding text indicate that no surface soil samples were analyzed during the Waste Pit Area Runoff Control Project. The only samples submitted for analysis were collected from depths between 1.5 feet and 2.0 feet bgs. Therefore, any conclusions drawn from this data regarding the lateral extent and vertical trends of surface soil contamination are misleading at best. This issue should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.2.1 Pg. #: 4-70 Line #: 12-21 Code:
Original Specific Comment #45
Comment: This paragraph discusses the results of the berm soil TCLP analyses. The sample from boring 1620 at 16 feet bgs showed very high TCLP results for cadmium, chromium, and silver. DOE suggests that these results should not be used to characterize berm soils because a split sample collected from this interval showed HSL metals at concentrations comparable to the other berm borings. However, the data tables in Appendix B.1 indicate that HSL metal analyses were not performed on the corresponding split sample. DOE has not provided any information to justify their claim that this sample does not represent a hot spot within the berm soils. This issue should be addressed further.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 4-28 Pg. #: 4-71 Line #: NA Code:
Original Specific Comment #46
Comment: Table 4-28 summarizes the inorganic results of the berm soils analyses. The data and corresponding text should be presented in terms of depth (instead of mean) so that any trends can be evaluated.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.3.1 Pg. #: 4-76 Line #: 14-16 Code:
Original Specific Comment #47
Comment: The text states that radiological concentrations significantly above background were detected in slant borings 1615 and 1616. This is misleading. Significant (above background) contamination was seen in all slant borings. This discrepancy should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.3.1 Pg. #: 4-83 Line #: 12-13 Code:
Original Specific Comment #48
Comment: This sentence lists the inorganics that were detected above background concentrations in the slant borings. Copper, cyanide, and sodium should be added to this list.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.3.1 Pg. #: 4-87 Line #: 14-21 Code:
Original Specific Comment #49
Comment: This paragraph proposes that OU4 subsurface soil contamination may have sources outside of the OU4 study area. Two of these potential sources include the waste pits, and contaminated surface runoff from other areas of the site. It is not clear how the waste pits north of the OU4 study area could contribute to subsurface soil contamination at OU4. Also, any site related runoff would be limited to the drainage areas north and south of OU4. These areas are unlikely to contribute to the subsurface soil contamination observed at OU4. This issue should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.3.2 Pg. #: 4-89 Line #: 11-16 Code:
Original Specific Comment #50
Comment: The text states that the radiological contamination seen in boring 1072 is the likely result of atmospheric deposition. DOE should indicate whether an on-site or off-site source is being suggested.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.1.1 Pg. #: 4-93 to 4-96 Line #: NA Code:
Original Specific Comment #51
Comment: This section describes several distinct perched water zones encountered in the slant borings. Accurate cross sections depicting the subsurface hydrogeology in the silo area should be prepared to aid the reader in data interpretation. The cross sections provided in Section 3 do not indicate two distinct water bearing zones in the glacial overburden.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.1.1 Pg. #: 4-96 Line #: 9 Code:
Original Specific Comment #52
Comment: The text indicates that borings 1617 and 1618 encountered perched groundwater below Silo 1. Boring 1617 did not. This discrepancy should be addressed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: Table 4-39 Pg. #: 4-98 Line #: NA Code:
Original Specific Comment #53
Comment: The data presented in this table does not indicate that groundwater samples were - analyzed for lead-210 or polonium-210. These radionuclides are used as indicator parameters for K-65 silo related contamination. The results of any lead-210 or polonium-210 should be presented in the RI report.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.1.2 Pg. #: 4-107 Line #: 8-10 Code:
Original Specific Comment #54
Comment: The text states surface and subsurface data suggest that radium is not a concern outside of the silos. This is inaccurate since radium was detected in relatively high concentrations in both surface and subsurface soils. This statement should be revised.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.1.2. Pg. #: 4-107 Line #: 16-17 Code:
Original Specific Comment #55
Comment: This sentence states that the "lower perched groundwater zone" encountered below the decant sump tank was found to have relatively low concentrations of uranium and progeny, which suggests that this is an unimpacted zone. This discussion again highlights the need for detailed hydrogeologic cross sections showing stratigraphic and water bearing units, sample locations and sample results. Additionally, sample 64021, located approximately 75 feet west of the decant sump tank, is located in the same "zone" mentioned above. This sample exhibited high (439 μg/L) total uranium suggesting that the "lower zone" is indeed impacted. This issue should be clarified.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.1.2 Pg. #: 4-107 Line #: NA Code:
Original Specific Comment #56
Comment: General chemistry parameters were found at concentrations above background in Well 1032. The text states that since these compounds are not unique to the silo materials, the data do not assist in identifying the contaminant source. This argument is not very convincing since none of the material stored in the silos is unique to the silos themselves. All groundwater data should be evaluated in terms of upgradient and downgradient concentrations when attempting to characterize sources.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.2.2 Pg. #: 4-113 Line #: 12 Code:
Original Specific Comment #57
Comment: The reasoning used in this paragraph to indicate that sources other than OU4 may be the source of groundwater contamination in the GMA is not completely supported. Potential pathways from OU4 through Paddy's Run indicates OU4 may be a source of contamination. The RI should be revised to consider these potential routes of contaminant migration.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.2.2 Pg. #: 4-113 Line #: 30 Code:
Original Specific Comment #58
Comment: The presence of technetium-99 in environmental media does not suggest a non-OU4 source because Appendix A of the RI report indicates none of the silo samples were analyzed for technetium-99. Because this conclusion lacks supporting data, it should be deleted from the report.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.2.2 Pg. #: 4-116 Line #: 8 Code:
Original Specific Comment #59
Comment: The RI report states that a direct link between groundwater contamination in the GMA and OU4 cannot be made. The report should also state that OU4 cannot be eliminated from consideration as a source of contamination in the GMA.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.6.2 Pg. #: 4-132 Line #: 8 Code:
Original Specific Comment #60
Comment: The RI report states that because technetium-99 is not present in silos 1 or 2, the silos are an unlikely source of the technetium-99 in the decant sump tank liquid. However, the silo 1 and 2 materials were not analyzed for technetium-99. DOE should provide additional justification for this statement.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 5.4.3 Pg. #: 5-31 Line #: 2 Code:
Original Specific Comment #61
Comment: Table 5-5 presents results which indicate the maximum uranium concentration in the GMA at the FEMP boundary is about 10 μg/L; Figure 5-32 indicates the maximum uranium concentration at the FEMP boundary is about 1 μg/L. Figure 5-6 and should be checked for accuracy.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 7.3.4 Pg. #: 7-9 Line #: 8 Code:
Original Specific Comment #62
Comment: The RI report states that perched groundwater with U-238 contamination in the range of 69 to 77 pCi/L is present under the silos. However, Section 4.3.1.1 presents data indicating much higher levels of uranium contamination in the perched groundwater in the OU4 area. Section 7.3.4 should be changed to be consistent with data presented earlier.
Response:
Action:

COMMENTS ON SECTIONS D.2.0, D.3.0, D.4.0, D.5.0, D.6.0, D.7.0, 6.2, 6.5, 6.6, AND REFERENCES TO THE OPERABLE UNIT (OU) 4 REMEDIAL INVESTIGATION (RI) REPORT

GENERAL COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #1
Comment: The report does not currently include relevant information from title 10 of the Code of Federal Regulations (CFR) regarding the lung retention time for radionuclides. 10 CFR Part 20, Appendix B (CFR 1992), assigns lung retention characteristics of the various elements to three classes: D, W and Y. This classification applies to a range of clearance half-times of less than 10 days for D, from 10 to 100 days for W, and for greater than 100 days for Y. This information should be added to the discussion in the report of radionuclide retentiaon in the lungs. Also, the discussion should note the following: (1) absorption and retention characteristics are based on the elemental reactions with body tissue and do not depend on the isotope of the element, and (2) retention characteristics depend on the chemical form of the element in a compound.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #2
Comment: The carcinogenicity of a radioactive isotope of an element depends on several factors, including the following:

- The decay mode of the isotope (alpha, beta, or photon emission)
- The emission energy of the photon or particle
- The radiological half-life of the isotope
- The retention and concentration characteristics (target organ) of the isotope in the human body
- Its toxicity as a nonradioactive element

These guidelines should be followed in the carcinogenicity determination of radioactive isotopes.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #3
Comment: The information regarding the toxic effects of particular radioisotopes is not clearly and consistently presented. Some of these effects are briefly described, while others are described in great detail. The hazards of the particle that is emitted are not always explained. Also, target organs, particular isotopes of concern, and respective half-lives are not consistently addressed. For example, the toxic effects of Uranium have been adequately described. The text should show a similar and consistent level of detail for all toxicity profiles.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #4
Comment: Regarding the review of Section 5.0, insufficient data were provided to replicate (1) actual development of unit risk factors (URF), (2) chemical-specific risk estimates, and (3) computer modeling such as Microshield. Sufficient data should be provided to allow reproduction of risk estimates.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #5
Comment: While it does not appear intentional, the presentation of risks may mask which routes and chemicals contribute significant risk. For example, the discussion may focus on a chemical that contributes 5×10^{-3} carcinogenic risk and fail to mention that three other chemicals contribute significant (greater than 1×10^{-6}) risk. A table showing significant contributions to risk, both by route and specific chemicals, should be added to the risk characterization discussion.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #6
Comment: The sole purpose of analyzing for chemicals of potential concern (CPC) is to identify the subset of site-related contaminants that pose the greatest human health risks at a hazardous waste site. This analysis is often necessary because the list of chemicals detected can be lengthy. A comprehensive quantitative risk assessment (RA) on the myriad of chemicals at most sites could be complex and distract from the dominant risks. Therefore, a step-by-step evaluation applying specific elimination criteria is performed to reduce the number of chemicals to manageable size. An initial analysis may involve eliminating background chemicals from the list of potential CPCs. However, the background analysis is only conducted to facilitate the quantitative RA; it is not a prerequisite for an RA. For this reason, robust statistical analyses are required to confirm which site-related contaminants are truly background chemicals.

