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RESPONSE TO USEPA AND OHIO EPA COMMENTS AND DOCUMENT REVISIONS OU1 DRAFT REMEDIAL INVESTIGATION REPORT MAY 1994 REF: 5510

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RESPONSES
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RESPONSE TO USEPA AND OHIO EPA COMMENTS AND DOCUMENT REVISIONS OU1 DRAFT REMEDIAL INVESTIGATION REPORT

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

MAY 1994

U.S. DEPARTMENT OF ENERGY
FERNALD FIELD OFFICE

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FOREWORD

This document provides the U.S. Department of Energy (DOE) responses to U.S. Environmental Protection Agency (EPA) and Ohio EPA (OEPA) comments on the February 1994 Draft Final Remedial Investigation (RI) Report for Operable Unit 1 of the Fernald Environmental Management Project (FEMP). This document is organized as follows:

- The Foreword: A users guide of the rationale used to develop this comment response document and an overview of the presentation of change pages to the revised RI Report.
- Comment Responses
- Change Pages: This section includes text pages, figures, and tables of the RI Report that have been revised as a result of the action specified in the comment responses.

This submittal includes responses to all comments made by EPA and OEPA to date and incorporates commitments made by DOE during subsequent formal meetings and informal discussions with both agencies, including the following:

- March 15, 1994; incorporation of Operable Unit 1 change pages submitted to EPA and OEPA.
- March 17, 1994; final comments made by OEPA.
- March 31, 1994; comment response meeting attended by EPA, OEPA, and DOE at the Region V office in Chicago.
- April 3, 1994; final comments made by EPA concomitant with EPA's letter of conditional approval.
- April 22, 1994; responses to verbal comments made by OEPA.

Comment Responses

Responses to EPA comments are followed by those for OEPA. A total of 80 comments were received which include 49 from USEPA and 31 from OEPA. Each comment has been numbered according to the order they were received from each agency.

Each response to a comment has three components: the agency comment, a narrative response, and an action statement that identifies the specific changes made to the corresponding text in the RI Report. Each action statement includes a reference to the text page, figure, or table number in the RI, in cases where the revision is made in locations other than that specified in the agency's comment.

Within most of the agency comments, previous agency comments are referenced. Those references are included in the comment number field. In such cases, DOE responded directly to the new comment by supporting or enhancing the referenced comment in this response document. No revisions have been made to the February 1994 Response to USEPA and OEPA Comments on the OU1 Draft RI Report.

Change Pages

Individual changed pages are provided in this section. Any text that has been changed or added in the RI document is identified by ***bold italic***. The comment number is provided in the left margin. USEPA comments are identified by the comment number followed by "-US" in bold italic (i.e., ***1-US***). OEPA comments are identified by the comment number followed by a "-O" in bold italic (i.e., ***24-O***). Clarifications made by DOE, outside of a response to a specific EPA comment, are identified by "DOE" in bold italic (i.e., ***DOE***). Changes in the text sections that resulted from EPA comments on a Table are identified by "TBL" in bold italic (i.e., ***TBL)***. Any text that has been deleted is identified by strikeout. All previous text identifiers used in the February 1994 RI Report (i.e., highlighted text and comment numbers) remain intact for this submittal. Revised tables and figures do not identify changes. In cases where revisions added more text than what was deleted, page numbers are supplemented with lowercase alpha characters (i.e., 4-22a). This allows text on the subsequent "overflow" pages to remain the same as they were in the February 1994 Draft Final RI Report.

SAMPLE OF CHANGED PAGE

387 HEAST (EPA 1993g) presents no inhalation RfC for lead, but refers to
41-US the National Ambient Air Quality Standard (NAAQS) for lead~~, which could be used in lieu of an inhalation RfC. However, this NAAQS standard was not used in the Operable Unit 1 baseline risk assessment.~~ . ***However, this NAAQS standard is not useful in determining the impact of lead on children under the age of seven and; therefore, was not used in the Operable Unit 1 baseline risk assessment.*** The NAAQS for lead is 1.5 $\mu g/m^3$, averaged quarterly (EPA 1992b). The NAAQS is equivalent to 0.00043 mg/kg/day, assuming a body weight of 70 kg and an inhalation rate of 20 m^3/day.

Section 3

USEPA Comments

U.S. EPA TECHNICAL REVIEW COMMENTS
OPERABLE UNIT 1 (OU1)
DRAFT REMEDIAL INVESTIGATION (RI) REPORT, REVISION 1

(Draft Responses Supplemented with Action Items
Resulting from 3/31/94 DOE-EPA Meeting)

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.4.2.1 Page #: 3-24 Line #: 24 Code:
Original Comment #: 1 (#66 - OSC #13)

Comment: The original comment states that the characterization of the till should address secondary permeabilities. The U.S. Department of Energy (U.S. DOE) discusses horizontal and vertical hydraulic conductivities (K_h and K_v) and uses a 10:1 ratio for K_h and K_v for the fate and transport modeling. Based on slug test data, K_h ranges from 3.1×10^{-3} to 2.5×10^{-6} centimeters per second (cm/s). Using a ratio of 10:1, these values for K_h would give K_v values that range from 3.1×10^{-4} to 2.5×10^{-7} cm/s. However, in the fate and transport modeling, U.S. DOE uses a K_v value that ranges from 4×10^{-6} to 6.6×10^{-6} cm/s. U.S. DOE should explain this discrepancy.

Response: Comment acknowledged. The values quoted from Section 5.3.2.3, while seeming to represent a discrepancy, were derived from the larger data set specifically for the "unweathered till" in Layer 1 of the vadose zone modeling, and thus, represent a much narrower application of the data. Characterizing the vertical permeability of moderately stratified materials, a ratio of 10:1 (horizontal to vertical) is considered appropriate. Text should be revised to explain how the vertical conductivity range may be estimated, to state that vertical conductivity would range from 2.5×10^{-7} to 3.1×10^{-4} cm/sec, and to interpret the significance of this vertical conductivity.

Action: Page-3-33, lines 4-7, have been revised as follows:
"To account for macroscopic aquifer properties which may not be measured in the laboratory core tests, the range in vertical permeability may be estimated by using a horizontal (1000-series wells' slug test data) to vertical conductivity factor of 10 to 1 which is typical for moderately stratified materials. Using the range of horizontal conductivities presented below, vertical conductivity would range from 2.5×10^{-7} to 3.1×10^{-4} cm/sec. This range is at the high end of values from the laboratory core testing and reflects larger scale aquifer features measured by the slug tests (e.g. some wells slug tested were screened across clay and sand lithologies)."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.4.2.3 Page #: 3-26 to 3-28 Line #: NA Code:
Original Comment #: 2 (#69 - OSC #16)

Comment: The original comment states that basic hydrogeologic information, including vertical and horizontal permeabilities, should be discussed. U.S. DOE does not fully discuss K_h and K_v values for the Great Miami Aquifer (GMA). U.S. DOE cites literature values (Spieker 1968a) for the GMA (Type III aquifer); however, it should also discuss if K_h and K_v values were determined from pump or slug tests performed on site wells installed in the GMA.

Response: Comment acknowledged. Actual values obtained from pump and slug tests were originally used in the modeling procedure, but when the model did not predict the conditions that were actually known, the values were modified. Therefore, the actual K_v values used in the final model were modified where appropriate.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.0 Page #: 3-41 to 3-45 Line #: Figures 3-2 to 3-6 Code:
Original Comment #: 3 (#70 - OSC #17)

Comment: The original comment states that waste pit cross-sections should indicate how media elevations were determined, specifically for the pit liners. U.S. DOE addressed this comment by stating that at least one boring in each waste pit extended to the clay liner below each pit. Figures 3-2 through 3-6 also illustrate this point. However, U.S. DOE's response to Original Comment #74 (OC #58) states that all borings in the pits were stopped above the liner to avoid damage. U.S. DOE should resolve this discrepancy.

Response: This comment actually refers to both Original Comments #70 and #74. The response to Original Comment #74 was misstated.

Action: The following text has been inserted on page 3-2, line 5: "The boring logs show that at least one of the borings in Waste Pits 1 through 4 terminated in a clay which was interpreted to be the liner material."

Figures 3-4 and 4-19 have been modified to indicate the Boring 1772 was terminated at the bottom of the native clay layer.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 3.0 Page #: 3-86 to 3-87 Line #: Figure 3-47 and 3-48 Code:
Original Comment #: 4 (#72 - OSC #19)

Comment: The original comment states that groundwater flow directions indicated on perched water level maps may be inaccurate because wells may not be screened in the same geologic units. U.S. DOE partially addressed this comment by stating that coarse-grained (sand and gravel) lenses were correlated in cross-sections A-A', B-B', E-E', and G-G'. The correlation of the lenses is not apparent in cross-sections A-A' and B-B'. U.S. DOE should address this issue.

Response: Comment acknowledged. The cross-sections were intended to be viewed collectively. Collectively, they show the presence of the coarse-grained lens at the same elevation and stratigraphic position. No revision to the RI Report needed.

Action: None.

Section 4

USEPA Comments

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Page #: 4-12 Line #: 27 and 28 Code:
Original Comment #: 5 (#93 - OSC #22)

Comment: The original comment discusses thorium concentrations in the waste pits. U.S. DOE apparently references the incorrect pages. As described in the Action, page 4-19 is incorrectly referenced twice. Apparently, the first and second reference to page 4-19 should actually reference page 4-15. U.S. DOE should resolve this discrepancy.

Response: Agree. The discrepancy can be resolved by changing reference to page 4-16.

Action: The following text has been inserted as line 1 on page 4-16: "All of the waste pits contained Th-230 concentrations that were above background levels." The text on page 4-16, line 4, has been modified as follows:

"The highest average value for Th-230, 11,000 pCi/g, was reported for Waste Pit 2."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.0.5 Page #: 4-14 Line #: 9 Code:
Original Comment #: 6 (#99 - OSC #26)

Comment: The original comment discussed the concentration of various metals in the waste pits. In the Response and Action section to this comment, U.S. DOE discusses "major" and "minor" inorganic contaminants. U.S. DOE should discuss which contaminants are considered "major" and "minor" and why.

Response: Comment acknowledged.
Subjective terms "major" and "minor" should be removed from the text.

The paragraph should be revised to discuss consistency of data sets using actual numeric correlation. Lesser correlation exists between trace analytical determinations than with predominant constituents.

Action: The following text has been modified on page 4-18, as follows:

"Although the concentrations of all analytes determined were not consistent between both data sets, there did exist consistency among many of the metals. Generally, the results for calcium, magnesium, sodium, potassium, aluminum, and iron compared well between the two studies. This is most likely due to the high concentrations found of these analytes resulted in less error. Whereas, the results for antimony, beryllium, cadmium, cobalt, and nickel compared between data sets more poorly, probably due to the fact that these analytes were reported out at concentrations close to the detection limit resulting in a greater associated error. The remaining metals varied in their consistency, generally determined by the concentration reported."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.1.3 Page #: 4-18 Line #: 2, 3, and 4 Code:
Original Comment #: 7 (#104 - OSC #31)

Comment: The original comment discusses elevated electromagnetic (EM) readings indicated on Figure 4-10. U.S. DOE addressed this comment by revising Figure 4-10. U.S. DOE should indicate in the table included in Figure 4-10 that area C is an area of elevated EM readings.

Response: Agree. Designation for area C EM readings in legend of figure should be included.

All geophysical figures should include a legend pattern for each anomaly such as EM, magnetic, and GPR readings.

Action: Individual figures (Figures 4-10, 4-18, 4-20, 4-22, and 4-24) and geophysical text updates (in Sections 4.2.1.3, 4.2.2.3, 4.2.3.3 and 4.2.4.3) have been prepared for each "dry pit". The legend in Figure 4-10 has been revised to include area C with an elevated magnetic anomaly reading.

Action taken under comment #10.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.1.3 Page #: 4-18 Line #: 5 and 6 Code:
Original Comment #: 8 (#105 - OSC #32)

Comment: The original comment states that a high density of buried objects is discussed in the text for area D, but this area is not indicated on Figure 4-10. U.S. DOE addressed this comment by revising Figure 4-10. However, the original comment also requested U.S. DOE to discuss in the text the apparent high density of buried objects indicated in area D in Figure 4-10. Because this revision was apparently not included, U.S. DOE should revise the text to include a discussion of area D.

Response: Disagree. Area D is discussed on page 4-23, lines 9, 12, and 25 through 27. As discussed in Comment #7 (above), all geophysical figures will be revised to identify anomalies such as EM, magnetic, and GPR readings.

Action: Individual figures (Figures 4-10, 4-18, 4-20, 4-22, and 4-24) and geophysical text updates (in Sections 4.2.1.3, 4.2.2.3, 4.2.3.3 and 4.2.4.3) have been prepared for each "dry pit." The legend in Figure 4-10 has been revised to include area C with an elevated magnetic anomaly reading.

Action taken under comment #10.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.1.6 Page #: 4-24 Line #: 30 and 31 Code:
Original Comment #: 9 (#107 - OSC #34)

Comment: The original comment states that a conflict exist in the text concerning what radiological contaminants are considered predominant in Waste Pit 1. U.S. DOE has not resolved this issue. A discrepancy still exists between which constituents are considered predominant and others which are detected above background (see Section 4.2.1.4, page 4-24, paragraph 1, and Section 4.2.1.6, page 4-32, paragraph 1). U.S. DOE should resolve this discrepancy.

Response: Agree. An editorial change is required for Radium-226 to be consistent with the previous discussion of predominant versus above-background concentrations.

Action: The text on page 4-32, line 4 has been modified as follows: "U-238, U-234, Th-230, and Ra-226 are the predominant radiological constituents found in Waste Pit 1. Th-228, Th-232, U-235/236 and Ra-228 were found at concentrations above background."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.2.5 Page #: 4-33 Line #: 20 and 21 Code:
Original Comment #: 10 (#117 - OSC #41)

Comment: The original comment discusses inorganic constituents being a possible source of dissolved solids in Waste Pit 2. U.S. DOE addressed this comment by stating that increased EM readings taken from over 70 percent of Waste Pit 2 area probably due to the presence of highly conductive material. U.S. DOE should provide evidence to support this conclusion, such as material encountered in borings or detections of material from ground penetrating radar.

Response: Partially agree. EM data showing elevated readings is included in Figure 4-18, however the figure is not clear. The figure should be revised to identify anomalies such as increased EM readings, corresponding with the strategy in second half of Comment #7. No attempt was made to correlate the EM readings against the boring locations. The EM readings were used primarily to prevent boring through unknown and potentially dangerous materials such as drums.

Action: Individual figures (Figures 4-10, 4-18, 4-20, 4-22, and 4-24) and geophysical text updates (in Sections 4.2.1.3, 4.2.2.3, 4.2.3.3 and 4.2.4.3) have been prepared for each "dry pit". The legend in Figure 4-10 has been revised to include area C with an elevated magnetic anomaly reading.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.3.3 Page #: 4-38 Line #: 34 Code:
Original Comment #: 11 (#121 - OSC #45)

Comment: The original comment states that thorium and radium were not reported for the RI/FS leachate samples and that strontium-90 (Sr-90) is elevated in Waste Pit 3 leachate, but is not discussed in the text. U.S. DOE responded to this comment in part by stating that the uranium found in the leachate from Waste Pit 3 was, on average, natural uranium, and that this was consistent with the activities presented for the waste material. However, according to Table F.2.38.3 included in the "Response to USEPA and Ohio EPA Comments, OU1 Draft Remedial Investigation Report" (dated February 1994), 2 of 5 (40 percent) of the RI/FS pit material samples from Waste Pit 3 indicates the presence of depleted uranium in the waste pit material. U.S. DOE should address this discrepancy.

Response: Disagree. Discrepancy exists only when comparing individual sample results to average sample results. When considering two of five samples, it would indicate the presence of depleted uranium. However, when the additional uranium samples are averaged into the distribution, analysis of all the uranium samples indicates that natural uranium is present based on the ratio of the various isotopes.

Action: Included in the radiological discussion of Waste Pit 3 is the following text on page 4-51, line 8:

"Although 40 percent of the actual sample data points indicate depleted uranium present; when all samples are integrated into the analysis, the resulting ratios indicate the presence of natural uranium. Natural uranium means that the ratio of the activity concentration of U-234 to U-238 is one and the ratio of U-235 to U-238 is twenty."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.4.6 Page #: 4-52 Line #: 3 and 4 Code:
Original Comment #: 12 (#127 - OSC #51)

Comment: The original comment discusses metals that were detected above background but were not discussed in the text. U.S. DOE addressed this comment by discussing the metals that were detected above background levels. However, in the original comment, it was noted that cobalt and zinc appeared to be elevated when compared to background levels. Because U.S. DOE did not address these constituents in its discussion, it should discuss these constituents.

Response: Agree. An editorial change should be made to include cobalt and zinc where results are above background.

Action: The text on page 4-52, lines 29-30 have been modified as follows: "Antimony, chromium, cobalt, mercury, silver and zinc were reported at concentrations exceeding those of the background soil."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.2.7.6 Page #: 4-68 Line #: 20 and 21 Code:
Original Comment #: 13 (#140 - OSC #61)

Comment: The original comment states that there are metals that exceed "normal abundance levels" that are not discussed in the text and that the term "normal abundance levels" should be defined. U.S. DOE addressed this comment by revising the list of metals that exceeded normal abundance levels" to mean above background levels. However, in the revised list of metals, arsenic, lead, and magnesium are deleted. U.S. DOE should state why these constituents were deleted.

Response: Consistent with the previous submittal, the term "normal abundance levels" has been deleted. Agree that arsenic and lead should be included. An editorial change should be made to include arsenic and lead where appropriate, but not magnesium, which is less than background.

Action: The text on page 4-90, line 3, has been modified as follows: "Arsenic, barium, beryllium, cadmium, copper, lead, and silver were the inorganic metal constituents which exceeded the background soil concentrations during both sampling programs."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.1.1 Page #: 4-75 Line #: NA Code:
Original Comment #: 14 (#146 - OSC #66)

Comment: The original comment states that background field instrument for detection of low energy radiation (FIDLER) readings and locations should be provided. U.S. DOE's response states that descriptions of the background FIDLER measurements are presented in Table 4-25; however, Table 4-25 contains RI/FS groundwater data. U.S. DOE should reference the correct table. Also, according to Figure 3-7, there is a significant portion of time when background FIDLER locations 14 and 15 are downwind. This would appear to invalidate these locations as background locations. U.S. DOE should address this discrepancy.

Response: Partially agree. The Comment Response document indicated the background measurements are presented in Table 4-25, which is incorrect. However, the text on page 4-99 presently refers to Figure 4-25 rather than Table 4-25.