If the data are insufficient to make such a determination, or the results from the analysis are suspect, the questionable chemicals should be carried through the quantitative RA. Following generally accepted steps, data are sequentially evaluated to ultimately select the most appropriate statistical test. The four statistical tests commonly employed in environmental toxicology for a background analysis include the F-test, Student's t-test, Cochran t-test, and Wilcoxon Rank Sum Test.

Some chemicals were excluded as background without an adequate statistical test for this assumption. Either an adequate statistical evaluation should be performed or all of these chemicals should by carried through the RA.

Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: NA Pg. #: NA Line #: NA Code:
Original General Comment #7
Comment: Throughout the document the phrase "constituents of concern (COC)" should be changed to "constituents of potential concern (CPC)."
Response:
Action:

SPECIFIC COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.0 Pg. #: D-2-1 Line #: 9 Code:
Original Specific Comment #1
Comment: This section states that only CPCs that migrate from OU4 will be considered in the characterization of risk from associated media and that CPCs already present in the associated media will be considered in the operable unit (OU) 5 RA. This section should be revised to clearly state whether CPCs migrating from OU1, OU2, OU3, and OU4 will be considered in the OU5 RA.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.1.1.1 Pg. #: D-2-2 Line #: NA Code:
Original Specific Comment #2
Comment: Table D.2-1 and various sections of the report refer to surface and subsurface soils. However, it is not clear what soil boring depths represent each soil layer. The report should clearly state and support what sample depths were used to characterize each soil layer.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.1.1.3 Pg. #: D-2-5 Line #: 3, 5, and 7 Code:
Original Specific Comment #3
Comment: See Original Comment # 2.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.1.1.3 Pg. #: D-2-5 Line #: 9 Code:
Original Specific Comment #4
Comment: This section states that composite samples from 0 to 5 feet below ground surface (bgs) should adequately characterize berm soils because they consist of fill moved into place. However, if chemicals have since been air-deposited, the composite samples would underrepresent actual concentrations of air-deposited chemicals. The report should be revised to address this issue.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.1.2 Pg. #: D-2-5 Line #: 21 Code:
Original Specific Comment #5
Comment: This section states that background surface soil samples were analyzed for radionuclides and nonradioactive metals only. However, site related compounds often show up in "background" samples, requiring that a different "background" location be selected (U.S. EPA 1989). Therefore, because volatile organic compounds (VOC) and semivolatile organic compounds (SVOC) are associated with site operations, they should be analyzed for. Their presence and may indicate that "background" samples are actually affected by site operations.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.2.2 Pg. #: D-2-9 Line #: 18 Code:
Original Specific Comment #6
Comment: The cited U.S. EPA document does not state that one-half the detection limit (DL) should be used to represent chemical concentrations when a chemical is reported as "not detected" in sample analytical results. Rather, the cited document recommends use of one-half the sample quantitation limit (SQL). The text should be revised to replace DL with SQL, and any calculations made using one-half the DL should be recalculated using one-half the SQL.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.2.2 Pg. #: D-2-9 Line #: 5 Code:
Original Specific Comment #7
Comment: The "curve-fitting or goodness-of-fit" methodology described in this paragraph is an acceptable approach, but it might be useful to include the coefficients of kurtosis and skewness, which are typically included in most statistical software packages, to support a log normal assumption. Furthermore, it is advisable to consider other distributions as well. For example, Pinder and Smith (1975) have shown that the Wellbull distribution fits some radionuclide data better than other distributions.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.3.1 Pg. #: D-2-10 Line #: NA Code:
Original Specific Comment #8
Comment: This section discusses the comparison of on-site chemical concentrations with representative background concentrations to determine whether chemicals are likely to be site related. However, the report does not discuss why such a comparison should be performed on silo contents if it is known that the contents result from site operations. The report should be revised to discuss this issue. Unless justified, all chemicals detected on site and known to be related to past site operations should be included as CPCs regardless of background concentrations.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.3.3.3 Pg. #: D-2-23 Line #: 19 Code:
Original Specific Comment #9
Comment: This section states that CPCs lacking published toxicity data are not evaluated in the risk characterization portion of the report. However, the report does not discuss why surrogate chemicals for which toxicity data are available are not used. Such a discussion should be added to the report. Also, the Environmental Criteria and Assessment Office (ECAO) should be contacted about toxicity values needed for an RA.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1 Pg. #: D-3-2 Line #: NA Code:
Original Specific Comment #10
Comment: Not all the lines leaving the secondary source box labeled Soil/Surface are clearly labeled. Figure D.3-1 should be revised to clearly indicate which primary sources these lines refer to.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1 Pg. #: D-3-2 Line #: NA Code:
Original Specific Comment #11
Comment: Figure D.3-1 indicates that only structural failure of Silo 3 will result in contamination of surface soil. Either the figure should be revised to indicate that failure of Silos 1 and 2 may also result in contamination of surface soil, or the text should clearly explain why this is not the case.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1 Pg. #: D-3-2 Line #: NA Code:
Original Specific Comment #12
Comment: In Figure D.3-1, two lines leave the pathway box labeled Surface Water and Sediments. These lines should be clearly labeled to indicate which line refers to surface water and which refers to sediments.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1 Pg. #: D-3-2 Line #: NA Code:
Original Specific Comment #13
Comment: Figure D.3-1 includes the terms RME and CT; the figure should be revised to include definitions of these terms.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1 Pg. #: D-3-3 Line #: NA Code:
Original Specific Comment #14
Comment: See Original Comment # 11.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.1.2 Pg. #: D-3-5 Line #: 19 Code:
Original Specific Comment #15
Comment: The phrase "included risk assessment source term" should be changed to "included as a risk assessment source term."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.1.2 Pg. #: D-3-5 Line #: 24 to 32 Code:
Original Specific Comment #16
Comment: The paragraph describes the berm fill as a source term and suggests several ways in which this material could have been contaminated. The paragraph should be revised to describe the original source of the berm fill.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.1.4 Pg. #: D-3-6 Line #: 22 Code:
Original Specific Comment #17
Comment: The phrase "and risk assessment" should be changed to "and the risk assessment."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.3.1 Pg. #: D-3-10 Line #: 7 to 10 Code:
Original Specific Comment #18
Comment: This sentence states that fruits and vegetables are affected by plant uptake of contaminants from the soil. However, deposition of contaminants onto leaf surfaces also affects fruits and vegetables. This section should be revised to address air deposition.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.3.1 Pg. #: D-3-10 Line #: 10 to 13 Code:
Original Specific Comment #19
Comment: The text states that irradiation as a result of exposure within a cloud of radioactive gas contributes insignificantly to human health risk. The reasons for this conclusion are not readily apparent; the described exposure appears to be potentially significant under some circumstances. The section should be revised to clearly support this conclusion.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.3.3 Pg. #: D-3-10 Line #: 27 Code:
Original Specific Comment #20
Comment: The phrase "and a groundwater" should be changed to "and on groundwater."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.4.1 Pg. #: D-3-12 Line #: 5 to 6 Code:
Original Specific Comment #21
Comment: The sentence states that no remedial action is taken beyond that completed by U.S. Department of Energy (DOE) at the time the site is released by DOE. In fact, the RA assumes that no remedial action is taken beyond that presently accomplished and that no additional remedial action takes place under the scenario of current land use without access controls. The section should be revised to clarify that no remedial action is assumed beyond that already accomplished.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.4.3 Pg. #: D-3-14 Line #: 21 Code:
Original Specific Comment #22
Comment: The word "groundwater" should be changed to the phrase "groundwater from the Great Miami aquifer."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.1.4.3 Pg. #: D-3-14 Line #: 37 Code:
Original Specific Comment #23
Comment: The phrase "sediment associated with the sand lens" should be changed to "sediment potentially impacted by contaminants in the sand lens."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2 Pg. #: D-3-23 Line #: 3 Code:
Original Specific Comment #24
Comment: The phrase "exposure concentration" should be changed to "exposure point concentration."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.1 Pg. #: D-3-23 Line #: 20 Code:
Original Specific Comment #25
Comment: This sentence should include a reference to that part of the RA that presents the method and equations used to calculate upper contaminant levels (UCL).
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.1 Pg. #: D-3-23 Line #: 29 Code:
Original Specific Comment #26
Comment: The sentence beginning at the end of this line is unclear and should be reworded.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.1 Pg. #: D-3-24 Line #: NA Code:
Original Specific Comment #27
Comment: Table D.3-4 should be revised as follows: (1) include a reference to the method and equations used to calculate the UCLs, (2) add a title to the soil column, and (3) change the Sediment heading to Sand Lens Sediment.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.2 Pg. #: D-3-28 Line #: 5 Code:
Original Specific Comment #28
Comment: The phrase "at the locus" is unclear. It should be changed to "at the location."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.2 Pg. #: D-3-28 Line #: 14 to 15 Code:
Original Specific Comment #29
Comment: The modeled air concentrations introduced in this section and presented in Tables D.3-6 and D.3-7 should be revised in response to comments received on the description of the air model and results presented in Section 5.0 and Appendix E.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.3 Pg. #: D-3-28 Line #: 20 to 22 Code:
Original Specific Comment #30
Comment: The modeled groundwater concentrations introduced in this section and presented in Table D.3-8 should be revised in response to comments received on the description of the groundwater model and results presented in Section 5.0 and Appendix E.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.2 Pg. #: D-3-29 Line #: NA Code:
Original Specific Comment #31
Comment: In Table D.3-6, microgram should be changed to picogram in footnote c.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.2.4 Pg. #: D-3-34 Line #: 14 to 15 Code:
Original Specific Comment #32
Comment: The modeled surface water concentrations introduced in this section and presented in Tables D.3-9 and D.3-10 should be revised in response to comments received on the model assumptions, equations, parameters, and results presented in Section 5.0 and Appendix E.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3. Pg. #: D-3-38 Line #: 11 Code:
Original Specific Comment #33
Comment: The term Cs should be changed to C_S.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-39 Line #: NA Code:
Original Specific Comment #34
Comment: Tables D.3-11 and D.3-12 present inhalation and ingestion rates in cubic meters per hour (m^3/hr), liters per hour (L/hr), liters per day (L/day), and cubic meters per day (m^3/day). However, Sections D.3.3.2, D.3.3.3, D.3.3.5, and D.3.3.7, require annual inhalation and ingestion rates in order to calculate radiologic exposures. Tables D.3-11 and D.3-12 should be revised to present annual inhalation and ingestion rates as appropriate.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-39 Line #: NA Code:
Original Specific Comment #35
Comment: Tables D.3-11 and D.3-12 should be revised to clearly explain the source of the parameters that are not specifically referenced within the tables.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-39 Line #: NA Code:
Original Specific Comment #36
Comment: Tables D.3-11 and D.3-12 should be revised to clearly explain where the chemical specific values (csv) referred to in these tables are presented.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-40 Line #: NA Code:
Original Specific Comment #37
Comment: Tables D.3-11 and D.3-12 should be revised to present and reference values for both the ingestion rate (IR) and fraction ingested from contaminated source (FI) parameters; in most cases only the product of these terms (IR x FI) is presented and referenced.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-41 Line #: NA Code:
Original Specific Comment #38
Comment: Footnote d in Table D.3-11 refers to specific guidance from U.S. EPA Region 5. This footnote should be revised with specific reference to this guidance. For example, the footnote could refer to a specific meeting, telephone conversation, or letter; the reference should include a date and the U.S. EPA Region 5 personnel who supplied the guidance.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-41 Line #: NA Code:
Original Specific Comment #39
Comment: Footnote f in Table D.3-11 includes a citation from U.S. EPA Region 5. This footnote should be revised to supply a specific reference for the assumptions made (see Specific Comment #38).
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-41 Line #: NA Code:
Original Specific Comment #40
Comment: Footnote h in Table D.3-11 refers to page 10 of a specific reference; this page does not apply to all the instances in which this footnote is cited. Footnote h should be revised to either include all the appropriate page references or eliminate the reference to page 10.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-41 Line #: NA Code:
Original Specific Comment #41
Comment: Footnote k in Table D.3-11 refers to Sections 6.1 and 6.2 of the Risk Assessment Guidance for Superfund (U.S. EPA 1989). However, these sections do not address the use of 50th percentile body weight as suggested in the footnote. Footnote k should be revised to either refer to the correct sections as appropriate or eliminate any reference to specific sections of this guidance document.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-42 Line #: NA Code:
Original Specific Comment #42
Comment: Footnote l in Table D.3-11 includes references to specific pages in the guidance document cited. However, these references are incorrect in some cases. For example, exposure frequency (EF) should refer to pages 8-7 and 8-8 rather than 8-6. Footnote l should be revised to include correct page references.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-43 Line #: NA Code:
Original Specific Comment #43
Comment: The inhalation rate (0.83 m^3) presented in Table D.3-12 for an on-property resident child, age 1-6, exposed to dusts, volatiles, and radon is derived from a daily adult inhalation rate. The table should be revised to present an age-specific inhalation rate or should clearly explain the uncertainties of using an adult inhalation rate.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-46 Line #: NA Code:
Original Specific Comment #44
Comment: Footnote d in Table D.3-12 refers to specific U.S. EPA Region 5 guidance. The footnote should be revised to clearly identify the source of this specific guidance.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-46 Line #: NA Code:
Original Specific Comment #45
Comment: In footnote g in Table D.3-12, Oswer should be changed to OSWER.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-46 Line #: NA Code:
Original Specific Comment #46
Comment: Footnote k in Table D.3-12 refers to chemical specific values (csv). This footnote should be revised to specify where the csv are located in the report.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-46 Line #: NA Code:
Original Specific Comment #47
Comment: Footnote n in Table D.3-12 refers to page 6-36 of the Risk Assessment Guidance for Superfund (U.S. EPA 1989). This page does not appear to contain the information necessary to support the footnoted items. The footnote should be revised with the appropriate page citation.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-47 Line #: NA Code:
Original Specific Comment #48
Comment: The table header of Table D.3-13 contains the term TF; this term must be defined. Further, the text alternately refers to transfer coefficients and transfer factors (TF). If possible, the RA should be revised to use only one of these terms. Otherwise, the RA should be revised to clarify the meaning of each term.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-48 Line #: NA Code:
Original Specific Comment #49
Comment: The second page of Table D.3-13 contains a superfluous line beneath the transfer coefficients for 3-methyl-2-butanone-3-methyl. This line appears to serve no purpose and should be removed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3 Pg. #: D-3-48 Line #: NA Code:
Original Specific Comment #50
Comment: Table D.3-13 contains minor errors in the estimation of the beef TF and milk TF for some organics. For example, using the log K_{ow} for carbon tetrachloride presented in the Superfund Public Health Evaluation Manual, a beef TF of 1.1×10^{-5} was calculated versus the value of 1.35×10^{-5} presented in the table. The beef and milk TFs presented for organics should be verified. Also, the source of the log K_{ow} used to calculate these terms should be clearly identified.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3.2 Pg. #: D-3-51 Line #: 4 Code:
Original Specific Comment #51
Comment: The term C_{ivd} was not used in Equation D.3-3 and should be removed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3.2 Pg. #: D-3-51 Line #: 17 Code:
Original Specific Comment #52
Comment: This line suggests that the potential for vegetables to be exposed to contaminated dusts will be evaluated. However, the only equations presented in this section refer to exposure to contaminated irrigation water and to contaminated soils. The section should be revised to evaluate the potential for vegetable contamination as a result of contaminated dusts or should clearly explain and justify why this potential source of contamination is not evaluated.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3.2 Pg. #: D-3-51 Line #: NA Code:
Original Specific Comment #53
Comment: The section should be revised to provide a reference for Equation D.3-4.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3.4 Pg. #: D-3-57 Line #: NA Code:
Original Specific Comment #54
Comment: Footnote a of Table D.3-14 refers to a regression equation in Fernald Environmental Management Project's (FEMP) reference EPA, 1992d. However, this reference contains numerous equations. The footnote should be revised to either include the specific equation or provide a more detailed citation.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.3.3.6 Pg. #: D-3-58 Line #: NA Code:
Original Specific Comment #55
Comment: The section should be revised to provide a reference for Equation D.3-16.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.1 Pg. #: D-4-2 through D-4-9 Line #: NA Code:
Original Specific Comment #56
Comment: Following the review of about 20 percent of the data in Tables D.4-1 and D.4-2, data for acenaphthylene, endosulfan, and arsenic were found to be inconsistent with information currently available in the Integrated Risk Information System (IRIS). Therefore, the tables should be updated to reflect current IRIS data.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.1 Pg. #: D-4-2 through D-4-5 Line #: NA Code:
Original Specific Comment #57
Comment: Because only inhalation reference concentrations (RfC) were provided for boron and manganese in the referenced documents, the methods and justifications (such as conversion factors and assumptions) used to convert RfCs to reference doses (RfD) in Table D.4-1 should be explained.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.1 Pg. #: D-4-6 through D-4-9 Line #: NA Code:
Original Specific Comment #58
Comment: Because only unit risks were provided for arsenic and methylene chloride in the referenced documents, the methods used to convert unit risks to inhalation cancer slope factors in Table D.4-2 should be explained.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.1 Pg. #: D-4-7 Line#: NA Code:
Original Specific Comment #59
Comment: The reference in Table D.4-2 is incorrectly footnoted as Health Effects Assessment Summary Table (HEAST) ("e"). The correct reference is IRIS; therefore, the footnote should be changed to "d" to indicate IRIS.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.1 Pg. #: D-4-10 Line #: NA Code:
Original Specific Comment #60
Comment: Table D.4-3 should include a footnote indicating the reference used to prepare the table.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.1.1 Pg. #: D-4-15 Line #: 16 Code:
Original Specific Comment #61
Comment: The text states that actinium-227 clearance from the lungs is expected to take years. However, retention of actinium in the lungs is class W for halides and nitrates, class Y for oxides and hydroxides, and class D for all other compounds (CFR 1992). Therefore, further discussion regarding these classifications and their corresponding lung retention characteristics should be added to the text.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.1.3 Pg. #: D-4-15 Line #: 26 Code:
Original Specific Comment #62
Comment: The text states that the "carcinogenicity of actinium-227 is due to its emission of low-energy beta particles." Carcinogenicity is determined by several factors (see General Comment #2). The guidelines presented in General Comment #2 should be followed in the carcinogenicity determination of radioactive isotopes.