Disagree that locations 14 and 15 should be invalidated as background locations. Their concentrations fall within two SD of the mean. Removal of these two points will not impact the reported mean significantly.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.2.1 Page #: 4-81 Line #: 22 and 23 Code:
Original Comment #: 15 (#154 - OSC #74)

Comment: The original comment states that the amount of uranium detected in each zone is a result of the limited number of samples collected from the zones. U.S. DOE has not adequately addressed this comment. According to Figure 2-12A, there were nine borings drilled through the Upper Sand and Gravel Layer, three were drilled through the Lower Saturated Sand and Gravel Layer, and just one was drilled into the Deep Saturated Sand and Gravel Layer. If, as stated in the document, a soil sample from each borehole for each layer was submitted for radiological analysis, then there would be nine samples collected from the Upper Saturated Sand and Gravel Layer, three samples collected from the Lower Saturated Sand and Gravel Layer, and one collected from the Deep Saturated Sand and Gravel Layer. This would still seem to indicate that lesser amounts of radiological contaminants would be detected in the two lower layers due to the fewer samples analyzed. Also, the fact remains that only one sample from the Deep Saturated Sand and Gravel Layer was submitted for radiological analysis and this sample was collected from a location upgradient of OU1. Because this would affect the amount of uranium in this layer, U.S. DOE should address these issues.

Response: Comment acknowledged. It appears that the commentor believes that there is a negative bias due to the number of samples analyzed for radiological constituents within the lower sand and gravel layers. However, this limited number of samples is due to the fact that only positively screened samples were field screened by the SPA-3 prior to submission to the lab for full radiological analysis. The response to the original comment did not fully address this issue. Refer to response to Comment 155, which stated, "Agree. The detected U-238 and U-234 activity concentrations, as shown in Table 4-20, represent the highest concentrations in each boring. In addition, U-238 activity concentrations are shown on Figure 4-29. The subsurface soil samples collected at 5-foot intervals were first screened by a large volume scintillation detector (SPA-3), and the sample with the highest reading within each geologic horizon was selected for radiological laboratory analysis; so, the vertical extent of radiological contamination could be determined qualitatively by the sample collection scheme." No further action required.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.3.2.1 Page #: 4-81 Line #: 34, 35, and 36 Code:
Original Comment #: 16 (#157 - OSC #77)

Comment: The original comment states that contamination is detected at a depth of 35.0 feet in Zone 2, but that 35.0 feet is indicated as Zone 1 in Table 4-20. U.S. DOE's response to this comment states that the soil sample collected at boring 3004 at 35 feet below ground surface (bgs) is from the Upper Saturated Sand and Gravel Layer. According to Table 4-20, this sample was collected from the Glacial Overburden. U.S. DOE should address this discrepancy.

Response: Agree. Discrepancy exists for subsurface Sample 007932 in Boring 3004 at 35 feet. Both the text and Table 4-20 should be revised to resolve this discrepancy.

Action: Text on page 4-107, lines 20-24 was correct as presented. Table 4-20 was updated to indicate that Boring 3004 was from the upper sand and gravel layer (Zone 2).

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.5 Page #: 4-108 Line #: 17 and 18 Code:
Original Comment #: 17 (#171 - OSC #89)

Comment: The original comment requests that U.S. DOE provide analytical evidence supporting U.S. DOE's statement that contaminant loading from OU1 to Paddys Run has been reduced. U.S. DOE has not provided the data, although it may only be semi-quantitative according to Original Comment #172, to support the statement that the stormwater runoff control system, and subsequent contaminant loading to Paddys Run, is operating effectively. U.S. DOE should provide the data.

Response: Comment acknowledged. Data to support conclusions in Section 4.5, Surface Water and Sediment, are non-existent. Conclusions should be revised to be qualitative instead of quantitative.

Action: The text on page 4-141, lines 15-21, has been inserted as follows: "Although there does not exist any analytical data prior or subsequent to the completion of the Stormwater Run-off Removal Action, the loading of contaminant run-off into Paddys Run has been considered to have been reduced. If the stormwater run-off from the waste pit area has been diverted to the Clearwell, (with eventual removal to the biodenitrification surge lagoon), it should be apparent that the contaminant loading to Paddys Run has been diverted."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.5.1.1 Page #: 4-109 Line #: 2 and 3 Code:
Original Comment #: 18 (#173 - OSC #90)

Comment: The original comment states that the surface water body from which samples shown in Table 4-33 were collected should be indicated and that a figure showing these locations should be provided. U.S. DOE addressed this comment by referencing Figures 2-5 and 4-36 for surface water samples (DD-07 and DD-09) listed in Table 4-33. However, the location where sample DD-09 was collected is not shown in Figure 2-5 and the locations where samples DD-07 and DD-09 were collected are also not shown in Figure 4-36. The respective figures should indicate the locations where these samples were collected. Additionally, U.S. DOE should include a figure showing the location where samples DD-07 and DD-09 were collected on Paddys Run in relation to OU1, especially because they are contaminated. The location where a background sample was collected can then be shown on the figure.

Response: Agree. Figure 2-6 should be revised to identify the locations where water samples DD-07 and DD-09 were collected. Two reasons exist for using Figure 2-6 rather than the original Figure 2-5. First, Figure 2-6 shows a larger area, which alleviates changing the perspective of Figure 2-5. Second, Figure 2-6 presently contains the locations of other surface water samples collected. There were no background surface water samples collected during the sampling program.

Action: Text on page 4-142, line 15, has been modified to refer to Figure 2-6 only, which now shows the location of DD-01, DD-07, and DD-09.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.5.1.1 Page #: 4-109 Line #: 14 and 22 Code:
Original Comment #: 19 (#176 - OSC #93)

Comment: The original comment states that samples R08 and R06 show elevated uranium concentrations, but they are not included on Figure 4-35. U.S. DOE addressed this comment by revising Figure 4-36 (formerly Figure 4-35). However, the areas where samples R08 and R06 were collected were not shaded as areas of elevated uranium concentrations in Figure 4-36. U.S. DOE should address this issue.

Response: Agree. Areas surrounding sampling locations RO-6 and R-08 should be shaded to show the elevated uranium concentrations.

Action: Figure 4-36 has been modified to include area surrounding samples R-08 and R-06 as shaded to indicate elevated uranium concentrations.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.5.1.1 Page #: 4-110 Line #: 21 Code:
Original Comment #: 20 (#179 - OSC #96)

Comment: The original comment states that samples ASIT-18, -19, and -22 should be indicated as areas of elevated uranium concentrations. U.S. DOE addressed this comment by indicating in Figure 4-36 (formerly Figure 4-35) where samples ASIT-18, -19, and -22 were collected. However, it was requested that these sample locations be indicated as areas of elevated uranium concentrations. According to Table 4-35 in the revised RI report, samples ASIT-18, -19, -23, and -24 meet the criteria for elevated uranium concentrations. U.S. DOE should shade these areas in Figure 4-36 to indicate elevated uranium concentrations. Also, U.S. DOE should indicate which sample was used to establish background levels and its concentration and location.

Response: Agree. Shading should be added to Figure 4-36 to identify areas of elevated uranium concentrations at sampling locations ASIT-18, 19, 23, and 24.

Action: Figure 4-36 has been modified to include shaded areas around ASIT-18, -19, -23, and -24 to indicated areas of elevated uranium concentrations.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.5.2.3 Page #: 4-112 Line #: 6 and 7 Code:
Original Comment #: 21 (#187 - OSC #104)

Comment: The original comment states that Cs-137, Np-237, and isotopic uranium results should be provided and that the reason for rejecting all radium results. U.S. DOE did not include the Cs-137 and isotopic plutonium results in Table 4-38. U.S. DOE should include these results because they are part of the original comment.

Response: Comment acknowledged.

Action: Table 4-38 has been modified to include the additional radionuclides Cs-137, Np-237, and isotopic plutonium.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.5.3 Page #: 4-113 Line #: 27 Code:
Original Comment #: 22 (#191 - OSC #108)

Comment: The original comment states that the incorrect figure is referenced. U.S. DOE partially addressed this comment by referencing Figure 4-37. However, Figure 4-37 only shows the Characterization Investigation Study (CIS) sediment results. Section 4.5.3, which references Figure 4-37, is a summary of surface water and sediment results. This summary would include the RI/FS sediment sample results. U.S. DOE should revise Figure 4-37 and the text to include the RI/FS sediment sample results in the summary.

Response: Agree. A discrepancy exists. Figure 4-37 identifies CIS screening and should not have been referenced in the summary. Figure 4-36 is the correct figure for this reference. Figure 4-36 should be referenced in the text in Section 4.5.3 for both CIS and RI/FS surface water and sediment in the summary.

Action: The text on page 4-148, line 5 has been modified as follows: "Figure 4-36". Also the word "sediment" has been added to the figure title.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Page #: 4-165 and 4-166 Line #: Table 4-2 Code:
Original Comment #: 23 (#193 - OSC #110)

Comment: The original comment states that some background concentrations for groundwater are above maximum contaminant levels (MCL). U.S. DOE partially addressed this comment by stating that the background groundwater concentrations for some inorganic constituents exceeded MCLs. However, according to Table 4-2, antimony, beryllium, cadmium, and thallium also exceed their respective MCLs. U.S. DOE should review the data and revise the table.

Response: Comment acknowledged. All analytes exceeding their MCL in Table 4-2 should be footnoted.

Action: Table 4-2, which presents the 95th percentile values as background concentrations, has been footnoted to indicate the reported values exceeding the MCLs.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 4.0 Page #: 4-167 Line #: Table 4-2 Code:
Original Comment #: 24 (#194 - OSC #111)

Comment: The original comment discusses the occurrence and source of radionuclides Ru-106, Sr-90, and Tc-99 in soils at the site. U.S. DOE partially addressed this comment by stating that the background soil samples were collected in areas that would not be influenced by wind or other transport mechanisms. U.S. DOE should provide a map indicating where the background soil samples were collected.

Response: Comment acknowledged. A reference to the figure identifying background soil samples should be provided.

Action: The text has been inserted on page 4-4, line 8, as follows: "Sampling locations of the background soil samples are presented in Figure 2-11. These sample locations were chosen because of their physical similarity to the soils encountered within the FEMP site and their (unlikely) minimal contamination from the FEMP via the wind or other transport mechanisms."

Commenting Organization: U.S. EPA - Region 5, Radiation Section Commentor: Rad Section
Section #: 4.2.2.4 Page #: 4-28 Line #: 37 Code: C
Original Comment #: 49 (#113 - OC #6)

Comment: It is stated that the concentration value for Th-228 listed in Table 4-5 is considered to be an anomalous analytical result since Th-228 should be in secular equilibrium with Th-232 and Ra-228 parents. Nonetheless, both the CIS and RI/FS radiological data indicates an excess average concentration of Th-228, with Th-228/Th-232 concentration ratios of 1.5 (CIS) and 3 (RI/FS); radium data is not available from the CIS, so a Th-228/Ra-228 ratio comparison is not possible. This is a consistent indication that within Waste Pit 2, Th-228 is present in higher concentrations than its Th-232 "parent" for whatever reason. While viewed as an anomaly, this data should still be accepted as true and usable, provided it's validated data.

2nd Comment: U.S. DOE states in its response that the Th-228 results in fact are not anomalous, but their stated modifications to text were not made. The modifications for this comment involved deletion of the reference to the anomalous results, requiring most of the original paragraph to be deleted.

Response: Comment noted. Upon review of the data presented in Appendix A, it was determined that one of the CIS samples (-009) and two of the samples from the RI/FS program revealed results with high Th-228 results. Tables 4-4 and 4-5 present the data as statistical averages which makes it appear that all Th-228 is not in secular equilibrium. Considering that Waste Pit 2 has been closed for 30 years, it should be considered that minimally only about 10 years would be required for the disposed waste to be in secular equilibrium. Additionally, the Ra-228 data for the two RI/FS samples portrays a better correlation to the Th-232 results than does the Th-228, as indicated in the text on page 4-37. Although a situation exists which reports data that are in question, the data have been validated and have been considered true and useable for both Fate and Transport Modeling and Risk Assessment.

Action: The following text has replaced the statement regarding anomalous results found on page 4-37, lines 32-33: "Although the statistical mean of both the CIS and RI/FS data indicate that the Th-228 is not in secular equilibrium with Th-232, the individual results indicate the activity concentrations are within secular equilibrium and the other three sample results portray high results for the Th-228 isotope."

Section 6

USEPA Comments

Commenting Organization: U.S. EPA Commentor: Saric
Section #: 6.0 Page #: 6-26, 6-28, 6-30, 6-32 Line #: NA Code:
Original Comment #: 25 (#263 - OSC #6)

Comment: The original comment requested that total risks for the visitor be changed in Table 6-1. The response stated that risks were recalculated using linked spreadsheets. The incremental lifetime cancer risks presented in Tables 6-3, 6-5, 6-7, and 6-9 appear to be correct. However, the risks are presented with two significant digits. For example, in Table 6-3 the radiocarcinogenic risk for the groundskeeper via exposure to the air is reported as 5.9E-06. U.S. Environmental Protection Agency (U.S. EPA) guidance recommends that carcinogenic risks be reported only with one significant digit.

Response: Agree. ILCRs in summary tables in Section 6, 7, E.5 and E.7 were presented to one significant figure. The ILCR tables in Attachment E.IV were presented to two significant figures to benefit those who want to duplicate the calculations.

Action: ILCR values in the summary tables were changed to one significant figure.

Appendix E

USEPA Comments

Commenting Organization: U.S. EPA Commentor: Saric
Section #: E.2.2.1 Page #: E-2-6, E-2-7 Line #: 27-40, 1-9 Code:
Original Comment #: 26 (#313 - OSC #18)

Comment: The original comment stated that tentatively identified compounds (TIC) should be reviewed and evaluated if a significant number of TICs are present. The response states that TICs were generally qualified as "R" (unusable) or "NJ" (tentatively identified estimated). Therefore, TICs could not be positively identified and were not carried through the risk assessment. This response is not acceptable. Even if TICs cannot be positively identified, it would be possible to provide a qualitative estimate of the percentage of total chemical contamination represented by TICs. The risk assessment should be revised to provide such a qualitative estimate and to discuss the effects of the fact that TICs were not evaluated and their bearing on the characterization and interpretation of the risks for OU1 based only on compounds that were identified. For example, if TICs appear to represent about 50 percent of the total chemical contamination and are assumed to be at least as toxic as identified chemicals, then risks based only on chemicals that could be identified may under represent the total OU1 risks by about 50 percent.

Response: Agree that tentatively identified compounds (TICs) can make a significant impact on risks posed by organic contaminants and can contribute to the uncertainty of a risk assessment. However, as stated in RAGs Volume 1, Part A, the identity and concentration of TICs are uncertain, making quantitative assessment of chemical contamination or risk difficult.

RAGs, Volume 1, Part A, Section 5.6 describes how TICs can be addressed. The method involves comparing the relative number of TICs to TCL/TAL chemicals. This evaluation was performed from a review of CRU1 data. The review indicated there were few TICs compared to TCL and the TAL chemicals, supporting exclusion of TICs from the quantitative assessment.

Action: A qualitative discussion of the impact of TICs to risk consistent with RAGs guidance was included as Section E.6.3.2. This analysis included an assessment of frequency and a qualitative toxicological analysis based upon compound class.

A discussion of the impact of TICs to the RI/FS was added to Tables E.6.3, 6-11 and 7-7.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: E.2.3.1.2 Page #: E-2-15 Line #: 7-11 Code:
Original Comment #: 27 (#326 - OSC #25)

Comment: The original comment requested that the U.S. EPA Region III guidance document referred to in the text be identified and the values in the guidance document that were compared to OU1 concentrations be identified. The response identified the U.S. EPA guidance document and added a table in Section E.II that lists one set of U.S. EPA Region III screening criteria. However, the text on page E-2-15 states that "Solid samples were compared to residential surface soil samples and liquid samples were compared to tap water." The table added to Section E.II (Table E.II-13) contains only one column labeled "Region III Residential Value." Apparently this column contains U.S. EPA Region III residential surface soil values; however, this is certainly not clear. The risk assessment should be revised to more clearly label Table E.II-13 and to include another column in the table that presents U.S. EPA Region III tap water values.

Response: Comment acknowledged. The screening values for water were overlooked. Due to a change in procedures, in response to USEPA Comment #43, Region III screening criteria will no longer be used. This screening criteria was replaced with risk-based screening criteria calculated from the U.S. EPA Risk Assessment Guidance Supplement, Part B guidance for both soil and surface water.

Action: The ninth bullet in Section E.2.3.12 was removed and replaced with the following:

- Chemicals with representative concentrations lower than screening values calculated from USEPA RAGs Part B, based on a HQ of 0.1 and a risk level of 10^{-7}, were removed from the CPC list and assigned the deletion symbol "F" in Attachment E.II. [Note: This section underwent further changes per request from USEPA and OEPA.]

The tables in Section E.II were changed to reflect this toxicological screening criteria. Table E.II-13 was revised to include risk-based screening criteria based on USEPA RAGs Part B for soils and surface water.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: E.3 Page #: E-3-99 Line #: Table E.3-18 Code:
Original Comment #: 28 (#338 - OSC #61)

Comment: The original comment stated that this table (formerly Table E.3-17) presented input parameters for incidental ingestion of and dermal contact with soil and sediment together. This comment was possibly misinterpreted because of the wording of the original comment. The original comment was intended to point out that the input parameters for ingestion of soil and sediment (reported in the table as soil/sediment) and for dermal contact with soil and sediment were apparently combined. For example, the ingestion rate (IR) of soil/sediment for the trespassing youth is reported as 0.1 gram per day. It is not clear if the risk assessment assumes that the trespassing youth ingests a total of 0.1 gram of soil and sediment per day or if the trespassing youth ingests 0.1 gram of soil per day and 0.1 gram of sediment per day. Table E.3-18 should be revised to indicate whether the input parameters presented for ingestion of soil/sediment and dermal contact with soil/sediment represent totals for both media or if the parameters represent the values that were used for each medium. If the parameter values represent sums, a footnote should be added explaining how the values were divided between the two media.

Response: Agree that the table was unclear. The same ingestion rate was used for incidental ingestion of both soil and sediment. The contribution from the two media was adjusted by the fraction ingested term (FI), to reflect the amount of time the receptors are exposed to that particular media out of a 16 hour day. For dermal contact for soil/sediment, parameters represent the values used for each medium. The table should be corrected with a footnote to clarify the use of these parameters.

Action: Footnote "t" in Table E-3-18 was changed to read: "FI for soil and sediment are based on the number of hours exposed out of 16 waking hours per day (DOE 1993e)." Footnote "u" was added to Table E-3-18 stating, "Parameters represent values used for exposure to both media, sediment, and soil which apply to that receptor."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: E.3.5.7.4 Page #: E-3-65, E-3-98 Line #: 15-16 Code:
Original Comment #: 29 (#378 - OSC #53)

Comment: The original comment stated that an inhalation rate of about 2.0 cubic meters per hour (m^3/hour) would be acceptable for the construction worker. The response states that the standard default value of 2.5 m^3/hour was used. However, Section E.3.5.7.4 states that "an inhalation rate of 2.0 m^3/h is used..." On the other hand, the inhalation rate for the "On-property home building Age 19+" is reported as "0.83 m^3/hr" in Table E.3-18. The risk assessment should be revised to resolve these inconsistencies. An inhalation rate of either 2.0 m^3/hour or 2.5 m^3/hour is acceptable for the construction worker.