The following information should be added to the toxic effects description of actinium-227: because the low-energy beta particles from this radionuclide are attenuated by dead layers of skin and the half-life of actinium-227 is about 22 years, this radionuclide primarily presents only an internal hazard (see General Comment #3).
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.1.3 Pg. #: D-4-15 Line #: 26 Code:
Original Specific Comment #63
Comment: The text states that the "carcinogenicity of protactinium-231 is due to its emission of alpha particles." Carcinogenicity is determined by several factors (see General Comment #2). The guidelines presented in General Comment #2 should be followed in the carcinogenicity determination of radioactive isotopes.

The following information should be added to the toxic effects description of protactinium-231: alpha particles are primarily considered an external hazard and the half-life of protactinium-231 is about 30,000 years (see General Comment #3).

Also, the text should note the isotope(s) of protactinium which are of concern. If protactinium-231 is the only isotope of concern, this should be noted.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.2.1 Pg. #: D-4-16 Line #: 3 Code:
Original Specific Comment #64
Comment: This introduction should be revised to state that antimony is found in trivalent and pentavalent (not petravalent) states, as stated correctly in Lines 19 and 22.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.2.1 Pg. #: D-4-16 Line #: 8 Code:
Original Specific Comment #65
Comment: This relatively high absorption efficiency is characteristic of organoantimony complexes. Inorganic antimony compounds have much less water solubility and, therefore, very low absorption efficiencies. Unless there is sound evidence that the antimony in FEMP media is in organoantimony form, then the characteristics of inorganic antimony should be used.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.15.2 Pg. #: D-4-38 Line #: 14 Code:
Original Specific Comment #66
Comment: The molybdenum livestock syndrome is called "teart disease" (derived from the dialect of Somersetshire, England), not "heart disease."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.18.1 Pg. #: D-4-42 Line #: 4 Code:
Original Specific Comment #67
Comment: The text states that protactinium clearance from the lungs is expected to take years. However, retention of actinium in the lungs is class W for halides and nitrates, class Y for oxides and hydroxides, and class D for all other compounds (CFR 1992). Therefore, further discussion regarding these classifications and their corresponding lung retention characteristics should be added to the text.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.19 Pg. #: D-4-42 Line #: 23 Code:
Original Specific Comment #68
Comment: The pharmacokinetics for radium should be provided. Retention of radium in the lungs is class W for all compounds (CFR 1992). The text should also note that radium is a bone-seeking element.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.20 Pg. #: D-4-43 Line #: 22 Code:
Original Specific Comment #69
Comment: Regarding pharmacokinetics, the text should note that radon is an inert gas and as such is not classified in terms of lung retention.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.23.1 Pg. #: D-4-48 Line #: 19 Code:
Original Specific Comment #70
Comment: The text notes that data were not located regarding strontium inhalation absorption. Retention of strontium in the lungs is class D for all soluble compounds except $SrTiO_3$, and class Y for all insoluble compounds including $SrTiO_3$ (CFR 1992). This information should be included in the text.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.23.3 Pg. #: D-4-49 Line #: 1 Code:
Original Specific Comment #71
Comment: The text should note that Sr-90 is the only isotope of strontium of concern, if that is the case. The text should also be revised to include the following information regarding Sr-90 that is not currently included in the text. Sr-90 is a fission product that has a half-life of about 29 years and emits a beta particle of fairly low energy. It decays to yttrium (Y-90) which has a short half-life (64 hours) and emits a relatively high energy beta particle. Yttrium decays to stable zirconium. Of primary concern is that Sr-90 accumulates and is retained in bone. Beta particles are primarily an internal hazard (see General Comment #3).
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.24.1 Pg. #: D-4-49 Line #: 12 Code:
Original Specific Comment #72
Comment: The text notes that data were not located regarding technetium inhalation absorption. Retention of technetium in the lungs is class W for oxides, hydroxides, halides and nitrates and class D for all others (CFR 1992). This information should be included in the text.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.24.3 Pg. #: D-4-49 Line #: 24 Code:
Original Specific Comment #73
Comment: If technetium-99 is the only isotope of technetium of concern, it should be noted. Technetium-99 is a fission product which has a half-life of over 10,000 years and decays by emitting a relatively low energy beta particle. It decays to stable ruthenium. Beta particles are primarily an internal hazard (see General Comment #3). This information should be included in the text.

Also, the text states that the "carcinogenicity of technetium-99 is due to its emission of low-energy beta particles." Carcinogenicities of radionuclides are determined by several factors (see General Comment #2) and these should be noted in the text.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.26 Pg. #: D-4-51 Line #: 6 Code:
Original Specific Comment #74
Comment: The pharmacokinetics should be provided for thorium. Retention of thorium in the lungs is class Y for oxides and hydroxides and class W for all other compounds (CFR 1992). In addition, thorium has a very low absorption factor of 0.02 percent. The text should note that thorium tends to concentrate in the bone, liver, and spleen.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.27 Pg. #: D-4-52 Line #: 21 Code:
Original Specific Comment #75
Comment: The text does not provide the inhalation characteristics of uranium. Retention of uranium in the lungs is class D for UF_6, $UO_2(NO_3)_2$, and UO_2F_2, class W for UO_3, UF_4 and UCl_4, and class Y for UO_2 and U_3O_8 (CFR 1992). This information should be included in the text.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.4.2.27.3 Pg. #: D-4-54 Line #: 10 Code:
Original Specific Comment #76
Comment: This section details the physical properties of alpha particles. This information should also be included or referenced in any other section dealing with radioisotopes that emit alpha particles. Also, similar supporting information should be presented for beta particle emission.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.5.1.1 Pg. #: D-5-1 Line #: 18 rb
Original Specific Comment #77
Comment: Equation D.5-1 calculates risk from the intake of a radionuclide. However, the equation does not define whether this intake is acute or chronic. The equation should be revised to define whether the intake is acute or chronic. If the intake is chronic, the definition should include the averaging period.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.5.1.1 Pg. #: D-5-1 Line #: 20 Code:
Original Specific Comment #78
Comment: This section discusses the development of unit risk factors (URF). While the use of URFs appears reasonable, their use may mask whether a single exposure route contributes most of the risk or all routes contribute equally. Care should be taken throughout the report to clearly indicate which route(s) contribute significant risk.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.5.1.2 Pg. #: D-5-2 Line #: 7 Code:
Original Specific Comment #79
Comment: Equation D.5-3 does not estimate a risk, as indicated. Rather, the equation estimates a dose. Therefore, the text should be revised to clarify this, and the method of estimating risk from the dose calculated in the equation should be presented.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.5.2.1 Pg. #: D-5-2 Line #: NA Code:
Original Specific Comment #80
Comment: This section implies that no radionuclides have noncarcinogenic effects, which is not true. The report should be revised to indicate whether any radionuclides included as CPCs in the RA have noncarcinogenic health effects.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.5.3.1.1 Pg. #: D-5-5 Line #: 25 Code:
Original Specific Comment #81
Comment: This section states that the trespassing child receptor was not evaluated with current access controls because the effect of current access controls on exposure frequency could not be determined. However, this may imply that current access controls result in no trespassing child exposure. The report should clearly state whether there is evidence to support such an implication or clearly state that some exposure may occur.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.5.3.1.1 Pg. #: D-5-8 Line #: 4 Code:
Original Specific Comment #82
Comment: This section discusses chemicals contributing carcinogenic risks between 1×10^{-6} and 1×10^{-4}. However, benzo(a)pyrene (b[a]p), which has a carcinogenic risk of 1.8×10^{-5} in Table D.5.1, is not discussed. B(a)p should be added to the discussion.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.5.3.1.1 Pg. #: D-5-8 Line #: 23 Code:
Original Specific Comment #83
Comment: The risks estimated for a trespassing child from CPCs in the silos range from above (5×10^{-3}) to below (4×10^{-5}), depending on the location of the receptor. Because the presented risks range over approximately two orders of magnitude, a likely exposure point for a trespassing child in the silos should be presented with the corresponding risk.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.0 Pg. #: D-6-1 Line #: 2 to 8 Code:
Original Specific Comment #84
Comment: The organization of this section is inadequate. The introduction does not clearly explain how the section is organized. For example, under the current organization, the introduction should briefly identify Section D.6.1 Terminology, Section D.6.2 Sources of Uncertainty, Section D.6.3 Toxicity Assessment, and Section D.6.4 Uncertainty Analysis For Operable Unit 4. However, Section D.6.2, which should discuss sources of uncertainty discusses only sources of uncertainty in the exposure assessment. Sources of uncertainty associated with the toxicity assessment are presented in Section D.6.3, and sources of uncertainty associated with the risk characterization are not addressed.

Section D.6.0 should be reorganized to clearly and completely discuss the uncertainties associated with the RA. One alternative would be to use three major subsections: D.6.1 Terminology, D.6.2 Sources of Uncertainty (including uncertainties associated with the exposure assessment, toxicity assessment, and risk characterization), and D.6.3 Uncertainty Analysis For Operable Unit 4.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.1 Pg. #: D-6-1 Line #: 10 Code:
Original Specific Comment #85
Comment: This line mentions two types of uncertainty. The first is called measurement uncertainty, while the second type is not named. The first paragraph of this section should be revised to provide a name, such as informational uncertainty, for the second type of uncertainty as well as a clearer explanation, including some examples, of this type of uncertainty.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.1 Pg. #: D-6-2 Line #: 4 Code:
Original Specific Comment #86
Comment: This line discusses the conveyance of "real world" information. While reasonable maximum exposures (RME) are by definition conservative, these exposures are also by definition not maximum exposures. Therefore, lines 4 through 8 should be rewritten to clearly explain that RMEs are not maximum exposures and contain some degree of "real world" information.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.1 Pg. #: D-6-2 Line #: 22 Code:
Original Specific Comment #87
Comment: The word "Medium" should be changed to "Median."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.1 Pg. #: D-6-2 Line #: 25 Code:
Original Specific Comment #88
Comment: The word "subgroups" should be changed to "subgroup."

Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.2 Pg. #: D-6-3 Line #: 1 Code:
Original Specific Comment #89
Comment: This line implies that all parameters used in the RA are conservatively biased. This is not the case. Therefore, the phrase "conservative bias of parameters" should be changed to "conservative bias of some parameters."
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.2.1.1 Pg. #: D-6-3 Line #: 16 Code:
Original Specific Comment #90
Comment: This line refers to "generic reasons previously discussed." It is not clear what reasons this statement refers to. The section should be revised to restate these reasons or provide a specific reference to where in the report these reasons are discussed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.2.1.2 Pg. #: D-6-4 Line #: 20 and 21 Code:
Original Specific Comment #91
Comment: These lines state that most model parameter values used in modeling efforts maximize estimates of transport (and hence risk). This discussion should be revised to give some examples of such parameters.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.4 Pg. #: D-6-7 Line #: NA Code:
Original Specific Comment #92
Comment: All of the specific examples of OU4 uncertainties discussed in this section should also appear in Table D.6-1. Some examples, such as soil-to-plant transfer factors (B_{iv}) do not appear in this table.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.4 Pg. #: D-6-8 Line #: NA Code:
Original Specific Comment #93
Comment: The specific uncertainties presented in Table D.6-1 should be grouped by the general source of the uncertainty (exposure assessment, toxicity assessment, and risk characterization).
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.6.4 Pg. #: D-6-10 Line #: 29 Code:
Original Specific Comment #94
Comment: This line refers to Version 6.0 of the U.S. EPA UBK model used to estimate blood lead levels. This sentence should be revised to include a reference for this model.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.7.0 Pg. #: D-7-1 Line #: NA Code:
Original Specific Comment #95
Comment: This section should be revised in response to comments regarding Sections D.1.0 through D.6.0.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.7.1 Pg. #: D-7-2 Line #: NA Code:
Original Specific Comment #96
Comment: Table D.7-1 should be revised to provide a definition of the term "NA." Also, this table presents carcinogenic and noncarcinogenic risk estimates to two significant figures. U.S. EPA's Risk Assessment Guidance for Superfund (U.S. EPA 1989) specifies that these risk estimates should be presented to only one significant figure. Table D.7-1 should be revised to present all risks to one significant figure.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.7.1 Pg. #: D-7-3 Line #: 31 Code:
Original Specific Comment #97
Comment: This line stops prematurely after only two words. The text beginning on line 32 should begin on this line.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.7.1 Pg. #: D-7-5 Line #: NA Code:
Original Specific Comment #98
Comment: Table D.7-2 should be revised to present all risks to one significant figure.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.7.2 Pg. #: D-7-8 and D-7-9 Line #: NA Code:
Original Specific Comment #99
Comment: Tables D.7-3 and D.7-4 present risks associated with background concentrations of COCs in soil. These tables would be more useful if they also presented risks associated with RME conditions. Tables D.7-3 and D.7-4 should be revised to include RME risks. Also, these tables should be revised to present risks to only one significant figure.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6.2 Pg. #: 6-2 Line #: NA Code:
Original Specific Comment #100
Comment: This section states that if sufficient information is available to perform the t-test, Wilcoxon Rank Sum Test, or upper tolerance limit (UTL) test (which is only a simple comparison), a visual comparison of the histograms for the background and site-related data will be performed. It appears as though in these particular cases, subjective professional judgement will be used to eliminate chemicals. This can lead to a conclusion that is not scientifically tenable. The elimination of chemicals from consideration in the RA should follow U.S. EPA Risk Assessment Guidance for Superfund (U.S. EPA 1989), which suggests that subjective elimination of chemicals is not appropriate.

Also, the report does not clearly define how the UTL test will be used. The UTL approach is not a robust statistical test. This approach is, at best, a screening procedure. With the UTL approach, individual maximum contaminant concentrations are simply compared with the calculated upper 95 percent confidence limit of the mean background concentration. This approach does not address whether the population of site-specific and background chemical data is different and therefore can result in either a false negative or false positive conclusion. If, for example, the maximum detected concentrations represent spurious data points or a hot spot, one could erroneously concluded that site-specific and background contamination was different, when these concentrations were only isolated outliers. Conversely, if site-related contaminants had a lower standard deviation than background, the maximum concentration could be less than the 95 UTL, but the site-specific and background mean concentrations could be statistically different. For these reasons, the UTL should be used exclusively for screening purposes or for hot spot analysis and the report should be revised to clearly define how the UTL test will be used.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6.5 Pg. #: 6-6 Line #: NA Code:
Original Specific Comment #101
Comment: Table 6-1 lists the pathway, but not the route, contributing significant risk. Because different routes (that is, ingestion, inhalation, dermal contact, direct exposure) have different associated uncertainties, mechanisms of exposure, and methods of control or prevention, the route(s) contributing significant risk should be listed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6.5.5 Pg. #: 6-8 Line #: 9 Code:
Original Specific Comment #102
Comment: The risks from chronic exposure discussed here are extremely high. This suggests that risks from acute exposure may also be significant. Therefore, the possibility of acute effects should be discussed in the conclusion and may be evaluated in a separate report.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6.6 Pg. #: 6-8 Line #: NA Code:
Original Specific Comment #103
Comment: This section does not include a discussion of data sufficiency. Any "data gaps" may lead to a poor characterization of on-site concentrations and errors in selection of CPCs. These sources of uncertainty and their potential impact on risk characterization should be discussed in this section.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: References Pg. #: D-R-8 Line #: NA Code:
Original Specific Comment #104
Comment: The reference cited as U.S. EPA, 1992d reads in part "Interim Guidance for Dermal Exposure Assessment." This reference should be changed to "Dermal Exposure Assessment: Principles and Applications."
Response:
Action:

BASELINE RISK ASSESSMENT COMMENTS

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.1.4 Pg. #: D-1-5 Line #: 10 Code:
Original Specific Comment #105
Comment: The justification presented in the report for assuming that all environmental data from the site are distributed lognormally is inadequate. According to Pinder and Smith (1975), some environmental contaminants, such as radionuclides, are better fitted with a Weibull distribution than a two-parameter lognormal distribution. Therefore, because it may be untenable to assume a priori that all contaminants at the site are distributed lognormally, the report should provide justification for any determination of distribution. This will facilitate the selection of appropriate statistical procedures for background comparisons. Also, in the cases where the distribution cannot be reliably determined, a normal distribution should be assumed.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.1.4 Pg. #: D-1-5 Line #: NA Code:
Original Specific Comment #106
Comment: The calculation of statistics for estimating intake should be based on the arithmetic, not the geometric mean. This is because the exposure of an individual to site-related contaminants is evaluated spatially and carcinogenic and noncarcinogenic toxicity data is based on lifetime average exposures. It is a fundamental assumption that the exposed individual randomly comes into contact with contaminants across the site. Under this assumption, the spatially averaged soil concentration can be used to estimate the true average concentration contacted over time. In addition, EPA's health criteria are based on the long-term average daily dose which is by definition based on the arithmetic mean, not the geometric mean. Therefore, the arithmetic mean should be calculated and used for estimating exposure in the baseline risk assessment.
Response:
Action:

Commenting Organization: U.S. EPA Commentor: Saric
Section #: D.2.2.2 Pg. #: D-2-9 Line #: 5 Code:
Original Specific Comment #107
Comment: It is appropriate and correct to carry out a line fitting analysis to identify the distribution of the data set. However, using such an analysis to choose between a normal and lognormal distribution for a particular data set appears to be somewhat arbitrary and limited. There are many other distributions that were not considered in the curve fitting analysis, including Weibull and random distributions. Determining the distribution is not an academic exercise since the calculated arithmetic and geometric means can differ by an order of magnitude for the same data set. Simply choosing the distribution based on higher correlation coefficient between lognormal and normal ignores the case in which data do not fit either curve. Therefore, an alternate approach should be used, such as establishing a threshold criteria below which an alternate distribution would be evaluated.
Response:
Action:

REFERENCES

Code of Federal Regulations (CFR). 1992. Title 10, Part 20, Appendix B to Sections 20.1001 through 20.2402. Revised January 1.

Pinder, J.E. III and Smith, M.H. 1975. *Frequency distributions of radiocesium concentrations in soil and biota, in Mineral Cycling in Southeastern Ecosystems.* Howell, F.B., Gentry J.B., and Smith, M.H., eds. CONF-740513. National Technical Information Service, Springfield, VA. pp. 107-125.

Stannard, J. Newall. 1988. *Radioactivity and Health, A History.* October.

U.S. Environmental Protection Agency (U.S. EPA). 1989. Risk Assessment Guidance for Superfund (RAGS), Human Health Evaluation Manual Part A. July.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION V

DATE: June 17,1993

SUBJECT: Review of Remedial Investigation Report for Operable Unit 4, Fernald Environmental Management Project (FEMP), Fernald, OH, November 1992

FROM: Pat Van Leeuwen, Toxicologist PVL
Technical Support Unit

TO: Jim Saric
Project Manager

I have reviewed the risk assessment portion (Appendix D) and related sections of the Remedial Investigation Report for Operable Unit 4 of the Fernald Environmental Management Project (FEMP), dated April 1993. I was very impressed with the organization and presentation of the report. However, my enthusiasm rapidly faded as I began reviewing the report. It appears that all the comments we made on the Site-Wide Characterization Report (SWCR) which were to be incorporated in all subsequent Operable Unit (OU) reports were ignored. I feel that we are back to ground zero on the OU 4 report. The required changes are so extensive that I cannot begin to address them all by page and line references. The following comments address major areas of the report and methodologies in need of correction. I also refer DOE to the corrections and changes in methodology agreed to for all future OU reports during the review of the SWCR. These changes are applicable to the OU 4 Report.

If you have any questions on these comments or any section of the risk assessment, please contact me at 886-4904.

Section D.1; Changes to Risk Assessment Workplan Methodology

We have discussed a number of changes to the WorkPlan Methodology during the review of the SWCR. I do not see these changes noted here.

Page D-1-5 Regarding the use of the geometric mean for small data populations, we refer DOE to the June 22, 1992 Memorandum requiring the use of "Intermittent Bulletin Volume 1, Number 1: Supplemental Guidance to RAGS: Calculating the

Concentration Term". This bulletin refers to methodology to be used for determing the shape of the data distribution. It further reaffirms that in cases where the data can be shown to be lognormally distributed, the UCL of the arithmetic mean for the log transformed data should be calculated. As equations are not presented here, I cannot evaluate whether this was calculated correctly. Present the equations used in this OU report.

Page D-1-7 Regarding the use of the "Unit Risk Factor" methodology for the calculation of intake equations,described in Sections D.5.0 and Attachment D.1, EPA had agreed to review this methodology before allowing its use in an OU risk assessment. As was discussed at the Chicago meeting, the develop of the Unit Risk Factors (URFs) and Unit Toxicity Factors (UTFs) are not fully described. We are still awaiting a sample calculation and presentation of the results. The sample calculation presented in Attachment D.1 was previously rejected as it was based on the methodology for radionuclides and does not include an example of a calculation for the dermal pathways. EPA will review this methodology when an appropriate example is submitted for review; until then the methodology is considered unacceptable for use in OU risk assessments.

Page D-1-7 Regarding the modifications to the dermal contact models and parameters, DOE referenced the correct dermal guidance in the footnotes (but not in the reference section): Dermal Exposure Assessment: Principles and Applications, EPA/600/8-91/011B; however I do not see that the recommended default parameter values given in Table 8-6 of that document were incorporated in the risk assessment. References to the document for some parameter values are incorrect as these parameters are not discussed in those sections of the document.

Section D.2, Identification of COCs

Page D-2-3. line 17 Is data from 31 consecutive days in December adequate for evaluating the radon concentration in the silo headspace? Are there seasonal differences in the silo breathing rate? This section requires more explanation to be convincing that the methods used give a true representation of the silo radon concentration.

Page D-2-9, line 2 The arithemetic mean should be specified here. In general, the UCL of the mean is not used to select the Chemicals of Concern (COCs). If the mean is unstable (due to small sample size or non-detects), the UCL of the mean will be even more unstable.

Page D-2-9, line 21 The value to be used for "nondetects" is 1/2 the sample quantitation limit, not 1/2 the detection limit. We have discussed this issue for nearly two years; make the change in the text and in the calculations.

Page D-2-10, lines 5-11 The use of the Upper Tolerance Limit (UTL) test, as described here to choose Chemicals of Concern, has been a point of discussion since the preparation of the site Workplan. We continue to request the use of traditional statistical methods which provide predictable outputs in this step of the risk assessment. This is consistent with the preparation of all risk assessments reviewed in this Region. Furthermore, the discussion in this section does not indicate how the UTL is being used. A recent teleconference, which included DOE and EPA statisticians, failed to resolve this issue. Thus, this method is still under discussion and has not been approved for use in this or any other OU risk assessment, although it appears to not have created any bias in this instance.

Section D.3, Exposure Assessment

Figure D.3-1, OU 4 Conceptual Model - Silo Contents

We had discussed the release of radon from the silos and the deposition of radon daughters on soil, both from burping and if the silos fail. The potential receptors are off-site farmers, nearby residents, trespassers, groundsworkers and future residents and the significant exposure pathways include incidental ingestion, dermal absorption and direct radiation. This pathway is now listed as minor and dismissed in the risk assessment, without even a discussion. This approach is not satisfactory.

Page D-3-15, lines 29-30 I do not understand how the trespassing child could have assess to the silo area if access controls are in place. I think this scenario needs reevaluating. The trespass scenario should be site-specific and make sense. The trespassing child could still have access to contaminants carried to Paddys Run or deposited in more accessible areas.

Page D-3-25, footnote a The "geometric upper 95% CI on the mean" should be replaced by the "upper 95% CI on the arithmetic mean of the log-transformed data". Also I did not see any mention of "hot spot" analysis in the calculation of the exposure point concentration values in this table. Was the data examined for hot spots? The histgrams, while only a visual examination, should at least indicate if hot spots are present.

Page D-3-23, lines 28-29 I did not understand this comment. Why do the values in Tables D.2-4 and D.3-5 differ?

Page D-3-39, Table D.3-11 I do not see where the SA parameter values for the Dermal Contact with Soil/Sediments pathway came from. These are not the recommended RME values from Table 8-6 of the referenced document.

The parameter values for ET and EF given for the Incidental Ingestion and Dermal Contact with Surface Water pathways are not the RME values from Table 8-6 of the referenced document, nor are they consistent with the values in the other pathways. The difference warrants discussion.

Check footnote 1; the referenced document does not

have a Table 10-1. The Table of recommended values is Table 8-6.

Where are the CT parameter values for these receptor exposure pathways?

Page D-3-43, Table D.3-12 Why are CT parameter values given for only one receptor population? To what is the CT scenario given here to be compared? There is no RME on-property resident.

The On-site Farmer scenario indicates exposure from age 0-70. It would be more appropriate to include a RME On-site resident exposure, with 6 years as a child, and a 50 year farming scenario.

Explain the rationale for the ET parameter values for Inhalation of Dusts, etc. pathway in footnote d. Also explain the ET values for other exposure pathway parameters where this footnote is used.

Footnote d is not correct for the RME On-site Farmer IR value under Incidental Ingestion pathway or for the Ingestion of Fruits/Vegetables, Meat or Milk pathways.

See also the comments on Table D.3-11.

Footnote j is incorrect. See above. Why is reference m needed in addition to footnote j? The recommended body surface area values for the RME and CT exposures, as well as values for ET and EF, are given in Table 8-6 of the reference.

Page D-3-54, line 2 "Decimally absorbed dose" is not the correct meaning for DAD; the correct reference here is "dermally absorbed dose".

Table D.3-14 Some of the Soil Absorption Coefficients listed are incorrect and do not agreed with the values presented in Dermal Exposure Assessment: Principles and Applications, EPA/600/8-91/011B. The soil absorption value for cadmium is 1.0%, not 0.1%. The reference in footnote b is outdated and has been replaced by Human Health Evaluation Manual, Supplemental Guidance: "Interim Dermal Risk Assessment Guidance" DRAFT, September 23, 1992. The values for the dermal absorption of carcinogenic PAHs are inappropriate because these compounds are dermally active and have a different endpoint when the exposure pathway is the dermal route. Addressing the dermal absorption of PAHs in this manner will not be protective, and dermal toxicity values should not be derived for these compounds.

Section D.3 I did not see the inhalation shower scenario described here. The methodology for exposure to volatiles released duri ng showering described on page D-1-12 is not referenced, but appears not to follow the methods developed for EPA.

Section D.3 I did not see any incorporation of risk calculations based on a TEF approach for carcinogenic PAHs. The results of both the BAP and TEF methods can be presented in the results sections and the uncertainties in both methods discussed in the Uncertainties section.

Section D.4 Toxicity Assessment

Table D.4-1 RfC values should be used for the inhalation route of exposure when available. I am not aware of the Region II memorandum on cobalt toxicity. Please restrict toxicity information to IRIS, HEAST and other Agency documents.

Table D.4-4 I have commented previously on DOE's generation of oral absorption factors. EPA Superfund does not ask each contractor to develop their own set of values, but instead employs a contractor through the Environmental Criteria and Assessment Office (ECAO), Cincinnati, to perform literature searches and develop oral and dermal absorption values. The use of ECAO values give some consistency between risk assessments. The values in Table D.4-4 are not consistent with ECAO values. For example, ECAO determined a value of 100% absorption for barium based on data from Lisk et al., 1988, showing > 91% absorption from drinking water and food. The value listed here for barium is 5%, and RAGS is referenced. RAGS does not give oral or dermal absorption for specific chemicals.

Section D.5 Risk Characterization

Page D.5-2, section D.5.2.1 This discussion is misleading. Actually EPA specifies the use of the linearized multistage model at low risk levels; when chemical intakes are high and risk levels exceed 0.01, the one-hit model is used instead.

Page D.5-3 ICLR is used in the text without a definition.

Section D.5 Summary ICLR and HQ tables have been prepared so that they address one medium at a time. It is not possible to determine how much each exposure pathway contributes to the adverse health effects from exposure to that medium. Media risks are segrageted so that it is impossible to determine the total risks from carcinogens or noncarcinogens from exposure to multiple pathways for more than one media. What if the receptor population is exposed to several media? The tables as presented do not adequately summarize the risk to each receptor or provide information needed by the risk manager. All cancinogenic PAHs can be grouped to simplify the tabulation as the same toxicity values are used for each in this calculation.

Section D.5.3.2.1 The CT scenario specifies the on-site resident farmer, while the parameter table gives exposure values for an On-site resident. There is a disjoint here. The CT scenario does not explain that this calculation is an attempt to calculate the average exposure, but that 50% of the population can be expected to have a risk level greater than the CT risk level.

Section D.6, Uncertainty I did not see any discussion of the uncertainties in the PAH calculations (lots here: methodology, dermal endpoints differ, etc.)

Section D.7

Table D.7-1 This table would be more useful if carcinogenic and non carcinogenic risks were separated. Within the carcinogenic risk tabulation, radiological and chemical risks could be separated.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 22 1992

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

MEMORANDUM

SUBJECT: Transmittal of Interim Bulletin Volume 1, Number 1 "Supplemental Guidance to RAGS: Calculating the Concentration Term"

FROM: Larry G. Reed, Director
Hazardous Site Evaluation Division
Office of Emergency and Remedial Response

TO: Regional Waste Management Division Directors

PURPOSE

This memorandum transmits a new interim bulletin, entitled "Calculating the Concentration Term" (Publication 9285.7-08I). This is the first in a series of bulletins designed to provide supplemental guidance to the Risk Assessment Guidance for Superfund (RAGS).

BACKGROUND

A Quality Action Team (QAT) was initiated at the annual Superfund Risk Assessment Meeting in March, 1991, specifically to address the problem of calculating the concentration term for use in Superfund exposure assessment. One of the first action items of the QAT was to develop additional guidance on calculating the "95 percent upper-confidence limit (95% UCL) on the arithmetic mean of site contaminant concentration" that is called for in the Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part A (RAGS, Part A). The QAT membership consists of risk assessors from eight Regions, staff from the Toxics Integration Branch, and staff from the Exposure Assessment Group in the Office of Research and Development. Meetings have been conducted primarily through teleconferencing.

OBJECTIVE

The interim bulletin series will clarify the policy set forth in RAGS Part A, and answer many of the common questions risk assessors are asked regarding the concentration term for use in Superfund risk assessment. The objective is to explain the calculation of the concentration term to RPMs, risk assessors,

statisticians and others involved in the RI/FS process. This interim bulletin specifically addresses the need for calculating an arithmetic mean concentration when modelling long-term exposure to site contaminants, and accounting for the uncertainty in site data by applying the 95 percent UCL.

IMPLEMENTATION

The bulletin should be used by all involved in risk assessment to supplement the guidance in RAGS, Part A. Future bulletins will focus on topics such as, defining an exposure area and dealing with non-detects. The interim bulletins will be available to EPA staff through the Center for Environmental Research Information (CERI) by calling (513) 569-7562. Other interested parties may obtain copies through the National Technical Information Service (NTIS) by calling (703) 487-4650.

cc: Workgroup members
Regional Toxics Integration Coordinators

United States Environmental Protection Agency

Office of Solid Waste and Emergency Response Washington, D.C. 20460

Publication 9285.7-08I May 1992

EPA

Supplemental Guidance to RAGS: Calculating the Concentration Term

Office of Emergency and Remedial Response
Hazardous Site Evaluation Division, OS-230

Intermittent Bulletin
Volume 1 Number 1

The overarching mandate of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is to protect human health and the environment from current and potential threats posed by uncontrolled releases of hazardous substances. To help meet this mandate, the U.S. Environmental Protection Agency's (EPA's) Office of Emergency and Remedial Response has developed a human health risk assessment process as part of its remedial response program. This process is described in *Risk Assessment Guidance for Superfund: Volume I — Human Health Evaluation Manual* (RAGS/HHEM). Part A of RAGS/HHEM addresses the baseline risk assessment, and describes a general approach for estimating exposure to individuals from hazardous substance releases at Superfund sites.