Response: Agree. This was a typographical error. The correct inhalation rate of 2.5 m^3/hour was used for calculation.

Action: The inhalation rate for the homebuilder described in the text of section E.3.5.7.4 was changed to 2.5 m^3/hr for the homebuilder.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: E.3.5.7.5 Page #: E-3-66 Line #: 4-6 Code:
Original Comment #: 30 (#379 - OSC #54)

Comment: The original comment requested that a citation be added for the U.S. Soil Conservation Service Field Office Technical Guide. The response added a citation for this document in the reference section. However, this document is still not referenced in the text. Section E.3.5.7.5 should be revised to added a reference to the appropriate guidance.

Response: Comment acknowledged. This discussion was deleted in response to USEPA Comment 40.

Action: None.

Commenting Organization: U.S. EPA Commentor: Saric
Section #: E.5.3 Page #: E-5-9 Line #: 26-31 Code:
Original Comment #: 31 (#407 - OSC #87)

Comment: The original comment requested that the location of all significant groundwater risks be identified. The response moved two figures from Section E.IV to Section E.5. These two figures are now included in the risk assessment as Figures E.5-1 and E.5-2. However, these figures are not referred to in the text at a point where such a reference would be most helpful; that is at the point where the locations of the greatest off-property and on-property risks are discussed. Therefore, Section E.5.3 should be revised to include references to Figures E.5-1 and E.5-2 to supplement the existing discussion.

Response: Agree. References should be added as requested.

Action: The text "(Figures E-5-1 and E-5-2)" was inserted in the third paragraph of Section E.5.3, after the text reading "...east of the fenceline" and "...just down-gradient of Waste Pit 4."

Commenting Organization: U.S. EPA Commentor: Saric
Section #: E.III.3.9 Page #: E.III-27 Line #: 37 and 38 Code:
Original Comment #: 32 (#435 - OSC #114)

Comment: The original comment stated that this section presented two equations for calculating the absorbed dose per event (DA_{event}); because t_{event} is always less than t^*, the second equation should be removed. The response suggests a change in the narrative. The change was made in the section discussing volatilization, but was not made in the section discussing dermal contact. In any case, the response is insufficient. As stated in the original comment, the second equation (line 38) is superfluous because t_{event} is always less than t^* and should, therefore, be removed. Section E.III.3.9 should be revised to include the narrative change reported in the responses in the section discussing dermal contact and to remove the second equation (line 38).

Response: Agree that, for this particular scenario (dermal contact while showering), t_{event} is always less than t^*. However, this was intended as an example of the dermal contact with water pathway that would apply to both showering and swimming, where t_{event} is greater than t^* for many constituents. This should be clarified in the text.

Action: The first paragraph under the heading <u>Dermal Contact</u> in section E.III.3.9, was replaced with the following text: "The following sample calculation shows the method used to quantify exposure via dermal contact with water (i.e., from swimming, showering, bathing, etc.) (EPA 1989a, 1992b, 1992c). In the example given below, dermal contact with household water containing vinyl chloride is calculated."

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 33 (#160 - NEW)

Comment: I was surprised to see DOE again include the Upper Threshold Limits (UTL) approach. We have discussed this approach several times and commented that the UTL value might be very unstable, and even exceed the maximum background level, as the UTL calculation is sensitive to even a single elevated sample. I do not recall EPA ever agreeing to the use of the UTL approach. For radionuclides, the use of the UTL is a moot point. If the comparison of the radionuclide concentration including background with the background concentration is the basis of the assessment, then no prior elimination of radionuclides based on a comparison with any background concentration level, either means or the UTL, is acceptable.

Response: Agree that UTLs were included in some of the tables in Section 4. UTLs were not used in risk assessment calculations. The risk assessment used the 95% UCL, as discussed during the March 31, 1994 meeting between DOE and EPA. DOE indicated that UTL was designated in Section 4 for the purpose of assisting delineating nature and extent issues.

Action: Figure E.2-1 was added to Appendix E.2 describing CPC procedure.

The following text was added at the end of the first paragraph of Section E.2.3: "A flow diagram describing the CPC selection procedure is presented in Figure E.2-1."

All use of and references to UTLs were removed.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 34 (#261 - OC1)

Comment: My comment on the issue of the proper approach for radionuclides (subtract natural background levels and calculate the risk for the residual) is consistent with my comment #22 in the Response to Comments - Risk Assessment Work Plan Addendum, February 1992 referred to in the response. DOE continues to prefer to do two sets of risks calculations for radionuclides--one which includes the background component and a second for the background levels only. What is missing in the assessment is the risk above background; the latter is used in the risk management step.

DOE should probably rethink their approach, as it will make it more difficult for them to apply the evolving cleanup standards when they are available. The DOE approach also means that exclusion of radionuclides as CPCs using a comparison with background is not valid, and this step should be removed from the screening process outlined on pages E-2-14 and E-2-15.

Response: Comment acknowledged. During a meeting between DOE and EPA on March 31, 1994, it was determined that the method used for background comparison to risk of radionuclides at the FEMP had been consistently applied and would not result in deleting or removing radionuclides that could contribute significant risks. The concentration of background radionuclides is on the order of 1pCi/g and therefore in comparison to contamination and cleanup levels, it would not be prudent to attempt to subtract background. This is also consistent with proposed EPA cleanup criteria based on a 10^{-4} risk standard.

Action: None.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 35 (#309 - OC4)

Comment: The May 1993 DRAFT "Superfund's Standard Maximum Exposure Factors for the Central Tendency and Reasonable Maximum Exposure", while draft, represents Regional consensus as well as "best professional judgement" at present. As such, it is a relevant document. It is fine to include it in the reference section, but this should not be done unless it was used in the report. I did not see any reference to this document in the text. Please explain how it fits into the report.

Response: Comment acknowledged. This reference was used in Table E.3-18, Exposure Input Parameters, Future Source Term Receptors (EPA 1993h) to arrive at the FI term used for ingestion of fruits, vegetables and meat for the CT farmer. The remainder of the guidance was difficult to implement because of limited applicability to this site. For instance, exposure durations from the draft guidance for the CT and RME residents did not seem applicable to this site because guidance values were for residential exposure and not a resident farmer.

This topic was discussed between DOE and EPA on March 31, 1994. It was agreed that if the values in this guidance could not be applied completely, the guidance should not be referenced. It was noted by USEPA that this guidance should be used for future risk assessments.

Action: Exposure values for CT and RME residents will remain as they are.

Reference "r" was deleted from table E.3-18.

Reference to the guidance, (EPA, 1993h) has been removed from the reference section of this document.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 36 (#310 - OC5)

Comment: Action is incomplete. Please add to the text: "Some contaminant exposures (childhood exposure to lead, dermal exposure to PAHs, etc.) might be better addressed using a qualitative approach."

Response: Agree. The text should be added as requested.

Action: The text above was added to Section E.1.3.2 after the last bullet.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 37 (#327 - OC12) Table E.2-3

Comment: The reporting is still unconventional--soil metals are usually reported in mg/kg. I am now further confused as some metals previously reported have been eliminated (an example is arsenic), although the previously listed concentration in soil was toxic even if one assumes that the value should have been mg/kg instead of g/kg. Please explain the removal of these contaminants.

Response: a) Agree. Units should be converted to mg/kg for the tables in E.2.
b) Agree, some metals retained in the original risk calculation (i.e., arsenic, zinc) were removed from the CPC list after an improperly implemented comparison with background. (See OEPA Comments 28-32.)

Action: a) Units and values of concentrations in Tables E.2-2 - E.2-12 were converted to mg/kg.
b) Tables were verified to make certain that all constituents were handled appropriately.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 38 (#374 - OC18)

Comment: The response is incomplete. I/the reader does not have any idea why the exposure is limited to a 30-year period if the resident lives in the area for 70 years? Please provide an explanation of your assumptions for this scenario.

Response: Agree. There are no areas designated for swimming on the Great Miami River; therefore, we assumed that it was not used for recreational purposes. However, young adults have recently been observed swimming and fishing in the Great Miami River. Accordingly, we have assumed that a youngster of 12 years of age would use the Great Miami River for swimming, fishing and diving, probably through age 42. For recreational use of the river, this receptor would use the river seven times per year, 2.6 hours per event, 30 years of a 70-year lifespan.

Action: The following text was added to replace the second sentence of paragraph 4 in section E.3.5.7.1: "Although there are no areas designated for swimming in the GMR, it is assumed that a youth, 12 years of age, would use the GMR for swimming, fishing and diving, through age 42. This age range was selected because the GMR current makes the river unsafe for very young children to swim in and because there are no designated swimming areas to attract visitors. It is very unlike that anyone would use the river for recreational purposes over an entire lifetime. Therefore, the exposure duration assumed for this scenario is 30 years."

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 39 (#375 - OC19)

Comment: The new explanation is interesting; however, I believe that the NRC value represents an average (read CT) exposure, not an RME exposure as required by RAGS. In any assessments, which is more on the order of 175 eight-hour days. It might be longer if the contractor/builder puts up the barns, garage, etc. in addition to the house. I am concerned that the risk to this receptor is seriously underestimated.

An additional problem is raised by the use of 10 hour workdays, as the soil Incidental Ingestion and Dermal Absorption pathways use 8 hour days in the calculation. (Actually, the gamma radiation exposure is the only exposure for which the total hours input will work.) A further confounder in the construction/builder scenario is the use of 365 days as the averaging time for non-carcinogens. The time frames must be consistent; the risk stops when the exposure stops.

Response: Agree. An exposure duration of 175 eight-hour days should be used for the RME home builder. Agree - Averaging time for non-carcinogens was not applied appropriately.

Action: Parameters for this receptor were changed in Table E.3-18 The fourth paragraph in Section E.3.5.7.2. was replaced with the text: "The homebuilder is evaluated to assess the health impacts of exposures incurring while building a home on property. For this activity, it is assumed that a worker spends approximately 175 eight-hour days constructing a home."

Risks were recalculated for the homebuilder and presented in Section E.5.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 40 (#370 - OSC52; #377 - OC20)

Comment: Some additional explanation is still needed in the scenario description of the on-site farmer. It is not readily apparent that the gamma radiation exposure is based on the total time spent outdoors (total hours/year), while the Incidental Ingestion of soil pathway uses the number of days exposed (in the explanation, either 100 or 48 days) at the elevated ingestion rate.

The second question, whether the US Conservation Services data represents an average (read CT) exposure or an RME exposure, was not addressed. What if the farmer chooses to plant more that 10% of his land in hay/spent more time in the field--is he at greater risk? What is a realistic upper bound (RME) exposure value? Maybe this is a moot point, as even the average exposure presents an unacceptable risk for any on-site farming activities at this OU. However, it would be nice to be able to use a consistent site-wide exposure scenario, as it might make a difference in another on-site location, and it will be difficult to explain the modification of the farmer's activities, based on location. By the way, 4.2 hrs x 275 days = 1155 hrs.

Response: In Table E3-18, the time of gamma radiation exposure of the on-site farmer is based on 5.7 hours outdoor and 18.3 hours indoor exposure, for a total of 24 hours for the RME receptor. The on-site farmer CT receptor receives 4.2 hours indoor and 19.8 hours outdoor exposure, for a total of 24 hours total.

Agree the text is confusing. The USDA values were chosen because there is only a small amount of data on the agricultural receptor. As pointed out in the comment, this lack of information makes sensitivity analysis difficult. The value for ET of 100 - 8 hour days, 800 hours per year, for the farmer was consistent with the approach used for the OU4 RI, OU4 FS and OU4 CRARE. The justification presented in E.3.5.7.5 was a summary of the logic initially used to calculate the average soil ingestion rate of 0.18 g/day for the RME farmer.

Action: The first two sentences in the third paragraph of Section E.3.5.7.3 were removed and replaced with: "It is assumed that the CT resident adult farmer is exposed outdoors approximately 4.2 hours/day for 275 days/yr, which is equivalent to 1155 hours of outdoor exposure in a year."

Section E.3.5.7.5: The text beginning with "The soil ingestion rate of the RME....." to "...Work Plan Addendum (DOE, 1992a)," was replaced with: "A soil ingestion rate of 0.18 grams per day (DOE, 1993f) was used to approximate lifetime exposure to the RME farmer. This value is based on ingestion rates for activities performed throughout the receptors lifetime including childhood, youth and adult lifestages over a 70 year period. For the sake of this risk assessment, it is assumed that all soil ingested is from OU1."

(DOE, 1993f) was added to the reference section to reference the OU4 RI Report, Final Edition.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 41 (#386 - OC23) Lead Profile
Comment: There still appear to be a number of problems with statements in this profile.

Page E-4-45, lines 19-24: The NAAQS for lead is useful in assessing the adverse health impacts on the general public from inhalation of lead; however, the NAAQS is not useful in determining the impact of lead on children under the age of seven, the population of concern. The text revision states that the NAAQS was not used, but gives the impression that it could be used for children, as the previous sentence discusses these health impacts.

Page E-4-46, lines 20-24: The limitations on the use of the UBK Model for Lead are the FEMP data, not the UBK Model. Versions 0.5 and 0.6 of the Model have been widely applied at CERCLA sites in both this Region and other Regions. The use of interim versions of the Model represent the best science at present.

Page 4-47, lines 1-2: The Science Advisory Board review took place more than a year ago. Version 0.99D of the IEUBK Model and the guidance manual have been completed and are in the process of being distributed.

Response: a) Agree. The lead profile should be changed to implicitly state that the NAAQS standard is not acceptable for children.
b) Agree. Statements regarding the adequacy of the lead model has been removed.
c) Agree. This passage discussing SAB review has been updated.

Action: a) In the second paragraph of Section E.4.2.47.2, the text "which could be used in lieu of an ....However,.... baseline risk assessment" was deleted and replaced with the text: "However, this NAAQS standard is not useful in determining the impact of lead on children under the age of seven and therefore was not used in the OU1 baseline risk assessment."
b) The sixth paragraph in Section E.4.2.47.2 was deleted.
c) The eight paragraph in Section E.4.2.47.2 was deleted and this text was added to the end of the sixth paragraph in this section: "Version 0.99 of the IEUBK model has undergone Science Advisory Board review and is currently being distributed."

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 42 (#394 - OC24)

Comment: I did not see the updates/dermal discussion for PAHs used in the OU4 reports included in this update, although other OU4 guidance was incorporated. EPA has revised the guidance for PAHs to allow the use of Relative Potency Factors (RPFs) in the risk calculation. Please comment.

Response: Comment noted. The approach for assessing dermal risk from exposure to carcinogenic PAHs was first provided by EPA in a comment to the FEMP on the OU4 Feasibility Study Report made in December, 1993, with additional comment provided on February 1, 1994. Final resolution on this comment was obtained after the response to comments by DOE to EPA on February 7, 1994. However, the OU1 baseline risk assessment was finalized on January 28, 1994 and did not allow a revision of the Remedial Investigation Report for the February 8, 1994 submittal date. There was not sufficient time for DOE to incorporate this guidance prior to the submittal of the OU1 baseline risk assessment.

Since that time, the agreed-upon approach was implemented and changed pages were submitted to USEPA on March 18, 1994.

Action: The pages revised on March 18, 1994, have been included. The RPFs used for PAHs in Table E.4-5 have been changed to those recommended in EPA's "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons" (EPA/600/R-93/089).

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 43 (#466 - DERR 158)

Comment: I was surprised to see that I had suggested the use of Roy Smith's tables for choosing CPCs in a 6/28/93 teleconference. (1) My calendar shows that I was engaged on another site on 6/28/93; I do have notation of a 6/8/93 teleconference with FERMCO. (2) I am not a big advocate of Roy Smith's tables, except as a quick screening device. I prefer the of EPA guidance--i.e., do the calculations in RAGS, Part B. (3) Roy's table should only be used for preliminary (pre-RI) screening of a site; they should <u>never</u> be used as part of the process to select CPCs. The tables have not been approved by Headquarters; therefore, they remain Region III guidance.

Response: DOE considered the procedures based on both RAGs Part B and EPA Region III (Roy Smith's tables) in the development of toxicity screening criteria for OU1. Both EPA Region III and RAGs Part B use similar procedures and ECAO values, however, the assumptions made are slightly different. A comparison of criteria generated by RAGs Part B and EPA Region III values assuming a risk level of 10^{-7} and hazard quotient of 0.1, showed that EPA Region III values used by Roy Smith were lower for toxicants, and consequently, more conservative. Therefore, DOE decided to use the more conservative values from EPA Region III as screening criteria for determining constituents of potential concern. DOE will establish the RAGs Part B as the primary screening method as recommended by EPA.

Action: Criteria calculated from RAGs Part B, assuming a risk level of 10^{-7} and a hazard quotient of 0.1. was used as the screening methodology in place of the EPA Region III values. References to EPA Region III table [E II-13] were deleted and replaced with EPA RAGs Part B.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 44 (#NEW 01) Page E-2-14, bullets.
Comment: This section has been revised to include some points which were eliminated in previous review comments.

Bullet 4: I have previously commented that the use of a 5% frequency of detection limit to eliminate contaminants as CPCs is an example in RAGS, not a rule. When a large number of samples are collected, detection in 5% of the samples might result in a large number of detects which cannot be dismissed so frivolously. A frequency of detection rule should not be used unless the limit value has been specifically agreed upon by the project manager, toxicologist and health physicist for the site.

Bullet 5: The first sentence seems to be incomplete--include "at concentrations found" where?

Bullet 7: Why? The decomposition products of some contaminants, such as chlorinated hydrocarbons and PAHs, are the more toxic entities, and these products are toxic at concentrations in the parts per billion range!

Bullet 8: Why? VOCs with vapor pressures less than 10 mm Hg would still be a problem under certain exposure scenarios. Please explain.

Bullet 9: Roy Smith's/Region III Tables may <u>never</u> be used to eliminate contaminants as CPCs; this is a screening guidance. See above comments.

Bullet 10: Add "These chemicals were discussed qualitatively or semi-qualitatively."

Bullet 12: <u>All</u> radionuclides might be present at levels that do not "significantly" exceed background levels, given the high natural background for some radionuclides, and still present an unacceptable risk above background. This is not a valid comparison given the methodology employed in this assessment. See above comments.

Response: Bullet 4. Agree. The screening criterion based on frequency of detection (bullet 4), was not used in the OU1 baseline risk assessment because, in general, there was inadequate data to allow a frequency screening. However, this screening criterion would only be applied on a constituent by constituent basis after considering the chemicals relative toxicity and concentration detected in a particular medium. Such evaluations would only be made by the Project Manager in conference with the site Toxicologist and Health Physicist.

Bullet 5. Agree. The bullet will be deleted.

Bullet 7. Agree. This screening criterion (bullet 7) was not used to screen CPCs in the OU1 baseline risk assessment and was removed from this list.

Bullet 8. Agree. This screening criterion (bullet 8) was used to screen out one

constituent in the OU1 baseline risk assessment. The constituent, Butanoic acid methyl esther, was concluded to be either a laboratory artifact produced during chemical analysis or possibly a fatty acid ester product of plant life. Accordingly this bullet will be removed from the list.