This bulletin explains the concentration term in the exposure/intake equation to remedial project managers (RPMs), risk assessors, statisticians, and other personnel. This bulletin presents the general intake equation as presented in RAGS/HHEM Part A, discusses basic concepts concerning the concentration term, describes generally how to calculate the concentration term, presents examples to illustrate several important points, and, lastly, identifies where to get additional help.

THE CONCENTRATION TERM

How is the concentration term used?

RAGS/HHEM Part A presents the Superfund risk assessment process in four "steps": (1) data collection and evaluation; (2) exposure assessment; (3) toxicity assessment; and (4) risk characterization. The concentration term is calculated for use in the exposure assessment step. **Highlight 1** presents the general equation Superfund uses for calculating exposure, and illustrates that the concentration term (C) is one of several parameters needed to estimate contaminant intake for an individual.

For Superfund assessments, the concentration term (C) in the intake equation is an estimate of the arithmetic average concentration for a contaminant based on a set of site sampling results. Because of the uncertainty associated with estimating the true average concentration at a site, the 95 percent upper confidence limit (UCL) of the arithmetic mean should be used for this variable. The 95 percent UCL provides reasonable confidence that the true site average will not be underestimated.

Why use an average value for the concentration term?

An estimate of average concentration is used because:

Supplemental Guidance to RAGS is a bulletin series on risk assessment of Superfund sites. These bulletins serve as supplements to *Risk Assessment Guidance for Superfund: Volume I — Human Health Evaluation Manual*. The information presented is intended as guidance to EPA and other government employees. It does not constitute rulemaking by the Agency, and may not be relied on to create a substantive or procedural right enforceable by any other person. The Government may take action that is at variance with these bulletins.

Highlight 1
GENERAL EQUATION FOR ESTIMATING EXPOSURE TO A SITE CONTAMINANT

$$I = C \times \frac{CR \times EFD}{BW} \times \frac{1}{AT}$$

where:

I = intake (i.e., the quantitative measure of exposure in RAGS/HHEM)
C = contaminant concentration
CR = contact (intake) rate
EFD = exposure frequency and duration
BW = body weight
AT = averaging time

(1) carcinogenic and chronic noncarcinogenic toxicity criteria[1] are based on lifetime average exposures; and

(2) average concentration is most representative of the concentration that would be contacted at a site over time.

For example, if you assume that an exposed individual moves randomly across an exposure area, then the spatially averaged soil concentration can be used to estimate the true average concentration contacted over time. In this example, the average concentration contacted over time would equal the spatially averaged concentration over the exposure area. While an individual may not actually exhibit a truly random pattern of movement across an exposure area, the assumption of equal time spent in different parts of the area is a simple but reasonable approach.

When should an average concentration be used?

The two types of exposure estimates now being required for Superfund risk assessments, a reasonable maximum exposure (RME) and an average, should both use an average concentration. To be protective, the overall estimate of intake (see **Highlight 1**) used as a basis for action at Superfund sites should be an estimate in the high end of the intake/dose distribution. One high-end option is the RME used in the Superfund program. The RME, which is defined as the highest exposure that could reasonably be expected to occur for a given exposure pathway at a site, is intended to account for both uncertainty in the contaminant concentration and variability in exposure parameters (e.g., exposure frequency, averaging time). For comparative purposes, Agency guidance (U.S. EPA, *Guidance on Risk Characterization for Risk Managers and Risk Assessors*, February 26, 1992) states that an average estimate of exposure also should be presented in risk assessments. For decision-making purposes in the Superfund program, however, RME is used to estimate risk.[2]

Why use an estimate of the arithmetic mean rather than the geometric mean?

The choice of the arithmetic mean concentration as the appropriate measure for estimating exposure derives from the need to estimate an individual's long-term average exposure. Most Agency health criteria are based on the long-term average daily dose, which is simply the sum of all daily doses divided by the total number of days in the averaging period. This is the definition of an arithmetic mean. The

[1] When acute toxicity is of most concern, a long-term average concentration generally should not be used for risk assessment purposes, as the focus should be to estimate short-term, peak concentrations.

[2] For additional information on RME, see RAGS/HHEM Part A and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 55 *Federal Register* 8710, March 8, 1990.

arithmetic mean is appropriate regardless of the pattern of daily exposures over time or the type of statistical distribution that might best describe the sampling data. The geometric mean of a set of sampling results, however, bears no logical connection to the cumulative intake that would result from long-term contact with site contaminants, and it may differ appreciably from — and be much lower than — the arithmetic mean. Although the geometric mean is a convenient parameter for describing central tendencies of lognormal distributions, it is not an appropriate basis for estimating the concentration term used in Superfund exposure assessments. The following simple example may help clarify the difference between the arithmetic and geometric mean when used for an exposure assessment:

> Assume the daily exposure for a trespasser subject to random exposure at a site is 1.0, 0.01, 1.0, 0.01, 1.0, 0.01, 1.0, and 0.01 units/day over an 8-day period. Given these values, the cumulative exposure is simply their summation, or 4.04 units. Dividing this by 8 days of exposure results in an arithmetic mean of 0.505 units/day. This is the value we would want to use in a risk assessment for this individual, not the geometric mean of 0.1 units/day. Viewed another way, multiplication of the geometric mean by the number of days equals 0.8 units, considerably lower than the known cumulative exposure of 4.04 units.

UCL AS AN ESTIMATE OF THE AVERAGE CONCENTRATION

What is a 95 percent UCL?

The 95 percent UCL of a mean is defined as a value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95 percent of the time. Although the 95 percent UCL of the mean provides a conservative estimate of the average (or mean) concentration, it should not be confused with a 95th percentile of site concentration data (as shown in **Highlight 2**).

Why use the UCL as the average concentration?

Statistical confidence limits are the classical tool for addressing uncertainties of a distribution average. The 95 percent UCL of the arithmetic mean concentration is used as the average concentration because it is not possible to know the true mean. The 95 percent UCL therefore accounts for uncertainties due to limited sampling data at Superfund sites. As sampling data become less limited at a site, uncertainties decrease, the UCL moves closer to the true mean, and exposure evaluations using either the mean or the UCL produce similar results. This concept is illustrated in **Highlight 2**.

Should a value other than the 95 percent UCL be used for the concentration?

A value other than the 95 percent UCL can be used provided the risk assessor can document that high coverage of the true population mean occurs (i.e., the value equals or exceeds the true population mean with high probability). For exposure areas with limited amounts of data or extreme variability in measured or modeled data, the UCL can be greater than the highest measured or modeled concentration. In these cases, if additional data cannot practicably be obtained, the highest measured or modeled value could be used as the concentration term. Note, however, that the true mean still may be higher than this maximum value (i.e., the 95 percent UCL indicates a higher mean is possible), especially if the most contaminated portion of the site has not been sampled.

CALCULATING THE UCL

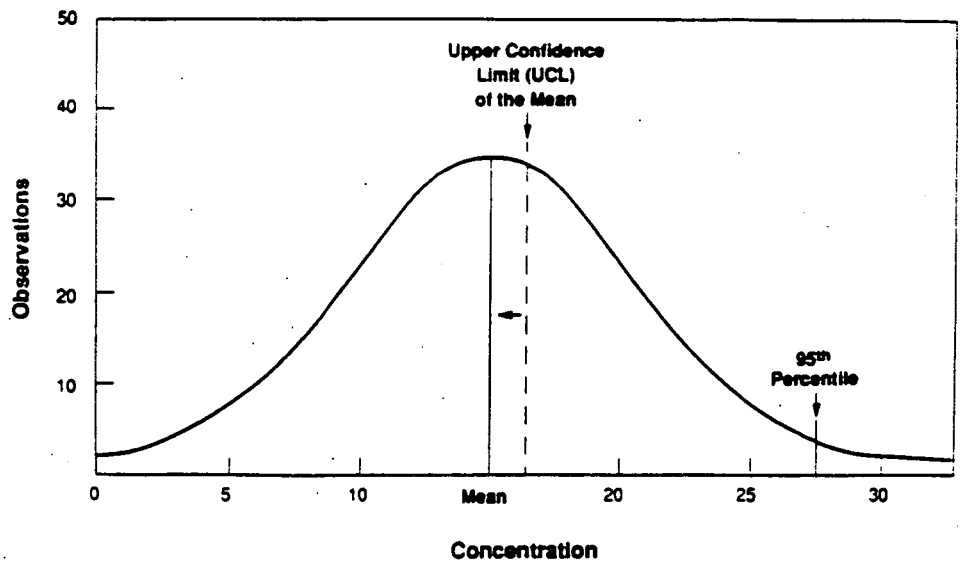
How many samples are necessary to calculate the 95 percent UCL?

Sampling data from Superfund sites have shown that data sets with fewer than 10 samples per exposure area provide poor estimates of the mean concentration (i.e., there is a large difference between the sample mean and the 95 percent UCL), while data sets with 10 to 20 samples per exposure area provide somewhat better estimates of the mean, and data sets with 20 to 30 samples provide fairly consistent estimates of the mean (i.e., the 95 percent UCL is close to the sample mean). Remember that, in general, the UCL approaches the true mean as more samples are included in the calculation.

Should the data be transformed?

EPA's experience shows that most large or "complete" environmental contaminant data sets

Highlight 2
COMPARISON OF UCL AND 95th PERCENTILE



As sample size increases, the UCL of the mean moves closer to the true mean, while the 95th percentile of the distribution remains at the upper end of the distribution.

from soil sampling are lognormally distributed rather than normally distributed (see **Highlights 3** and **4** for illustrations of lognormal and normal distributions). In most cases, it is reasonable to assume that Superfund soil sampling data are lognormally distributed. Because transformation is a necessary step in calculating the UCL of the arithmetic mean for a lognormal distribution, the data should be transformed by using the natural logarithm function (i.e., calculate ln(x), where x is the value from the data set). However, in cases where there is a question about the distribution of the data set, a statistical test should be used to identify the best distributional assumption for the data set. The W-test (Gilbert 1987) is one statistical method that can be used to determine if a data set is consistent with a normal or lognormal distribution. In all cases, it is valuable to plot the data to better understand the contaminant distribution at the site.

How do you calculate the UCL for a lognormal distribution?

To calculate the 95 percent UCL of the arithmetic mean for a lognormally distributed data set, first transform the data using the natural logarithm function as discussed previously (i.e., calculate ln(x)). After transforming the data, determine the 95 percent UCL for the data set by completing the following four steps:

(1) Calculate the arithmetic mean of the transformed data (which is also the log of the geometric mean);

(2) Calculate the standard deviation of the transformed data;

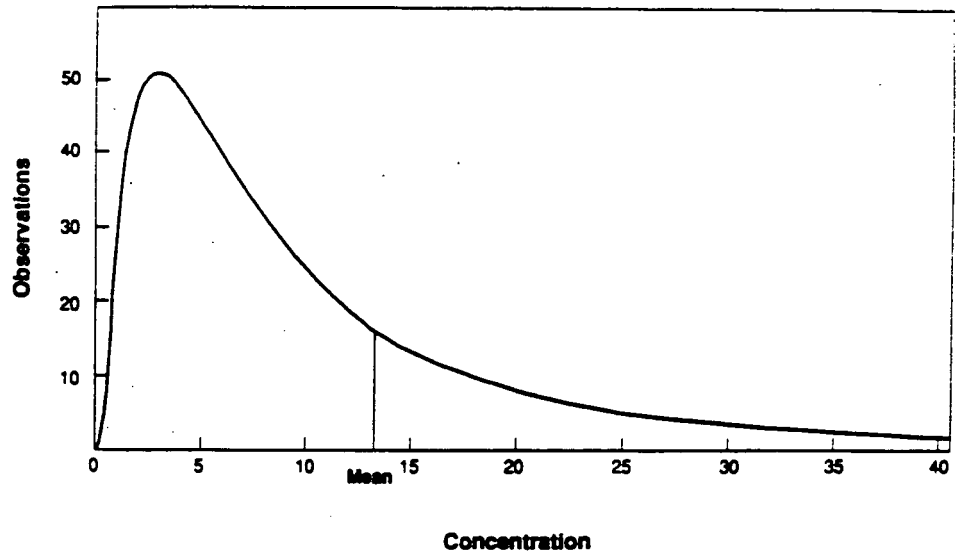
(3) Determine the H-statistic (e.g., see Gilbert 1987); and

(4) Calculate the UCL using the equation shown in **Highlight 5**.

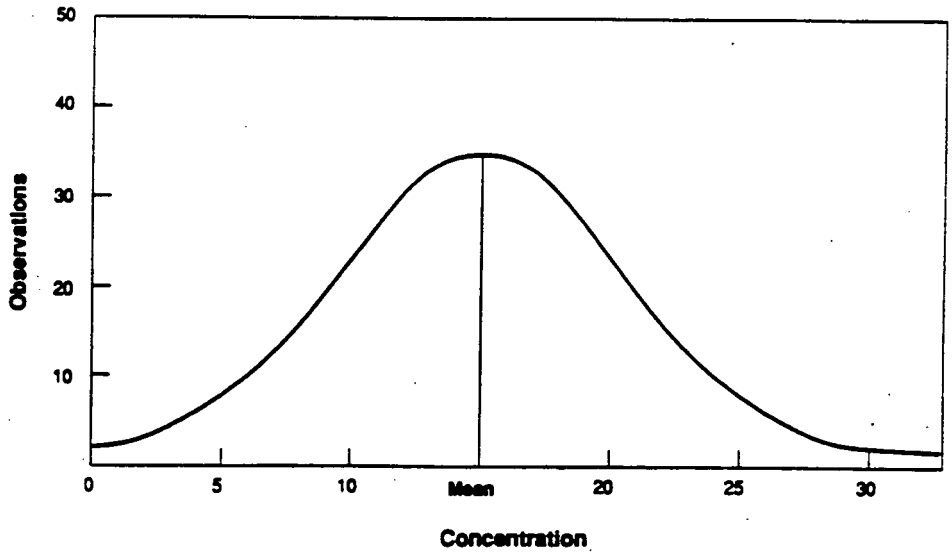
How do you calculate the UCL for a normal distribution?

If a statistical test supports the assumption that the data set is normally distributed, calculate the 95 percent UCL by completing the following four steps:

Highlight 3
EXAMPLE OF A LOGNORMAL DISTRIBUTION



Highlight 4
EXAMPLE OF A NORMAL DISTRIBUTION



Highlight 5
CALCULATING THE UCL OF THE ARITHMETIC MEAN FOR A LOGNORMAL DISTRIBUTION

$$UCL = e^{(\bar{x} + 0.5s^2 + sH/\sqrt{n-1})}$$

where:

UCL	=	upper confidence limit
e	=	constant (base of the natural log, equal to 2.718)
$\bar{x}$	=	mean of the transformed data
s	=	standard deviation of the transformed data
H	=	H-statistic (e.g., from table published in Gilbert 1987)
n	=	number of samples

Highlight 6
CALCULATING THE UCL OF THE ARITHMETIC MEAN FOR A NORMAL DISTRIBUTION

$$UCL = \bar{x} + t(s/\sqrt{n})$$

where:

UCL	=	upper confidence limit
$\bar{x}$	=	mean of the untransformed data
s	=	standard deviation of the untransformed data
t	=	Student-t statistic (e.g., from table published in Gilbert 1987)
n	=	number of samples

(1) Calculate the arithmetic mean of the untransformed data;

(2) Calculate the standard deviation of the untransformed data;

(3) Determine the one-tailed t-statistic (e.g., see Gilbert 1987); and

(4) Calculate the UCL using the equation presented in **Highlight 6**.

Use caution when applying normal distribution calculations if there is a possibility that heavily contaminated portions of the site have not been adequately sampled. In such cases, a UCL from normal distribution calculations could fall below the true mean, even if a limited data set at a site appears normally distributed.

EXAMPLES

The examples shown in **Highlights 7** and **8** address the exposure scenario where an individual at a Superfund site has equal opportunity to contact soil in any sector of the contaminated area over time. Even though the examples address only soil exposures, the UCL approach is applicable to all exposure pathways. Guidance and examples for other exposure pathways will be presented in forthcoming bulletins.

Highlight 7 presents a simple data set and provides a stepwise demonstration of transforming the data — assuming a lognormal distribution — and calculating the UCL. **Highlight 8** uses the same data set to show the difference between the UCLs that would result from assuming normal and lognormal distribution of the data. These

Highlight 7
EXAMPLE OF DATA TRANSFORMATION AND CALCULATION OF UCL

This example shows the calculation of a 95 percent UCL of the arithmetic mean concentration for chromium in soil at a Superfund site. This example is applicable only to a scenario in which a spatially random exposure pattern is assumed. The concentrations of chromium obtained from random sampling in soil at this site (in mg/kg) are 10, 13, 20, 36, 41, 59, 67, 110, 110, 136, 140, 160, 200, 230, and 1300. Using these data, the following steps are taken to calculate a concentration term for the intake equation:

(1) Plot the data and inspect the graph. (You may need the help of a statistician for this part [as well as other parts] of the calculation of the UCL.) The plot (not shown, but similar to **Highlight 3**) shows a skew to the right, consistent with a lognormal distribution.

(2) Transform the data by taking the natural log of the values (i.e., determine ln(x)). For this data set, the transformed values are: 2.30, 2.56, 3.00, 3.58, 3.71, 4.08, 4.20, 4.70, 4.70, 4.91, 4.94, 5.08, 5.30, 5.44, and 7.17.

(3) Apply the UCL equation in **Highlight 5**, where:

$\bar{x} = 4.38$
$s = 1.25$
$H = 3.163$ (based on 95 percent)
$n = 15$

The resulting 95 percent UCL of the arithmetic mean is thus found to equal $e^{(6.218)}$, or 502 mg/kg.

Highlight 8
COMPARING UCLS OF THE ARITHMETIC MEAN ASSUMING DIFFERENT DISTRIBUTIONS

In this example, the data presented in **Highlight 7** are used to demonstrate the difference in the UCL that is seen if the normal distribution approach were inappropriately applied to this data set (i.e., if, in this example, a normal distribution is assumed).

ASSUMED DISTRIBUTION:	Normal	Lognormal
TEST STATISTIC:	Student-t	H-statistic
95 PERCENT UCL (mg/kg):	325	502

examples demonstrate the importance of using the correct assumptions.

WHERE CAN I GET MORE HELP?

Additional information on Superfund's policy and approach to calculating the concentration term and estimating exposures at waste sites can be obtained in:

- U.S. EPA, *Risk Assessment Guidance for Superfund: Volume I — Human Health Evaluation Manual (Part A)*, EPA/540/1-89/002, December 1989.
- U.S. EPA, *Guidance for Data Useability in Risk Assessment*, EPA/540/G-90/008 (OSWER Directive 9285.7-05), October 1990.
- U.S. EPA, *Risk Assessment Guidance for Superfund (Part A — Baseline Risk Assessment) Supplemental Guidance/ Standard Exposure Factors*, OSWER Directive 9285.6-03, May 1991.

Useful statistical guidance can be found in many standard textbooks, including:

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

Questions or comments concerning the concentration term can be directed to:

- Toxics Integration Branch
  Office of Emergency and Remedial Response
  401 M Street SW
  Washington, DC 20460
  Phone: 202-260-9486

EPA staff can obtain additional copies of this bulletin by calling EPA's Center for Environmental Research Information at FTS 684-7562 (513-569-7652). Others can obtain copies by contacting NTIS at 800-336-4700 (703-487-4650 in the Washington, DC area).

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