Bullet 9. Comment noted. DOE has calculated values using Part B of the RAGs guidance.

Bullet 10. Agree. The text will be changed to read, "These chemicals were discussed qualitatively or semi-qualitatively."

Bullet 12. Agree clarification is needed. Radionuclides in the OU1 baseline risk assessment were screened based on a comparison to background using the procedures outlined in Section E.2.3.1.1. This method is consistent with the method used in the baseline risk assessment for Operable Unit 4, and approved by EPA. Bullet will be changed to clarify procedures used in the OU1 baseline risk assessment. The statement will read, methodology has established the 95th percentile background value as a decision making point in the procedure described in Section E.2.3.1.1; point values for radionuclides exceeding this value are considered CPCs while radionuclides at less than that value are deleted.

Action: Bullets 4, 5, 7, and 8 were deleted.

Bullet 9 was replaced with the text: "Chemicals that present a HQ less than 0.1 or ILCR lower than 10^{-7} when evaluated against screening criteria calculated from EPA RAGS Part B (EPA 1991f) were removed from the CPC list and assigned the deletion symbol "F" in Attachment E.II."

Removed (EPA 1993b) and (EPA 1993c) from the reference section.

The text, "These chemicals were discussed qualitatively or semi-qualitatively," was added to bullet 10.

Bullet 12 was changed to read: "Methodology has established the 95th percentile background value as a decision making point; radionuclides exceeding this value are considered CPCs while radionuclides at less then that value are deleted."

The corresponding letters in the E.II legend were deleted.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 45 (#NEW 02)
Comment: In Table E.3-18, there are two columns listed for the Expanded Trespasser, Age 7-18. The two lists of parameter values contain different values. What was used in this scenario?
Response: Agree. Table E.3-18 has a typographical error in the second column identified.
Action: The heading in the second column has been changed to state "Age 19 to 50".

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 46 (#NEW 03)
Comment: Table E.3-18. If the on-property Home Builder is only on site for 3 months, the AT-noncancer value should be 90 days (or 175 days, as suggested), not 365 days. The risk stops when the exposure stops.
Response: Agree. Averaging time for toxicants (AT-Noncancer) for the home builder in Table E.3-18 should be changed to equal the exposure frequency of 175 days.
Action: The AT-noncancer was changed to equal the exposure frequency.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 47 (#NEW 04)
Comment: The Table headers in Section E.3 have not been revised to be consistent with the new scenario labels. The reader does not know which parameter values were used in which scenarios.
Response: Agree clarification is needed.

Tables in Section E.3 present exposure parameters and exposure point concentrations for CPCs applicable for receptors under current and future land use, current and future source term. The distinguishing factor for the exposure point concentration is the current and future source term. Therefore, exposure point concentrations in Tables 3-4 to 3-6, and 3-10 to 3-16 are provided by source term.

The exposure parameters were broken out as in Table E.3-1. The distinguishing factor for exposure parameters (Tables E.3-17 and E.3-18) should be land use, which would be consistent with the new scenario labels. Therefore, Tables E.3-17 and E.3-18 will be revised to state "Current Land Use" (Table E.3-17) and "Future Land Use" (Table E.3-18).
Action: Tables E.3-17 and E.3-18 were revised to reflect land use.

Commenting Organization: U.S. EPA Commentor: Van Leeuwen
Section #: E Page #: Line #: Code:
Original Comment #: 48 (#NEW 05)

Comment: Page E-6-6: Under uncertainties associated with the calculation of the exposure point concentration, I did not see any discussion of the underestimation of the risk due to the use of surface soil data from 0-24 inches. For ingestion and dermal absorption pathways for soil, surface soil is usually considered to be six inches. This greater dilution of the surface soil contaminant concentrations will likewise reduce the risk. A discussion of this point should be included in Section E.6.2.2.2.1.

Response: Agree. Risk could be underestimated by the limited use of surface soil data from 0 to 24 inches. This was done out of necessity. Original queries to our site-wide database were done between depth of 0 to 6 inches revealing no radiological data. It was later discovered that all radiological surface soil data was entered with a depth range of 0 to 24 inches.

Action: A bullet was added to Section E.6.2.2.2.1 to read: "Concentration terms for surface soil were derived from results recorded from 0 to 24 inches in depth. Since surface soil contamination levels are usually greater in the first 6 inches of soil, this approximation may underestimate risks from exposure to surface soil."

General

OEPA Comments

OHIO EPA COMMENTS
DRAFT FINAL OU1 REMEDIAL INVESTIGATION REPORT
March 14, 1994
(Draft Responses Supplemented with Action Items
from DOE-EPA 3/31/94 Meeting)

Commenting Organization: Ohio EPA Commentor: DERR
Section #: General Page #: Line #: Code: C
Original Comment #: 1

Comment: In general Ohio EPA has found DOE's use of the redline version to be of substantial help in reviewing the document. An essential part of Ohio EPA's use of this methodology is the assumption that all changes to the document have been highlighted. At least one change to the document that was not highlighted was noted by Ohio EPA. DOE must ensure that all text changes are highlighted so that we can make full use of the benefits of the redline version. In the future if substantial portions of a section are changed, it may be easier to just note in the cover letter that the section changed and not worry with highlighting.

Response: Comment noted.

Action: The revised pages for the comment responses continue to provide the redline information from the February submittal in addition to *bold italics* for the changes made April 1994. Also strikeouts have been used to show removals made during this round of comment responses.

Section 1

OEPA Comments

Commenting Organization: Ohio EPA Commentor: DERR
Section #: 1 Page #: Line #: Code:
Original Comment #: 3 (009)

Comment: DOE's response and action fails to adequately address the issue of the decant lines. If DOE is going to make assumptions then the assumption should reflect the worst case scenario.

Response: Comment acknowledged. Additional text, as provided in the response to Original Comment #009, should be added to Section 1.2.1.1 of the RI Report.

Action: The following text has been inserted on page 1-16, line 2 after (NLO 1985):

"Since the actual date of installation of the decant lines is unknown, the disposition of the waste in these lines is undeterminable. If the lines were installed while Waste Pit 1 was actively used, then the rare overflows went to the stormwater drainage system (the Clearwell was not in operation during the lifetime of Waste Pit 1). If the lines were installed after the closure of Waste Pit 1, then the lines discharged into the Clearwell."

Commenting Organization: Ohio EPA Commentor: DERR
Section #: 1 Page #: Line #: Code:
Original Comment #: 4 (011)

Comment: DOE reference to the as built drawings should be included as reference material in the document.

Response: Agree. Representative drawings which include data from as-built drawings should be added to Appendix F.

Action: Text has been added to page 1-14, line 27 as follows:

"Historical configuration drawings which include as-built information for Waste Pits 1 through 6, the Clearwell, and the Burn Pit are provided in Appendix F.6.12."

Commenting Organization: Ohio EPA Commentor: DERR
Section #: 1 Page #: Line #: Code:
Original Comment #: 5 (016)
Comment: The reference to the word "approximate" can be applied to the narrative section on page 1-18 lines 7-18. In addition, some doubt exists as to the liner maintaining its 1 foot thickness, uniformly, throughout the bottom of the pit. DOE should provide all evidence of the liner's construction engineering diagrams along with any compaction, density, or conductivity data that may exist. If the existence of the liner cannot be documented then DOE should note the lack of certainty in the liner's integrity. Groundwater monitoring results around pit 3 indicate that the liner is leaking.
Response: Agree. Revisions should be included in the discussion of uncertainties associated with the liner's thickness. Refer to Appendix F for historical configuration drawings including as-built information.
Action: Revision to the text on page 1-18, lines 9 and 10 have been modified as follows: "This waste pit is approximately 42 feet deep, which includes a maximum of 14 feet of cover material, 27 feet of wastes and an estimated 1 foot of native clay (Parsons 1993)."

On page 1-18, lines 11-12 have been modified as follows: "A natural layer of low permeability clay forms the bottom of this waste pit, so the placement of additional clay was not deemed necessary (NLCO 1977). No documentation exists to determine the actual thickness or uniformity of distribution of this native clay across the bottom of the pit."

Commenting Organization: Ohio EPA Commentor: DERR
Section #: 1 Page #: Line #: Code:
Original Comment #: 6 (022)
Comment: The referenced section numbers do not match.
Response: Agree. The comment response should have read "As noted in Section 1.2.1.7..." The location in text is correct.
Action: None.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: 1 Page #: Line #: Code:
Original Comment #: 7 (029)
Comment: Without absolute proof of the existence of the liner DOE should not lay claims to its presence. Evidence that a nominal layer does exist does not justify a complete, impervious liner.
Response: Agree. Text, as provided below, should be added to Section 1.2.1.3.
Action: The following text has been inserted on page 1-18, line 13, immediately following the insert from Comment #5 above.

"Although there is no actual evidence that Waste Pit 3 has not penetrated into the sand and gravel aquifer, the combination of recent boring logs and as-built drawings (reference Appendix F) from pit construction provides indication there is some minimal clay layer between the materials in the waste pit and the sand and gravel layer. However, the presence of clay does not imply a complete impervious layer."

Section 3

OEPA Comments

Commenting Organization: Ohio EPA Commentor: DERR
Section #: 3 Page #: Line #: Code:
Original Comment #: 2 (080)

Comment: The referenced figures (3-2 through 3-6 and 4-9, 4-17, 4-19, 4-21 and 4-23) are not fence diagrams. At the time of the June 1993 OU1 RI meeting, USEPA and Ohio EPA described in detail exactly what was expected of DOE in regard to the fence diagrams for OU1. The figures in the OU1 are not even close. The DOE has simply used basic special effects to give cross sections the vague appearance of fence diagrams. These diagrams should be discarded and proper fence diagrams included. A draft fence diagram can be found in the IT report for FERMCO dated March 1, 1993: Transmittal of the Glacial Overburden Study Project #409195, Figure 6.0a.

Response: Agree that the referenced figures are not fence diagrams. They were provided to convey a pictorial illustration of heterogeneity and to depict the strata of process waste distribution based on process knowledge.

The fence diagrams referenced in the comment were produced as part of Volume 13, Appendix Q, of the FMPC Groundwater Report (FMPC-0004-2) of December, 1990. These diagrams were based on data that would now be considered incomplete and not current, in light of the sampling programs that have been completed since the data was gathered for the Groundwater Report. However, DOE agrees that there is utility in including a fence diagram for Operable Unit 1 in the OU1 RI Report. Thus, a fence diagram that is based on more current data will be provided. This diagram is being produced in concert with Operable Unit 5 as part of OU5's characterization of the subsurface area beneath OU1. This approach has been agreed to in discussions between DOE and OEPA.

The referenced figures are not intended to take the place of a fence diagram. A fence diagram would illustrate stratification of horizons over the entire operable unit; however, the conceptual drawings provided in Section 3 and Section 4 are merely intended to illustrate the contents of the waste pits, based on process knowledge as verified by analytical data and boring log information. It should be understood that these drawings are conceptual illustrations to depict a reasonable profile of waste pit contents in the absence of additional suitable scientific data.

Action: A fence diagram depicting the OU1 subsurface of the operable unit will be provided in the Final Remedial Investigation Report for Operable Unit 1, tentatively scheduled for publication in July 1994.

Insert the following text on page 3-2, line 3:

"A fence diagram depicting the Operable Unit 1 subsurface is provided as Figure 3-1a."

Section 6

OEPA Comments

Commenting Organization: Ohio EPA Commentor: DERR
Section #: 6 Page #: Line #: Code: C
Original Comment #: 8 (129)

Comment: DOE's response to Ohio EPA's comment suggests 70% revegetation and that revegetation will continue. If revegetation has not occurred by now, it is unlikely to in the near future. There are obviously reasons vegetation has not grown on these portions of the pits (i.e., conditions are not suitable for growth).

Response: Disagree. Waste Pits 1, 2, and 3 are covered with fill. They currently support 70% vegetative cover. This fraction was obtained through recent aerial photographs taken during the summer.

Action: Line 15 on page 6-5 was changed to read: "The current source term configuration ... as it exists today; Waste Pits 1, 2 and 3 are covered with fill and have 70 percent vegetative covering. Waste Pit 4 is covered by a polyethylene cover with compacted clay. Pits 5 and 6 are water covered (refer to Table E.1-1)."

The phrase "70 percent vegetative cover" was added to the physical descriptions listed for Waste Pits 1, 2, and 3 in Table E.1-1.

Appendix E

OEPA Comments

Commenting Organization: Ohio EPA Commentor: DERR
Section #: E.2.3.1.1 Page #: E-2-13 Line #: 17-27 Code: C
Original Comment #: 9

Comment: DOE must provide a reference to support the use of this proposed method.

Response: When a distribution can not be determined a method of determining a 95th percentile must be used that does not rely on the underlying distribution. These methods are known as non-parametric procedures. Since the underlying distribution is unknown, it is likely that any parametric estimation of the 95th percentile would be biased. Additionally, it would not be known if the parametric estimate is biased high or low. As the median is a better estimate of central tendency then the average for skewed distributions (as most concentration data are), non-parametric estimates of the 95th percentile will also yield more reliable results. A non-parametric percentile estimate of an unknown distribution (based on order statistics) is the point at which 95% of the data are less than this value. The median is defined as the 50th percentile and is the point in a distribution where 50% of the data exceed and 50% are below. The sample dataset is our best representation of the true underlying distribution. For this reason the non-parametric estimate of the 95th percentile, based on the sample dataset is our best estimate of the true 95th percentile. Often the percentile value would be interpolated between the two ordered data values that bound the 0.95*n rank. To add more certainty that we are not underestimating the 95th percentile we always select the greater of the two bounding concentration values (i.e the smallest concentration value whose rank exceeds the calculated rank.) This approach has been used in U.S. EPA documents including "Statistical Support Documentation for the 40 CFR, Part 503 - Final Standards for the Use and Disposal of Sewage Sludge" (Final Report, November 11, 1992). Background theory can been obtained from "Distribution-Free Statistical Methods" by J.S. Maritz (Chapman and Hall, 1981).

Action: The reference, "Distribution-Free Statistical Methods" by J.S. Maritz (Chapman and Hall, 1981), was added to the reference section on page E-R-11 and cited at the end of the sentence on page E-2-13, line 19.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: E.2.3.1.2 Page #: E-2-14 Line #: Code: C
Original Comment #: 10
Comment: The whole section has been revised and thus should have been highlighted. In order for Ohio EPA to effectively use the redlined version of the document, all text changes should be highlighted.
Response: Comment noted.
Action: Section E.2.3.1.2 was highlighted to reflect changes made in February, 1994; in addition, the text in bold italics in this section indicate changes made in response to EPA Comment #27.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: E.2.3.1.2 Page #: E-2-15 Line #: 1-6 Code: C
Original Comment #: 11
Comment: DOE has failed to provide sufficient justification to support screening criteria "H" or "I". DOE neither referenced a guidance document to support these criteria nor provided an example contaminant, as requested in Ohio EPA's comment on the previous version of this document. DOE should eliminate these two screening criteria.
Response: Agree. These screening criteria were not used in the risk assessment and should be removed.
Action: Screening criteria "H" and "I" were deleted.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: E.2-2 Page #: E-2-19 Line #: Code: C
Original Comment #: 12
Comment: The representative concentrations for Pu-238 and Pu-239/240 are not correct. The correct concentrations should be 0.7 and 0.6 respectively. DOE must correct the table and all subsequent calculations.
Response: Disagree. The Pu-238 and Pu-239/240 values displayed in the table are correct. They represent the non-parametric 95th percentile concentration. In agreement with U.S. EPA Region V, the non-parametric 95th percentile was used as a conservative surrogate for the concentration term.
Action: None.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Tables E.2-2 thru E.2-13 Page #: Line #: Code: C
Original Comment #: 13
Comment: The tables should be revised based on Ohio EPA comments on Section E.II.
Response: Agree.
Action: Tables E.2-2 through E.2-13 were revised to reflect changes in corresponding Attachment E.II tables.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.2-5 Page #: E-2-24 Line #: Code: C
Original Comment #: 14
Comment: The representative concentration for thallium is not correct. The correct concentration is 12000. DOE must correct the table and all subsequent calculations.
Response: Agree.
Action: The representative concentration given in Table E.2-5 for Thallium (4100 ug/Kg) was corrected to 12000 ug/Kg. Subsequent calculations were re-done. Please note units were changed from ug/Kg to mg/Kg per request from USEPA, resulting in a representative concentration of 12 mg/Kg.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.2-9 Page #: E-2-31 Line #: Code: C
Original Comment #: 15
Comment: The representative concentration for U-235/236 is not correct. The correct concentration is 1750. DOE must correct the table and all subsequent calculations.
Response: Agree.
Action: In Table E.2-9, the representative concentration for U-235/236 was changed to 1750 pCi/g. Subsequent calculations were re-done.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.2-12 Page #: E-2-35 Line #: Code: C
Original Comment #: 16
Comment: The representative concentration for lead is not correct. The correct concentration is 417504. DOE must correct the table and all subsequent calculations.
Response: Agree.
Action: The lead value in Table E.2-12 was verified. Please note units were changed from ug/Kg to mg/Kg per request from USEPA, resulting in a concentration of 417.1 mg/Kg.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.3-4 Page #: E-3-78 Line #: Code: C
Original Comment #: 17
Comment: The exposure point concentrations for Pu-238 and Pu-239/240 are not correct. The correct concentrations are 7.00E-01 and 6.00E-01 respectively. DOE must correct the table and all subsequent calculations.
Response: Comment acknowledged. As stated in response to Comment #12, the Pu-238 and Pu-239/240 values displayed in the table are correct. They represent the non-parametric 95th percentile concentration. In agreement with U.S. EPA Region V, the non-parametric 95th percentile is used as a conservative surrogate for the concentration term.
Action: None.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.3-5 Page #: E-3-79 Line #: Code: C
Original Comment #: 18

Comment: a) The assumption under footnote "b" is unacceptable. When the assumption is made that since the contaminant is not a CPC the concentration is zero, the exposure point concentration is biased low. Additionally, if a contaminant was not sampled for in all four areas, assuming the concentration is zero when in fact it was not sampled for is unacceptable. DOE should consider the following: 1) If a contaminant was sampled for and detected the representative concentration should be used whether its a CPC or not; 2) If the contaminant was not sampled for in an area leave that area out of the calculation of the weighted average; 3) If the contaminant was not detected in an area then use the 1/2 the sample quantitation limit. For example, based upon these assumptions the weighted average for silver is 1.28 + E01. It appears this was the methodology used in the previous version of the document, see Table E.3-4.

b) What is the basis for substantially decreasing the surface area of Pit 3 used in the calculations from what was used in the previous version (6,720 current vs. 2.24 + E04)?

Response: a) Agree. The method used to calculate weighted average concentration for this table may underestimate source concentrations. This topic was discussed March 31 with USEPA and OEPA. This procedure describes inorganic chemicals and radionuclides differently than organic constituents. The averaging technique used for inorganics and radionuclides is described separately from the technique used for organics below and is summarized in the table below.

For inorganics or radionuclides, 1) if the chemical was sampled but not detected, half the Sample Reporting Limit would be used for the representative concentration. 2) If the chemical was detected and was a CPC for any of the sources being averaged, it will be considered at it's representative concentration. 3) If the inorganic or radionuclide was not sampled for, that source will be left out of the weighted average. Organic chemicals are treated differently from inorganics and radionuclides. 4) If the organic chemical was sampled for but not detected, a representative concentration of "0" will be used. 5) If an organic chemical was not analyzed for, that source will be left out of the weighted average.

DETERMINATION OF CONCENTRATION TERM

SITUATION	INORGANICS & RAD.	ORGANIC
Not sampled for	Left out of weighted average	Left out of weighted average
Sampled, not detected	½ of Sample Reporting Limit	0
CPC for any source	Representative concentration	Representative concentration

b) Comment acknowledged. The conceptual site model used for air modelling assumed that 1/3 of pit 3 was exposed. The October iteration of this table displayed the entire pit surface area for pit 3. This was corrected in the February iteration.

Action: a) Average concentrations in Table E.3-5 were re-calculated using the procedure outlined above. These results were carried through the risk calculations.

b) None

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Page #: Line #: Code:
Original Comment #: 19
Comment: No comment provided.
Response:
Action:

Commenting Organization: Ohio EPA Commentor: DERR
Section #:Table E.3-6 Page #: E-3-81 Line #: Code:C
Original Comment #: 20
Comment: The reference to this table in the text was not found. It is unclear what the basis is for only considering radionuclides in the future source term for Pit 4.
Response: a) Agree. This table should be referenced in text.
b) Only radionuclides were considered because the only exposure to the contents of Waste Pit 4 was from penetrating radiation.
Action: The following sentence was added on page E-3-41: "The future exposure point concentrations for Waste Pit 4 are listed in Table E.3-6."

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.5-7 Page #: E-5-3 Line #: Code: C
Original Comment #: 21
Comment: It appears the total risk and the chemical subtotal risk for the on-property RME farmer using perched groundwater are not correct. The correct subtotal chemical carcinogenic risk should be 1.0 (i.e., .13 + .89 > 1.0). The table should be revised.
Response: Disagree. Cancer risks for this receptor were calculated with the 1 hit model. The totals were also calculated using the one hit model. This model is not linear. Therefore, the total risks would not exceed 1.0.
Action: Footnote "a" in Table E.5-7 was modified to state, "Risk calculations...from higher doses and therefore total risks will not exceed 1.0 for this receptor."

Commenting Organization: Ohio EPA Commentor: DERR
Section #: E.6.3.1 Page #: E.6-17 Line #: Code: C
Original Comment #: 22

Comment: DOE should discuss within the section the basis for not just including the additional data within the baseline risk assessment. Obviously substantial effort was required to complete the sensitivity analysis and substantial changes were already being made to the date base. Questions will remain with regard to whether the appropriate exposure receptor and pathways were used for the sensitivity analysis. In the future if additional data is obtained between revisions of the RI, Ohio EPA believes DOE's efforts should be aimed at incorporation of the data rather than developing reasons for not incorporating the data.

Response: Comment noted. The time required to select CPCs, perform fate and transport modeling, enter data into the database, calculate risks and to write the text of the baseline risk assessment required that the database must be frozen prior to the document submittal. The new 1993 data was analyzed and included in the uncertainty section. Analysis indicated this data would not, quantitatively or qualitatively, impact the list of CPCs or the overall risk levels.

Action: The following paragraph was added to page E-6-17, after the first paragraph in Section E.6.3.1:

"Due to the time required to select CPCs, perform fate and transport modeling, enter data into the database, calculate risks and to write the text of the baseline risk assessment, it was required that the database be frozen at a date substantially prior to the document submittal. Therefore, data from the 1993 sampling event was not included in the baseline risk assessment. However, the 1993 data was quantitatively evaluated and included in this section. A sensitivity analysis of the 1993 data to the total database was performed."

Commenting Organization: Ohio EPA Commentor: DERR
Section #: E.6.3.1 Page #: E.6-20 Line #: Code: C
Original Comment #: 23

Comment: DOE should have considered the potential impact of new data on decision making with regard to which exposure pathway to analyze. The previous version of the risk assessment showed that remediation was necessary to protect an on-property resident thus that decision was unlikely to change. The risk to the off-property receptor would seem to be more appropriate due to the potential impacts on decision making as well as the likely public interest in off-property receptors. As stated previously, it would seem a better use of resources on DOE's part to work toward data inclusion rather than justifications for exclusion.

Response: Agree. Off-property receptors are important for the decision making process. DOE analyzed the 1993 data for potential impact to health hazard sources. That analysis was presented in Section E.6.3.1.

Action: If a similar situation occurs in the future, DOE commits to perform a much broader sensitivity analysis, evaluating a range of receptors, including both on- and off-property receptors.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: E.6.3.1 Page #: E-6-20 Line #: 19-20 Code:C
Original Comment #: 24
Comment: The statement that only two chemicals were detected in 1993 but not in the RI would seem to be in error. Table 6-1 suggests several selects that were not detected in the previous data bases.
Response: Agree. Statement was in error and should be corrected.
Action: The sentence "In addition,....but not in the RI", which begins on page E-6-20, line 19, was deleted.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.7-7 Page #: E-7-12 Line #: Code:C
Original Comment #: 25
Comment: The risks for the on-property farmer using perched ground water appear to be incorrect. Table E.II-25 suggests the radionuclide risk should be 5.8-E01 and the chemical risk is 1.0. The table should be revised to agree with Table E.II-25.
Response: Disagree. Cancer risks for individual chemicals and the total risk are calculated using the one-hit model. This model is not linear, as per RAGs guidance. See response to Comment #21.
Action: Footnote "b" in Table E.7-7 was modified to state, "Risk calculations...from higher doses, therefore, total risks will not exceed 1.0."

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.I-4 Page #: Line #: Code: C
Original Comment #: 26
Comment: DOE should define within the document which of the upper 95% confidence limits were used in making the "A" determination in Attachment E.II. The text should state what concentration from Table E.I-4 was used to complete the "95th Percentile Test" defined in Section E.2.3.1.1 which determined the "A" screening criteria.
Response: Agree. The 95th percentile background concentration is the comparison value. This statistic was not provided in the supplied background tables.
Action: Table E.I-4 was revised to reflect current procedure and includes a column for the 95th percentile background concentration. The screening criteria listed in determination "A" in the Attachment E.II Legend was changed from "higher than background concentration" to "higher than 95th percentile background concentration."

The upper 95th percentile background concentration for each inorganic chemical and radionuclide was added to the CPC screening tables in Attachment E.II.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.II-1 Page #: Line #: Code: C
Original Comment #: 27

Comment: a) The following contaminants were screened out based on the "A" criteria within this document but were retained as CPCs within the previous version of the RI: arsenic, cobalt, manganese, mercury, nickel, thallium, vanadium, zinc, Tc-99. All of these contaminants fail the 95% UCL test and should be included as CPCs. b) A designation of "G" is given to Pu-239/240 in this table but not in Table E.II-2. DOE should revise the table to be consistent. c) 1,4 Dioxane was shown as detected twice within Table E.II-1 of the previous submittal of the RI, yet it is not included here. DOE should include 1,4 Dioxane and review tables from the previous RI submittal to ensure that no additional contaminants have been inadvertently deleted.

Response: a) Agree. The comparison of site data with the 95th percentile background concentration was not properly implemented in this report. This should be rectified, all appropriate tables updated, and subsequent risk assessment calculations redone.

Since the comparison should have been with the background 95th percentile and not the background 95% UCL on the mean, some of the analytes listed in the comments will still pass the 95th percentile test. Most will not, though (i.e., they will be COPCs). For example, the comment on Table E.II-1 (comment 27a) lists nine analytes that fail the 95th UCL test (sic). Of these nine, seven would fail the 95th percentile test.

b) Agree.

c) Agree. 1,4-dioxane was inadvertently eliminated from the CPC tables.

Action: a) Tables in Section E.II were revised to reflect a comparison of site data, with the background 95th percentile concentration.

b) Parameter "G" was removed from Table E.II-1.

c) 1,4-dioxane was included in Table E.II-1

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.II-3 Page #: Line #: Code: C
Original Comment #: 28

Comment: Sr-90 was screened out based upon the "A" criteria but was retained in the original RI. The contaminant should be retained as a CPC since the concentration exceeds the background 95% UCL.

Response: Agree. The comparison of site data with the 95th percentile background concentration was not properly implemented in this report. This should be rectified, all appropriate tables updated, and subsequent risk assessment calculations redone.

Action: Tables in Section E.II were revised to include a comparison of site data with the 95th percentile background concentration. All subsequent risk calculations were redone.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.II-4 Page #: Line #: Code: C
Original Comment #: 29

Comment: The following contaminants were screened out based on the "A" criteria within this document but were retained as CPCs within the previous version of the RI: arsenic, cobalt, nickel, vanadium, and zinc. All of these contaminants fail the 95% UCL test and should be retained as CPCs.

Response: Agree. The comparison of site data with the 95th percentile background concentration was not properly implemented in this report. This should be rectified, all appropriate tables will be updated, and subsequent risk assessment calculations redone.

Action: Tables in Section E.II were revised to include a comparison of site data with the 95th percentile background concentration. All subsequent risk calculations were redone.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.II-6 Page #: Line #: Code: C
Original Comment #: 30

Comment: The following contaminant was screened out based on the "A" criteria within this document but were retained as CPCs within the previous version of the RI: The-232. This contaminant fails the 95% UCL test and should be retained as a CPC.

Response: Agree. The comparison of site data with the 95th percentile background concentration was not properly implemented in this report. This should be rectified, all appropriate tables updated, and subsequent risk assessment calculations redone.

Action: Tables in Section E.II were revised to include a comparison of site data with the 95th percentile background concentration. All subsequent risk calculations were redone.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.II-7 Page #: Line #: Code: C
Original Comment #: 31

Comment: The following contaminants were screened out based on the "A" criteria within this document but were retained as CPCs within the previous version of the RI: arsenic, barium, chromium, cobalt, lead, manganese, vanadium, Ra-226, Ra-228, Tc-99, The-228, and The-232. All of these contaminants fail the 95% UCL test and should be retained as CPCs.

Response: Agree. The comparison of site data with the 95th percentile background concentration was not properly implemented in this report. This should be rectified, all appropriate tables updated, and subsequent risk assessment calculations redone.

Action: Tables in Section E.II were revised to include a comparison of site data with the 95th percentile background concentration. All subsequent risk calculations were redone.

Commenting Organization: Ohio EPA Commentor: DERR
Section #: Table E.II-8 Page #: Line #: Code: C
Original Comment #: 32

Comment: The following contaminants were screened out based on the "A" criteria within this document but were retained as CPCs within the previous version of the RI: boron and manganese. All of these contaminants fail the 95% UCL test and should be retained as CPCs.

Response: Agree. The comparison of site data with the 95th percentile background concentration was not properly implemented in this report. This should be rectified, all appropriate tables updated, and subsequent risk assessment calculations redone.

Action: Tables in Section E.II were revised to include a comparison of site data with the 95th percentile background concentration. All subsequent risk calculations were redone.

Section 1

Materials Company of Ohio (WMCO), a wholly owned subsidiary of Westinghouse Electric Corporation, then assumed management responsibilities for the site operations and facilities. In 1991, Westinghouse renamed this subsidiary the Westinghouse Environmental Management Company of Ohio (WEMCO). During that same year, DOE renamed the site the Fernald Environmental Management Project to reflect the site's revised mission. On December 1, 1992, Fernald Environmental Restoration Management Company (FERMCO) assumed responsibility for the site as the first Environmental Restoration Management Contractor for DOE.

The FEMP began operations in 1952 upon completion of the Pilot Plant, the site's first operational facility. Plant 6 began operations in 1952. Plant 1, Plant 2/3, Plant 4, Plant 5, and Plant 8 began operations in 1953. Plant 7 (where UF_6 was processed) and Plant 9 became operational in 1954.

Production peaked in 1960 at approximately 12,000 MTU per year. A product decline began in 1964 and reached a low in 1975 of about 1230 MTU. During the 1970s, consideration was given to closing the FEMP. Thus, capital improvements and staffing were minimized. The staffing level, which peaked at 2891 personnel in 1956, slowly declined to 538 personnel in 1979. In 1981, the FEMP began planning to accommodate increased production requirements. Production levels significantly increased and there was a rapid staff buildup for several years. The renewed need for uranium metal resulted in the implementation of a major facilities restoration program. Production ceased in July 1989, and plant resources were focused on environmental cleanup activities. In June 1991, the site was officially closed as a federal production facility.

1.2 DESCRIPTION AND HISTORY OF OPERABLE UNIT 1

This section provides a brief physical description of each of the waste units included in Operable Unit 1 and a summary of the operational history pertinent to these facilities. The operational history focuses primarily on the operational activities conducted prior to the
4-O initiation of the site-wide RI/FS in 1986. ***Historical configuration drawings which include as-built information for Waste Pits 1 through 6, the Clearwell, and the Burn Pit are provided in Appendix F.6.12.***

1.2.1 Description of Operable Unit 1

Operable Unit 1 contains six waste pits, the Burn Pit, and the Clearwell (Figure 1-4). It is located west of the former production area and covers approximately 37.7 acres. The area is

009 Water drained from Waste Pit 1 through a series of three 8-inch decant lines constructed
3-O through the west berm of Waste Pit 1, but were rarely used (NLO 1985). ***Since the actual date of installation of the decant lines is unknown, the disposition of the waste in these lines is undeterminable. If the lines were installed while Waste Pit 1 was actively used, then the rare overflows went to the stormwater drainage system (the Clearwell was not in operation during the lifetime of Waste Pit 1). If the lines were installed after the closure of Waste Pit 1, then the lines discharged into the Clearwell.*** There are no records indicating the disposition of water decanted from Waste Pit 1. Normal practice was to pump the water collected in Waste Pit 1 from the sump portion to Manhole 175.}

Rainwater from the pipe trench in the K-65 area was pumped into the south end of Waste Pit 1 (Carvitti 1959).}

In 1954, the dumping pad on the east side of the waste pit was enlarged, and a curb was constructed of reinforced concrete was added (EF 1954). Materials used in constructing the pad included a 6-inch asphalt macadam base and a 2-inch surface treatment (EF 1954). In 1957, additional storage space was created when excavated material from the construction of Waste Pit 2 was used to increase the berm height by 5 feet on the west side of the waste pit (NLO 1985). Because of this increase in height, the slope of the dike near the top edge is approximately 1.5:1 (Figure 1-11).

In 1959, a channel at least 5 feet wide was excavated between the residues and the outer berm to facilitate the proper flow of rainwater to the sump (Carvitti 1959).

Waste Pit 1 was closed and covered with clean fill soil in mid-1959 (NLCO 1977). A portion of this cover was removed in 1972 as a source of cover material for Waste Pit 3. Also, a gravel roadway is constructed on top of the existing cover in the southern portion of the waste pit. The roadway leads to the Clearwell pumphouse.

The waste pit is classified as a solid waste management unit (SWMU) under the RCRA.

The results of material volume calculations are presented in Table 1-2.

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1.2.1.2 Waste Pit 2

In 1957, Waste Pit 2 was constructed northeast of Waste Pit 1 (H&R 1986). An existing spring-fed pond (water level elevation 574±1 feet) existed on what became the southern portion of the waste pit. The source of the spring is unknown.} The waste pit was constructed by draining the pond and excavating into the existing native clay. Trees, stumps, and roots had to be removed from the north end. The bottom and side slopes were then lined

000062

Waste Pit 2 is classified as a SWMU under RCRA.

The results of material volume calculations are presented in Table 1-3.

1.2.1.3 Waste Pit 3

014 Waste Pit 3, constructed by excavating into the underlying naturally occurring clay lens (H&R 1986), was placed in service in December 1958 (Stevenson 1971). To construct Waste Pit 3 and the Clearwell, a small creek that ran along the west embankment of Waste Pit 2 was relocated north of the Burn Pit and parallel to the railroad tracks (EF 1958).} The surface area boundary of Waste Pit 3 is oval-shaped and has dimensions of approximately 450 feet
5-O wide by 720 feet long. This waste pit is approximately 42 feet deep, ~~including 27 feet of~~
015, ~~wastes, 1 foot of native clay, and 14 feet of cover materials~~ ***which includes a maximum of 14 feet of cover material, 27 feet of wastes and an estimated 1 foot of native clay*** (Parsons 1993).}

A natural layer of low permeability clay forms the bottom of this waste pit, so the placement
5-O of additional clay material was not ***deemed*** necessary (NLCO 1977).} ***No documentation exists to determine the actual thickness or uniformity of distribution of this native clay***
7-O ***across the bottom of the pit. Although there is no actual evidence that Waste Pit 3 has not penetrated into the sand and gravel aquifer, the combination of recent boring logs and as-built drawings (reference Appendix F) from pit construction provides indication there is some minimal clay layer between the materials in the waste pit and the sand and gravel layer. However, the presence of clay does not imply a complete impervious layer.*** The bottom of Waste Pit 3 has an elevation of approximately 548 feet.

The sides of Waste Pit 3 were constructed with a 1.5:1 slope and lined with 12 inches of compacted clay (NLCO 1958, NLCO 1977). Its west berm was constructed approximately 20 feet above the 1958 ground level. Some of the soil excavated from the waste pit itself was used to form the west wall (NLCO 1977). No berm was constructed on the north side of Waste Pit 3.

The east side of Waste Pit 3 was formed from the west sides of Waste Pits 1 and 2. An effluent line from the general sump was constructed through the north dike of Waste Pit 3.

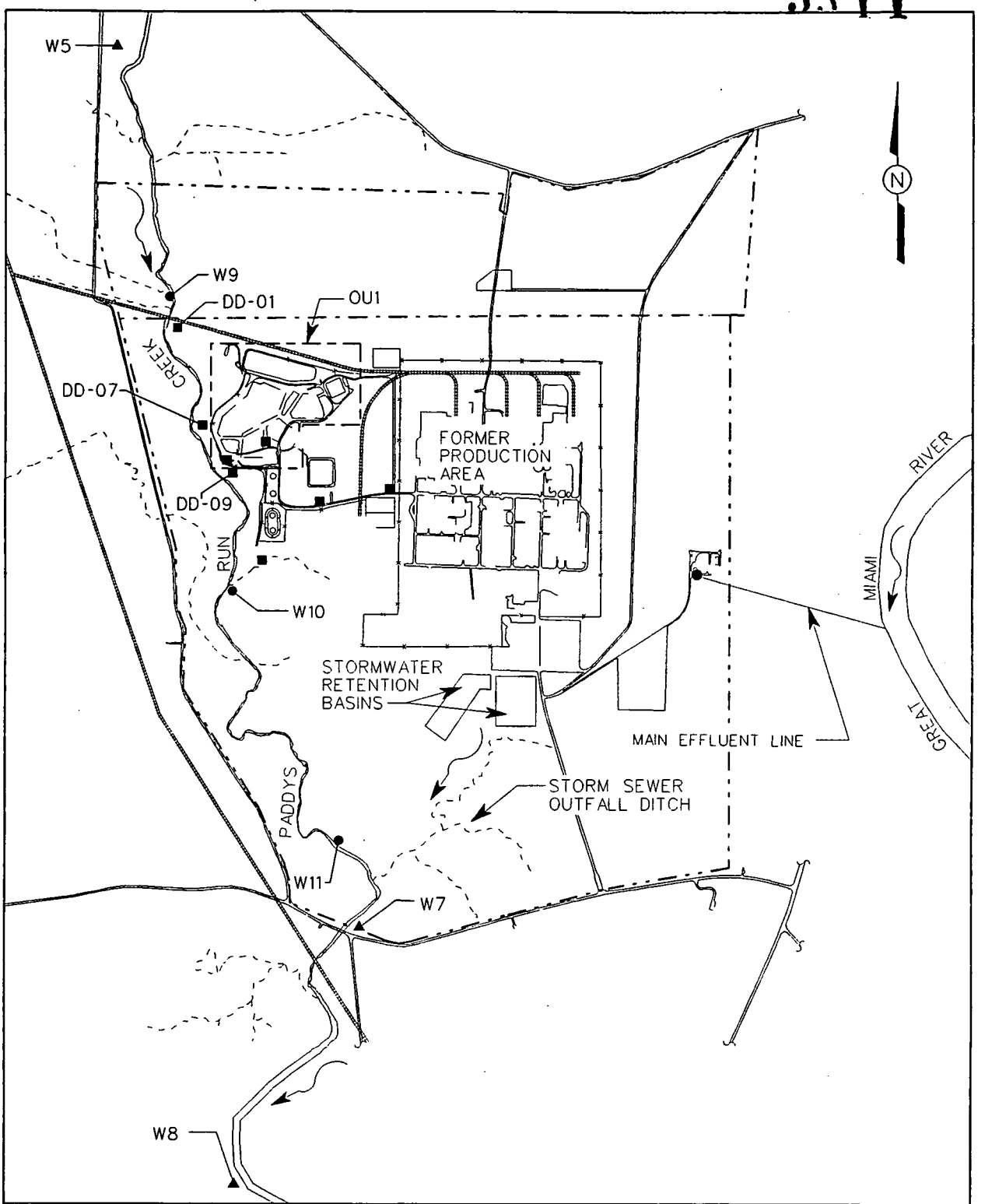
Spoil areas used during the construction of Waste Pit 3 were located due north and west of the waste pit. The spoil area due north of the waste pit was subsequently graded to an elevation of approximately 575 feet. Top soil was placed further north of the waste pit. Figure 1-14 presents a physical description of Waste Pit 3.

A 4-foot wide walkway of crushed stone was constructed on top of the berm between Waste Pit 3 and the Clearwell. In the middle of the berm, a 20-foot-long by 19-foot-wide reinforced concrete weir was constructed. The weir allowed water to decant from Waste Pit 3 to the Clearwell. The height of the weir was adjusted using 10-foot-long two-by-fours and two-by-

Section 2

Section 2

Figures



SCALE:
NOT TO SCALE

LEGEND:

- DRAINAGE WAY
- CSX RAIL LINE
- DIRECTION OF FLOW
- OPERABLE UNIT 1 OUTLINE
- FEMP PROPERTY BOUNDARY

- ▲ SAMPLED 1979-1991
- ● SAMPLED 1985-1991
- ■ SAMPLED 1988-1989

000087

409193-A-05 /OU1/KNOX/DS
40919305.OU1 04-13-94 DON GOSS

FIGURE 2-6. FEMP ENVIRONMENTAL MONITORING SURFACE WATER SAMPLING LOCATIONS

Section 3

is based on available geotechnical data. See Figure 3-1 for waste pit cross-section locations. An interpretation of the waste contents in Waste Pits 1 through 4 and the Burn Pit are shown
2-0 on Figures 3-2 through 3-6. ***A fence diagram depicting the Operable Unit 1 subsurface is provided as Figure 3-1a.*** Geotechnical data on the waste material is summarized in Table
3-US 3-1. ***The boring logs show that at least one of the borings in Waste Pits 1 through 4 terminated in a clay which was interpreted to be the liner material.***

3.1.1 Waste Pit 1

Historical records indicate that Waste Pit 1 received radioactive wastes consisting primarily of depleted magnesium fluoride slag and depleted residues, with smaller amounts of trailer cake, UAP filtrate, graphite/ceramics, and general sump sludge. The volume of waste material in Waste Pit 1 for the measurements shown is approximately 37,100 cubic meters (48,500 cubic yards).

A review of the boring logs indicates that the maximum depth of the waste material in this pit
074 is 18 feet. The waste} material encountered is very dark gray in color and predominantly of silt- and clay-size consistency. This coloration is consistent with that expected based on the process knowledge of the contents. The color of the material occasionally changed, in two borings, from dark gray to green. Moisture content of geotechnical samples averaged 21
059 percent. Waste Pit 1 is covered with 0.5 feet of clean fill which is included in the upper layer of clay shown in Figure 3-2. The typical depth to saturation in Waste Pit 1 for the measurements shown is approximately 4 feet below grade.}

3.1.2 Waste Pit 2

Historical records indicate that Waste Pit 2 received wastes consisting primarily of trailer cake and general sump sludge with smaller amounts of UAP filtrate, raffinate (including cold metal oxides), depleted residues, and graphite/ceramics. The volume of the waste is approximately 18,500 cubic meters (24,200 cubic yards).

Based on boring data, the maximum depth of the waste material in Waste Pit 2 is 15 feet. The upper portion of the waste, approximately 4 feet thick, is brown in color. Pieces of

concrete were encountered in some of the borings. The material in Waste Pit 2 also includes a yellowish brown, olive brown, very pale brown, and white heterogeneous mixture of what

066 the clay-rich tills have very low hydraulic permeabilities. However, enhanced secondary permeability due to the presence of coarser grained sand lenses in the glacial overburden is indicated in some areas of OU1. In such areas the vertical permeability is likely to be greater

1-US than that indicated by the laboratory core tests. ~~This is accounted for in fate and transport modeling (Section 5.3.2.3) by using a horizontal (1000 series wells slug test data) to vertical permeability factor of 10 which results in a vertical permeability range of 4.0 x 10^{-6} to 6.6 x 10^{-5} cm/sec (0.0114 to 0.0186 feet per day).~~ ***To account for macroscopic aquifer properties which may not be measured in the laboratory core tests, the range in vertical permeability may be estimated by using a horizontal (1000-series wells' slug test data) to vertical conductivity factor of 10 to 1 which is typical for moderately stratified materials. Using the range of horizontal conductivities presented below, vertical conductivity would range from 2.5 X 10^{-7} to 3.1 X 10^{-4} cm/sec. This range is at the high end of values from the laboratory core testing and reflects larger scale aquifer features measured by the slug tests (e.g. some wells slug tested were screened across clay and sand lithologies).***

Table 3-5 lists the results of 31 slug tests which represent horizontal conductivity. The test were performed in 1000 series wells located across the FEMP. All of the slug tests were performed in wells completed iglacial overburden materials that included at least a few feet of

069 glaciofluvial sand or sandy silt. These values range from 2.5 x 10^{-6} to 3.1 x 10^{-3} cm/s. Additional slug tests performed during 1993 show results for nine wells in the Operable Unit 1 area that fall within the range of the values in Table 3-5. Although there are significant differences between the testing procedures of laboratory core tests and in-situ slug tests, the results show that the horizontal conductivities are as much as three orders of magnitude greater than vertical conductivities.}

3.4.2.2 Groundwater Hydrology of the Great Miami Aquifer

Figure 3-35 shows the lateral extent of the sand and gravel of the Great Miami Aquifer. Also shown in Figure 3-35 are generalized groundwater flow directions and approximate horizontal groundwater flow velocities in the Great Miami Aquifer. In the northeast, groundwater moves southwest from the Ross area into the portion of the New Haven Trough now occupied by the Great Miami River. In the northwest, groundwater moves southeast from the Shandon area, which is a tributary to the New Haven Trough. The majority of the groundwater from

the Shandon Tributary flows under the waste storage area and the former production area and leaves the eastern boundary of the FEMP to flow east to the Great Miami River. The Ross and Shandon flows eventually leave the FEMP area via the Great Miami River Valley. This discharge is referred to as the New Baltimore outlet. The third source of groundwater is from the west. Recharge of groundwater at the Dry Fork of the Whitewater River, located approximately 2 miles west of the FEMP, causes groundwater to move east toward the FEMP. This flow turns southward under the southern part of the FEMP and flows to the

Section 3

Figures

FIGURE 3-1a TO BE PROVIDED
IN FINAL VERSION SUBMITTAL OF THE
REMEDIAL INVESTIGATION REPORT

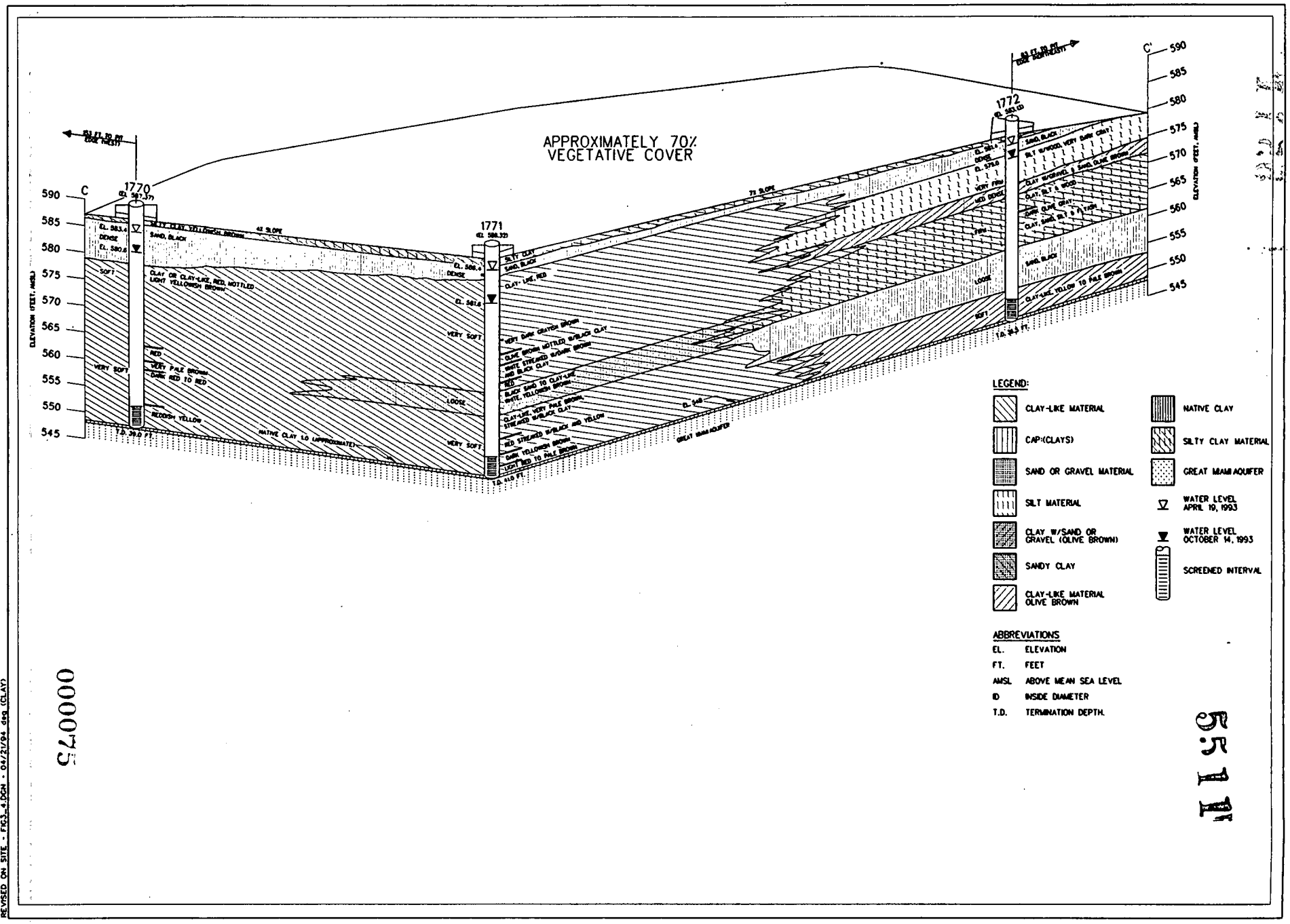


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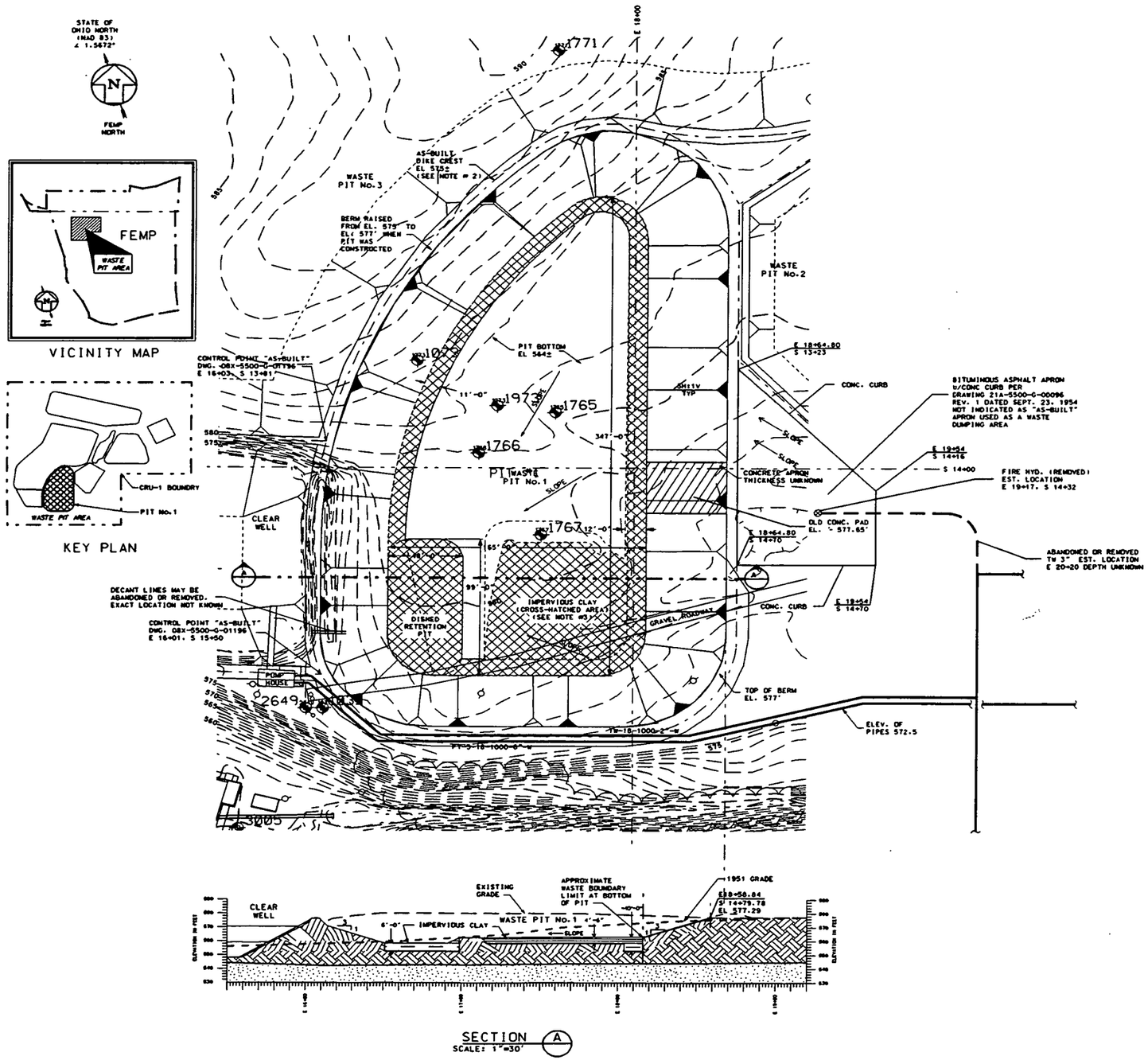
FIGURE 3-4 CONCEPTUAL CROSS SECTION OF WASTE PIT 3 CONTENTS

THE FOLLOWING DRAWINGS WILL BE PROVIDED IN APPENDIX F
IN THE FINAL SUBMITTAL OF THE REMEDIAL INVESTIGATION REPORT



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

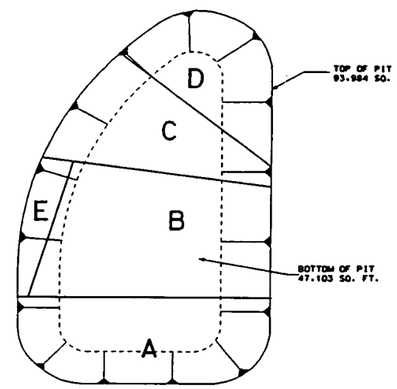
   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   AERIAL TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE GEOMETRIC CONFIGURATIONS, THE LINER THICKNESSES, AND THE BOTTOM ELEVATIONS OF THE WASTE PITS WERE DETERMINED FROM THE BEST AVAILABLE DATA AT THIS TIME. THIS DATA WAS GATHERED FROM CONSTRUCTION, AS-BUILT, SURVEY, AND FEASIBILITY STUDY DRAWINGS, 11/31/92, REV 11, AND FROM THE EXISTING PLANT ENGINEERING FILES.
   THE DIKE CREST SHOWN AROUND THE WASTE PITS REPRESENTS THOSE BUILT AT THE TIME OF CONSTRUCTION. MOST OF THE DIKES HAVE BEEN BURIED WITH COVER MATERIAL OF DIFFERENT THICKNESSES.

3. IT WAS DETERMINED FROM EXISTING PIT DRAWINGS THAT THIS AREA HAD A WET SPOTIN SOUTHEAST SECTION OF PIT1, A THICKENED MAT OF IMPERVIOUS CLAY WAS INSTALLED TO COUNTERACT THIS WETNESS

4. CP54-78 PERTAINS TO THE ASPHALT APRON AND CURBING ON THE EAST SIDE OF THE PIT.

5511



PIT 1

CONSTRUCTED: 1953 COST: EST. $24,000.00

IN USE: 1953 - MID 1959

CONSTRUCTION: PIT 1 WAS ORIGINALLY AN "IN-GROUND" FACILITY WHICH WAS CONSTRUCTED BY DIGGING A LARGE BASIN INTO THE EXISTING NATIVE CLAY AND THEN LINING PARTS OF THE BOTTOM WITH ADDITIONAL QUANTITIES OF CLAY. THE CAPACITY OF THE PIT WAS EXPANDED IN 1957 WHEN EXCAVATED SPOIL MATERIAL FROM THE CONSTRUCTION OF PIT 2 WAS USED TO BUILD UP THE BERM AN EXTRA 15 FEET ON THE WEST SIDE.

DIMENSIONS: ORIGINAL MAXIMUM DEPTH = 17 FEET; ORIGINAL VOLUME = 29,000 CY
EXPANDED MAXIMUM DEPTH = 17 FEET; EXPANDED VOLUME = 40,000 CY

PIT OPERATION: DURING THE PERIOD 1953-1959, THERE WAS NO NEED FOR A SETTLING LAGOON FOR F.M.P.C. WASTE STREAMS. WASTE SLURRIES WERE FILTERED OR CALCINED TO REMOVE WATER FROM THE SOLIDS, AND THE FILTER CAKES OR CALCINED DRY WASTES WERE PLACED IN ONE OF THE CONCRETE SILOS. OTHER SOLID WASTES WERE PLACED IN PIT 1. (DURING 1958-1959 PIT 1 WAS USED AS A CLEARWELL FOR PIT 2.)

PIT CONTENTS: PIT 1 RECEIVED THE FOLLOWING RADIOACTIVE WASTES: NEUTRALIZED WASTE FILTER CAKE, SUMP CAKES FROM THE PRODUCTION PLANTS, DEPLETED SLAG, SCAP GRAPHITE, CONTAMINATED BRICK, AND SUMP LIQUOR.

COMMENTS: PIT 1 WAS CONSTRUCTED WITH 8" DECANT PIPES THROUGH THE WEST BERM. THESE DECANT PIPES WERE RARLY USED DURING THE PIT'S OPERATING LIFE.

ZONE AREAS: AS PER DRAWING 08C-5500-G-01161, ARE AS FOLLOWS:
"A" - DEPLETED MATERIALS, SLAG LINER, "C" LINER AND FLOOR SWEEPINGS
"B" - FILTER CAKE - PLANT 8 (NORMAL)
"C" - SEMI-LIQUID CAKE, SUMP LIQUOR (NORMAL)
"D" - SCRAP GRAPHITE, BRICK AND MISC. SOLIDS (NORMAL)
"E" - CHEMICAL TRAP RESIDUES IN DRUMS (HF)

DATA SOURCE: "FMPC WASTE INVENTORY DATA" REPORT (MARCH 12,1985)

LEGEND

- GLACIAL OVERBURDEN
- CLAY LINER
- FILL SOIL
- SAND AND/OR GRAVEL
- SOIL MIXED WITH WASTE
- WASTE
- PIT OUTLINE COVERED
- PIT OUTLINE DIKE
- PIT OUTLINE BOTTOM
- SLOPE
- MAJOR CONTOUR
- FENCE
- RAILROAD
- PAVED ROAD
- GRAVEL ROAD
- POST INDICATOR VALVE (PIV)
- FIRE HYDRANT (FH)
- MANHOLE (MH)
- CATCH BASIN (CB)
- POWER POLE
- VALVE BOX
- MONITORING WELL

PRELIMINARY

000077

0 15 30 75 150
SCALE IN FEET

1992 PHOTOGRAMMETRY
PREPARED BY: WOOLPERT CONSULTANTS

WASTE PITS GEOMETRIC CONFIGURATION
PREPARED BY: PARSONS

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
										08C-5500-G-01161
										08C-5500-G-01195
										21A-5500-G-00101
										08C-5500-P-01218
										21A-5500-G-00096
										08C-5500-P-01131
										75X-5900-G-00247
										08C-5500-G-01116
										08C-5500-G-00864

NOTE:
FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/16
ANGLES ± 0°-30'
DECIMALS
.X ± 0.1
.XX ± 0.03
.XXX ± 0.005
.XXXX ± 0.0005
DRW. RELEASE DATE

APPROVALS					
CIVIL & STR.			SAFETY ENG.		
ELECTRICAL			MAINTENANCE		
ENGINEER			Q.A.		
INSTRUMENT			FIRE PROTECT.		
MECHANICAL			WASTE MANAGE.		
			SECURITY		
			CRU		
CHECKED					
APPROVED					

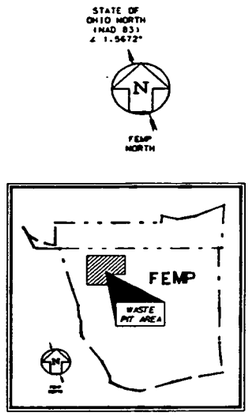
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

CRU-1 WASTE PITS AREA

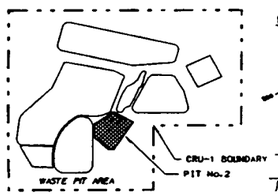
CERCLA/RCRA UNIT ONE AREA
WASTE PIT No.1
HISTORICAL CONFIGURATION
SCALE: 1"=30'-0"

RES 2080
DATE 25 FEB 93
DRAWN M.K. TILLMAN
21A-5500-G-00251 0

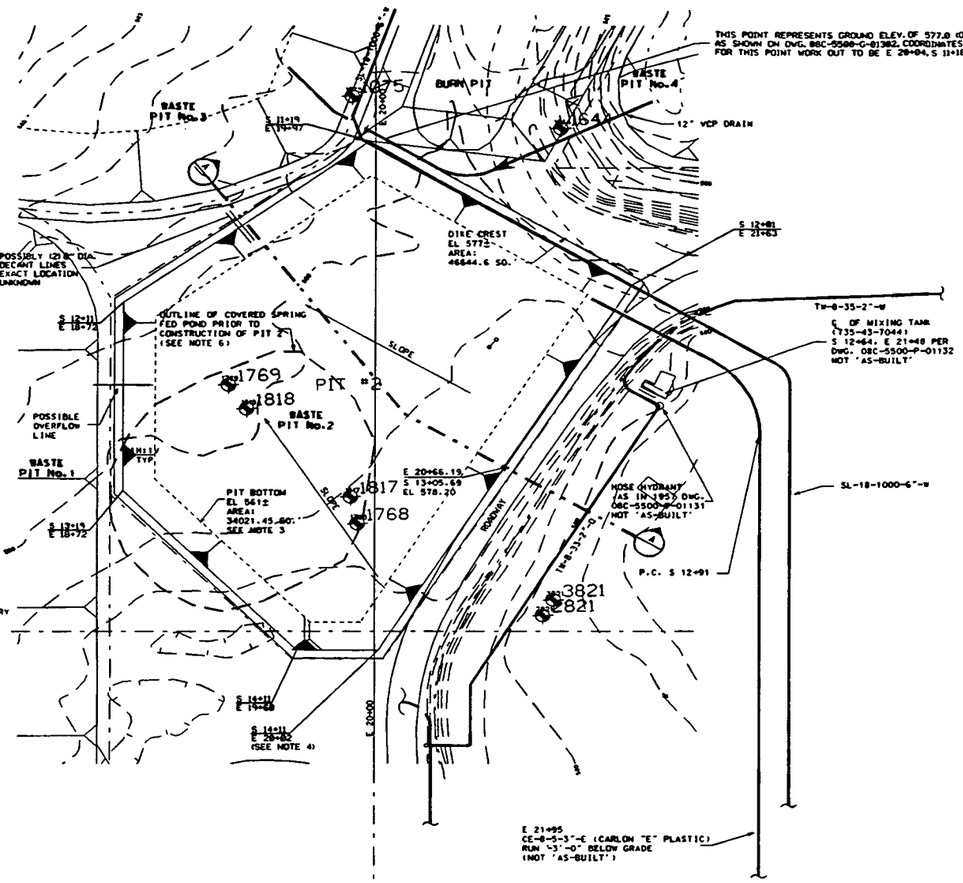
FILE NAME: /rea2080/CRU1A8005.DGN

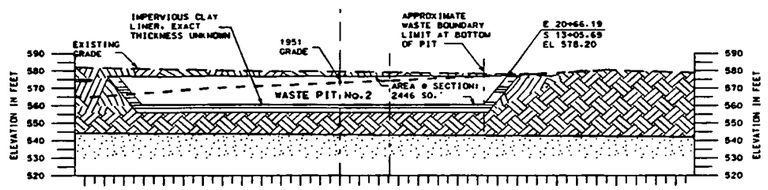


VICINITY MAP

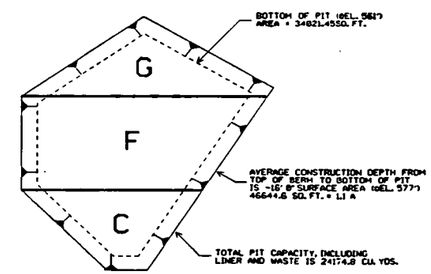


KEY PLAN





SECTION A
SCALE: 1"=30'



CONSTRUCTED: 1957 COST: $20,573.00

IN USE: 1957 - MID 1964

CONSTRUCTION: PIT 2 WAS CONSTRUCTED IN THE LOCATION OF A SMALL POND NORTH-EAST OF PIT 1. THE PIT IS AN IN-GROUND FACILITY WHICH WAS CONSTRUCTED BY EXCAVATING A BASIN INTO THE EXISTING NATIVE CLAY.

DIMENSIONS: MAXIMUM DEPTH OF WASTE = 13 FEET; VOLUME = 13,000 CY

PIT OPERATION: AS WITH PIT 1, FILTER CAKES AND SOLID WASTE WERE PLACED IN PIT 2. DURING 1958-1959, IT BECAME NECESSARY TO USE PIT 2 FOR THE DISPOSAL OF NEUTRALIZED, CONCENTRATED REFINERY RAFFINATE RESIDUES BECAUSE THE DRYING EQUIPMENT AVAILABLE COULD NOT PROCESS ALL OF THE RAFFINATE OUTPUT. THE REMAINING CAPACITY OF PIT 1 WAS USED AS A CLEARWELL FOR THE EFFLUENTS GOING TO THE GREAT MIAMI RIVER.

PIT CONTENTS: PIT 2 RECEIVED THE FOLLOWING RADIOACTIVE WASTES: NEUTRALIZED WASTE FILTER CAKE, SUMP CAKES FROM THE PRODUCTION PLANT, DEPLETED SLAG, SCRAP GRAPHITE, CONTAMINATED BRICK AND SUMP LIQUOR. IT WAS ALSO USED AS A SETTLING POND FOR NEUTRALIZED RAFFINATE RESIDUES FOR ABOUT ONE YEAR PRIOR TO THE COMPLETION OF PIT 3.

COMMENTS: LIKE PIT 1, PIT 2 WAS CONSTRUCTED WITH 8" DECANT PIPES THROUGH THE WEST BERM. THESE DECANT PIPES WERE RARELY USED DURING THE PITS' OPERATING LIFE.

ZONED AREAS: AS PER DRAWING 08C-5500-G-01161 ARE AS FOLLOWS:
"C" - SEMI-LIQUID FILTER CAKE AND SUMP LIQUOR (NORMAL)
"F" - RESERVED
"G" - RESERVED

DATA SOURCE: "FMPC WASTE INVENTORY DATA" REPORT (MARCH 12, 1985)

NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   AERIAL TOPOGRAPHY: 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE GEOMETRIC CONFIGURATIONS, THE LINER THICKNESSES; AND THE BOTTOM ELEVATIONS OF THE WASTE PITS WERE DETERMINED FROM THE BEST AVAILABLE DATA AT THIS TIME. THIS DATA WAS GATHERED FROM CONSTRUCTION, AS-BUILT, SURVEY, AND FEASIBILITY STUDY DRAWINGS (1/31/92, REV 1), AND FROM THE EXISTING PLANT ENGINEERING FILES.
   THE DIKE CREST SHOWN AROUND THE WASTE PITS REPRESENTS THOSE BUILT AT THE TIME OF CONSTRUCTION. MOST OF THE DIKES HAVE BEEN BURIED WITH COVER MATERIAL OF DIFFERENT THICKNESSES.

3. THE BORING LOGS WERE USED TO DEVELOP THESE BOTTOM ELEVATIONS.

4. COORDINATE VALUES ON THE ℄ CORNER ARE INDICATED ON DWG. 08X-5500-G-01109 AND DO NOT REFLECT AN "AS - BUILT" CONDITION

5. IT IS AT THIS POINT THAT THE GROUND CORRELATION OF 577' + 10' (AS WAS THE TOPOGRAPHY INDICATED ON THE 08C-5500-G-01161, 08C-5500-G-00254, 08C-5500-G-01382 AND 08C-5500-G-01002) WAS DETERMINED.

6. POND WAS REMOVED AND PLUGGED WITH IMPERVIOUS BLUE CLAY

551

LEGEND

- GLACIAL OVERBURDEN
- CLAY LINER
- FILL SOIL
- SAND AND/OR GRAVEL
- SOIL MIXED WITH WASTE
- WASTE
- PIT OUTLINE COVERED
- PIT OUTLINE DIKE
- PIT OUTLINE BOTTOM
- SLOPE
- 580 MAJOR CONTOUR
- FENCE
- RAILROAD
- PAVED ROAD
- GRAVEL ROAD
- POST INDICATOR VALVE (PIV)
- FIRE HYDRANT (FH)
- MANHOLE (MH)
- CATCH BASIN (CB)
- POWER POLE
- VALVE BOX
- MONITORING WELL
- SIGN

0 15 30 75 150
SCALE IN FEET

1992 PHOTOGRAMMETRY
PREPARED BY: WOOLPERT CONSULTANTS

WASTE PITS GEOMETRIC CONFIGURATION
PREPARED BY: PARSONS

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
										08C-5500-P-01132
										08C-5500-P-01131
										CP 56-24
										75X-5900-G-00247
										08C-5500-G-01161
										08C-5500-G-01302
										08X-5500-G-01109

NOTE:
FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/16
ANGLES ± 0°-30'
DECIMALS
.X ± 0.4
.XX ± 0.03
.XXX ± 0.005
.XXXX ± 0.0010
FINAL RELEASE DATE

APPROVALS			
CIVIL & STR.		SAFETY ENG.	
ELECTRICAL		MAINTENANCE	
ENGINEER		Q.A.	
INSTRUMENT		FIRE PROTECT.	
MECHANICAL		WASTE MANAGE	
		SECURITY	
		CRU	
CHECKED			
APPROVED			

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

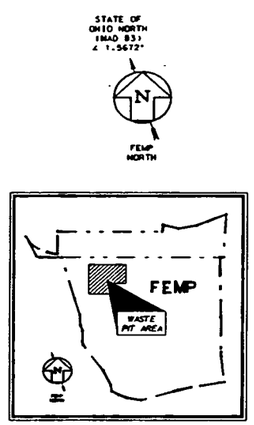
CRU-1 WASTE PITS AREA

CERCLA/RCRA UNIT ONE AREA
WASTE PIT No.2
HISTORICAL CONFIGURATION
SCALE: 1"=30'-0"

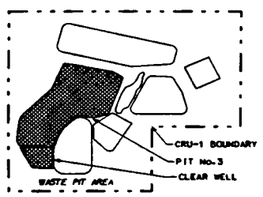
RES 2080
DATE 2 MAR 93
DRAWN M.E. TILLMAN
21A-5500-G-00252 | 0

FILE NAME: /res2080/cru1db006.dgn

000078



VICINITY MAP



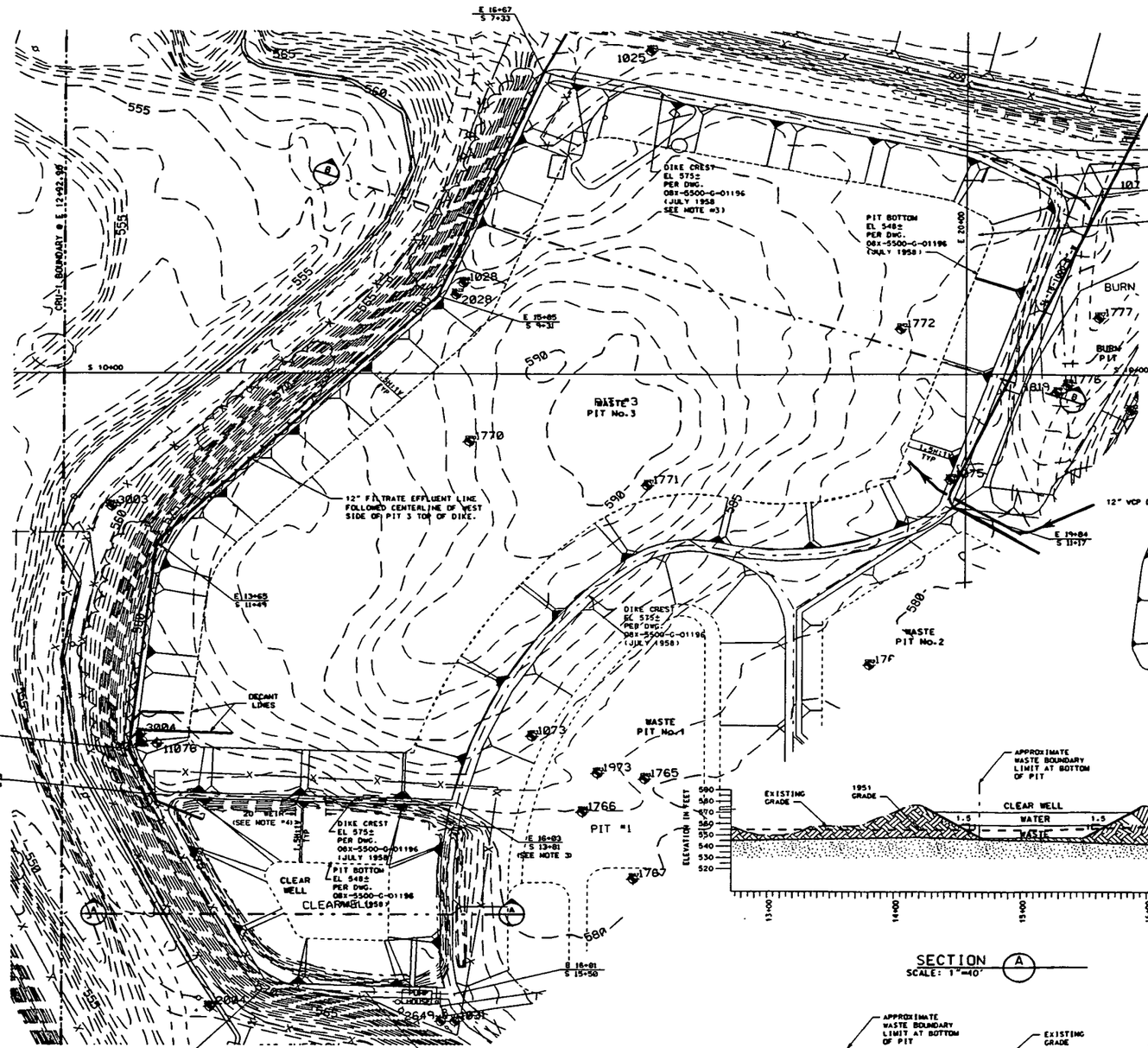
KEY PLAN

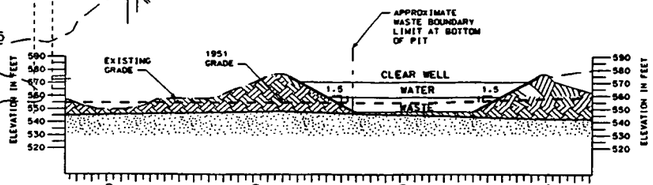
LEGEND

- GLACIAL OVERBURDEN
- CLAY LINER
- FILL SOIL
- SAND AND/OR GRAVEL
- SOIL MIXED WITH WASTE
- WASTE
- PIT OUTLINE COVERED
- PIT OUTLINE DIKE
- PIT OUTLINE BOTTOM
- SLOPE
- 580 MAJOR CONTOUR
- FENCE
- RAILROAD
- PAVED ROAD
- GRAVEL ROAD
- POST INDICATOR VALVE (PIV)
- FIRE HYDRANT (FH)
- MANHOLE (MH)
- CATCH BASIN (CB)
- POWER POLE
- VALVE BOX
- MONITORING WELL

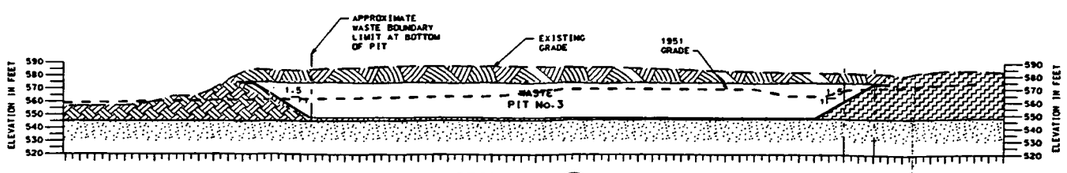
1992 PHOTOGRAMMETRY
PREPARED BY: WOOLPERT CONSULTANTS

WASTE PITS GEOMETRIC CONFIGURATION
PREPARED BY: PARSONS





SECTION (A)
SCALE: 1"=40'



SECTION (B)
SCALE: 1"=40'

5511

NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW:

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   AERIAL TOPOGRAPHY: 1993
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE GEOMETRIC CONFIGURATIONS, THE LINER THICKNESSES, AND THE BOTTOM ELEVATIONS OF THE WASTE PITS WERE DETERMINED FROM THE BEST INFORMATION AVAILABLE DATA AT THIS TIME. THIS DATA WAS GATHERED FROM CONSTRUCTION, AS-BUILT, SURVEY, AND FEASIBILITY STUDY DRAWINGS (1/31/92, REV 1), AND FROM THE EXISTING PLANT ENGINEERING FILES.
   THE DIKE CREST SHOWN AROUND THE WASTE PITS REPRESENTS THOSE BUILT AT THE TIME OF CONSTRUCTION; MOST OF THE DIKES HAVE BEEN BURIED WITH COVER MATERIAL OF DIFFERENT THICKNESSES.

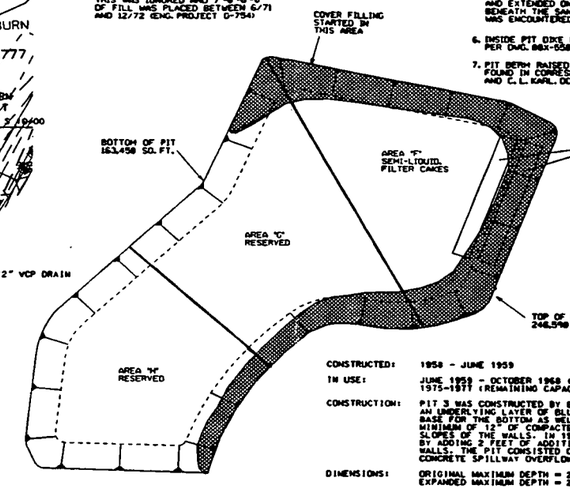
3. THE U.D. COORDINATE CALLOUTS REPRESENT "AS-BUILT" CONTROL POINTS AS INDICATED ON DWG. 08X-5500-G-01196

4. TIMBER PILING HAS BEEN NOTED FREQUENTLY DURING CONSTRUCTION OF WEIR. EXACT DEPTH NOT SPECIFIED. THIS WAS FOUND IN CP50-48 DOCUMENTS AND ON DWG. 08C-5500-G-00197.

5. POROUS AREAS WERE FOUND AT THE NORTH AND SOUTH ENDS (OF DIKES) OF PIT #3. APPROX. 45' X 0' ON THE SOUTH END AND 35' X 0' ON THE NORTH WERE EXCAVATED AND FILLED WITH COMPACTED CLAY. THE EXCAVATION WAS APPROX. 18' WIDE AND EXTENDED ONE FOOT INTO THE CLAY STRATA. BENEATH THE SAND AND GRAVEL, EST. 3.5'-4.0' OF SAND AND GRAVEL WAS ENCOUNTERED (AUG 21, 1958 CHANGE ORDER).

6. INSIDE PIT DIKE FACE LINED WITH NOM. 12" SELECT IMPERVIOUS CLAY PER DWG. 08X-5500-G-01196, NOT "AS-BUILT"

7. PIT DEPTH RAISED TO 577.0' IN 1965, PER COMMENT FOUND IN CORRESPONDENCE BETWEEN J. H. HOYES AND C. L. KARL, OCT. 18, 1965



CONSTRUCTED:	1958 - JUNE 1959 COST: $163,298.00
IN USE:	JUNE 1959 - OCTOBER 1968 (AS A SETTLING PIT) 1975-1977 (REMAINING CAPACITY FILLED WITH SOLID WASTE)
CONSTRUCTION:	PIT 3 WAS CONSTRUCTED BY EXCAVATING A LARGE BASIN DOWN INTO AN UNDERLYING LAYER OF BLUE CLAY, WHICH PROVIDED AN IMPERVIOUS BASE FOR THE BOTTOM AS WELL AS A LINING FOR THE WALLS. A MINIMUM OF 12" OF COMPACTED CLAY WAS USED TO LINE THE INNER SLOPES OF THE WALLS. IN 1965, THE PIT CAPACITY WAS EXPANDED BY ADDING 2 FEET OF ADDITIONAL MATERIAL TO THE TOP OF THE PIT WALLS. THE PIT CONSISTED OF A LARGE SETTLING BASIN WITH A CONCRETE SPILLWAY OVERFLOWING INTO A CLAY-LINED CLEARWELL.
DIMENSIONS:	ORIGINAL MAXIMUM DEPTH = 25 FEET; ORIGINAL VOLUME = 226,500 CY EXPANDED MAXIMUM DEPTH = 27 FEET; EXPANDED VOLUME = 248,500 CY
PIT OPERATION:	PIT 3 WAS THE FIRST "WET" PIT SPECIFICALLY FOR THE PURPOSE OF SETTLING SOLIDS FROM WET WASTE STREAMS. THE WASTE SLURRIES WERE PUMPED FROM PLANT 8 AND THE GENERAL SUMP INTO THE PIT. WITH THE CLARIFIED EFFLUENT OVERFLOWING THE SPILLWAY INTO THE CLEARWELL PRIOR TO DISCHARGE TO THE GREAT MIAMI RIVER.
PIT CONTENTS:	THE PRINCIPLE WASTE CONTAINED IN PIT 3 IS LIME-NEUTRALIZED RADIOACTIVE RAFFINATE CONCENTRATE. IN DECEMBER 1958, LIME SLUDGE FROM THE WATER TREATMENT PLANT BEGAN BEING ADDED TO SUPPLEMENT THE LIME USED FOR RAFFINATE NEUTRALIZATION. DURING THE LATE 1960'S LARGE QUANTITIES OF RADIOACTIVE SLAG (KEACH RESIDUES) WERE PUMPED TO PIT 3 UNTIL OCTOBER 1968, WHEN PIT 5 TOOK OVER AS THE SETTLING BASIN. FROM 1975 TO 1977, SOLID WASTES (FILTER CAKE AND FLY ASH) WERE USED TO COMPLETE THE FILLING OF THE PIT. A COVER OF DIRT AND CINDER WAS PLACED ON PIT 3 FROM 6/1/71 THRU 12/27/72 IN THE AMOUNT OF 83,000 CU.YD. A BREAKDOWN OF QUANTITIES ARE AS FOLLOWS: 18,390 CU.YD. (CINDERS FROM SOUTH PIT) 10,010 CU.YD. (SILO CINDERS) 46,730 CU.YD. (DIRT FROM FIELD N.W. PIT 3) 780 CU.YD. (COAL FINES FROM COAL PILE) 7,000 CU.YD. (COMBINATION BROKEN CONCRETE AND EARTH EXCAVATIONS) CONSIDERABLE AMOUNTS OF DIRT WAS PUSHED FROM PIT 1 + 2 ONTO PIT 3 DURING THAT TIME. THE ABOVE QUANTITIES DO NOT REFLECT THAT ADDITIONAL VOLUME. WHEN THE DIRT COVER WAS STARTED, THE LEVEL OF PIT 3 WAS AROUND 570' TO 571' AND THE DEPTH OF THE SLUDGE IN PIT 3 WAS AROUND 21 FEET. WITH THE ABOVE SURFACE AREA, ALONG WITH 83,000 CU. YD. OF MATERIAL FILL, A DEPTH OF AROUND 7.5 TO 8.0 FEET WAS SEEN (AVE. EL. 578.25'), PER ENG. PROJ. G-574
COMMENTS:	PRIOR TO THE EARTHEN COVER, THE PIT UNDERWENT A CONSOLIDATION OF MATERIALS AND DROPPED 3-4' BELOW BERM ELEVATION. ADDITIONAL QUANTITIES OF EARTH WERE MOUNDED TO PROVIDE SUITABLE RUNOFF TO THE SPILLWAY AND CLEARWELL ON THE SOUTH END. ADDITIONAL FILL DIRT WAS PLACED ON THE PIT WHICH CAME FROM THE AREA AROUND THE SURGE LAGOON, AREA WEST OF PIT 5 AND THE AREA AROUND THE STORM WATER RETENTION BASIN.
DATA SOURCE:	"FMPC WASTE INVENTORY DATA" MARCH 12, 1985.

PRELIMINARY

000079

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
										CP 58-40
										75X-5500-G-00247
										08C-5500-G-01197
										08X-5500-G-01196

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS ± 1/16
ANGLES ± 0°-30'
DECIMALS
.X ± 0.1
.XX ± 0.03
.XXX ± 0.005
.XXXX ± 0.0075
SPEC RELEASE DATE

APPROVALS					
CIVIL & STR.			SAFETY ENG.		
ELECTRICAL			MAINTENANCE		
ENGINEER			Q.A.		
INSTRUMENT			FIRE PROTECT.		
MECHANICAL			WASTE MANAGE.		
			SECURITY		
			CRU		
CHECKED					
APPROVED					

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

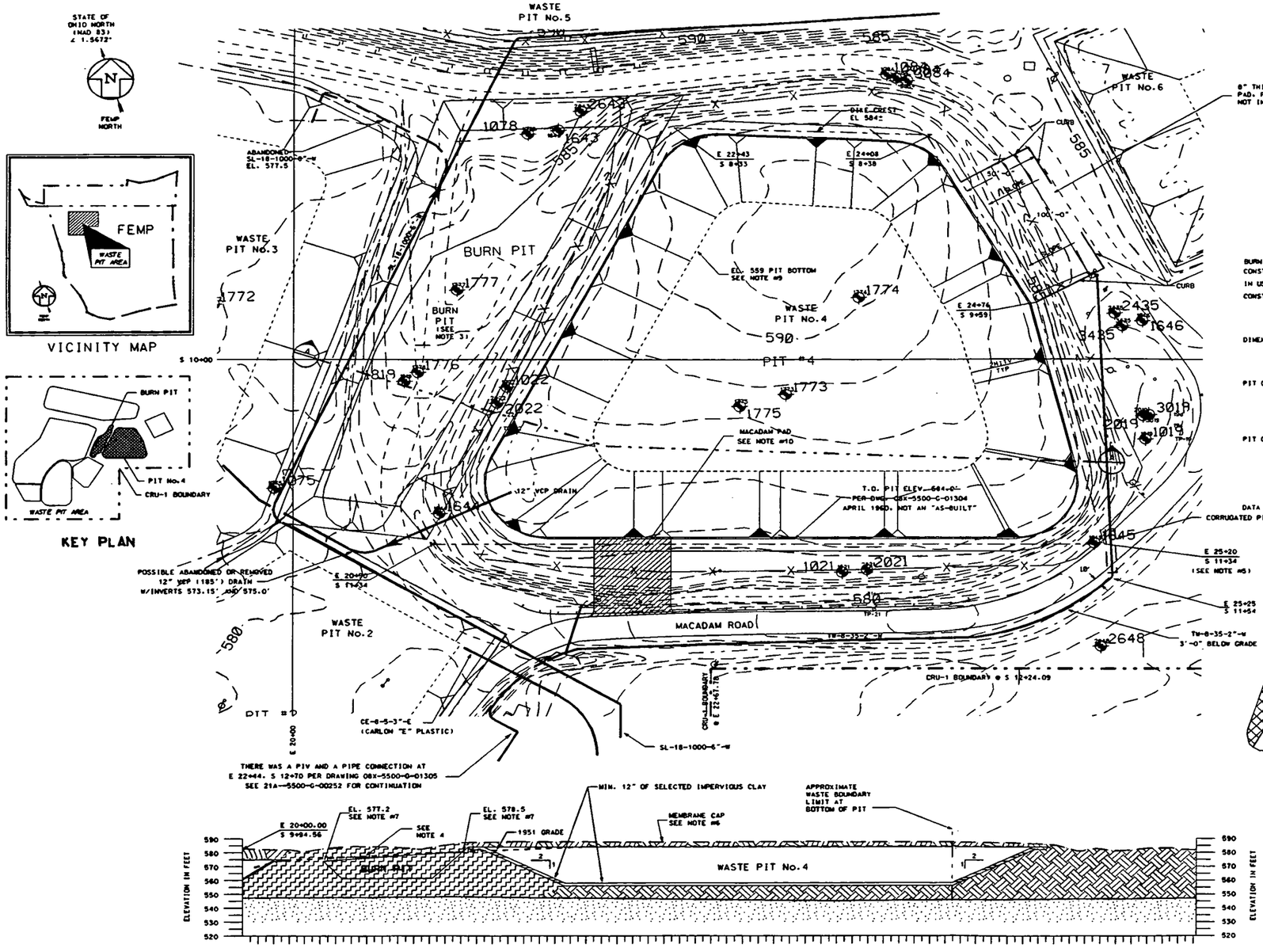
CRU-1 WASTE PITS AREA

CERCLA/RCRA UNIT ONE AREA
WASTE PIT No.3 & CLEARWELL
HISTORICAL CONFIGURATION
SCALE: 1"=40'-0"

RES 2080
DATE 3 MAR 93
DRAWN H.E. TILLMAN

21A-5500-G-00253 | 0

FILE NAME: /res2080/CRU1A8007.DGN



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   PARSONS TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE GEOMETRIC CONFIGURATIONS, THE LINER THICKNESSES, AND THE BOTTOM ELEVATIONS OF THE WASTE PITS WERE DETERMINED FROM THE BEST AVAILABLE DATA AT THIS TIME. THIS DATA WAS GATHERED FROM CONSTRUCTION, AS-BUILT, SURVEY, AND FEASIBILITY STUDY DRAWINGS (1/31/92, REV 1), AND FROM THE EXISTING PLANT ENGINEERING FILES.
   THE DIKE CREST SHOWN AROUND THE WASTE PITS REPRESENTS THOSE BUILT AT THE TIME OF CONSTRUCTION. MOST OF THE DIKES HAVE BEEN BURIED WITH COVER MATERIAL OF DIFFERENT THICKNESSES.

3. THE GEOMETRIC CONFIGURATION OF THE BURN PIT HAS BEEN DETERMINED FROM THE SITE AS-BUILT SURVEY OF THE BURN PIT DIKE (DWG. 08C-5500-G-01302 9/16/54). DEPTH AND SLOPES OF THE BURN PIT ARE NOT KNOWN.

4. BECAUSE OF INADEQUATE INFORMATION, THE BURN PIT AREA LOCATED BETWEEN WASTE PITS 3 AND 4 IS SHOWN AS SOIL MIXED WITH WASTE.

5. THE (S) COORDINATE CALLOUTS REPRESENT PIT 4 CONTROL POINTS AS INDICATED ON DWG. 08X-5500-G-01304 AND DO NOT REFLECT AN "AS-BUILT" CONDITION

6. THE CURRENT MEMBRANE CAP AND TOPOGRAPHY OF PIT 4 WAS ACCOMPLISHED BY THE A. E. FIRM OF LOCKWOOD GREENE IN THE LATE SUMMER OR FALL OF 1988. THE ENGINEERING PROJECT WAS TITLED "COVER FOR PIT 4" THE WEMCO ENGINEERING PROJECT TITLE IS 40-87681. THESE PROJECT DESIGNS REFLECT "CPC" STATUS.

7. THE CONFIGURATION OF THE BURN PIT WAS DERIVED FROM DWG. 08C-5500-G-01302 DATED 9/16/54. THE ELEVATIONS WERE DERIVED FROM THE SAME DRAWING. BURN PIT SLOPE AND BOTTOM ARE ARBITRARY. THE DRAWING IS NOT INDICATED AS "AS-BUILT"

8. THIS CONC. PAD WAS REMOVED UNDER PROJECT 40-87681.

9. PIT BOTTOM LOWERED TO EL. 559.0 FROM ORIGINAL EL. OF 568.0 PER CHANGE ORDER DATED 9/6/60. CP59-06.

10. MACADAM ROAD IS INDICATED ON DWGS 08X-5500-G-01304 AND 08X-5500-G-01305, WITH NO MENTION OF BEING "AS-BUILT"

BURN PIT

CONSTRUCTED: ~1953

IN USE: ? - JUNE, 1974

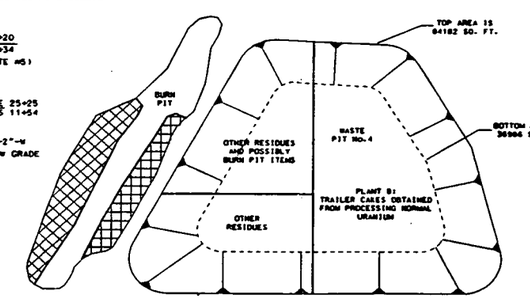
CONSTRUCTION: THE BURN PIT WAS EXCAVATED TO SUPPLY THE NATIVE BLUE CLAY FOR THE LINING OF PIT 1 AND 2. IT WAS AN EXCAVATED PIT WITH THE ENTRANCE ON THE NORTH SIDE SLOPING DOWN TO THE SOUTH. TO THE IMMEDIATE WEST WAS THE EASTERN BERM OF PIT 3 AND TO IMMEDIATE EAST WAS THE WESTERN BERM OF PIT 4.

DIMENSIONS: EXACT DIMENTIONS NOT KNOWN. BUT FROM SCALING DRAWING 08C-5500-G-01302, THE TOP OUTLINE IS ROUGHLY 340' BY A VARYING WIDTH OF BETWEEN 38' - 85'. EXACT DEPTH IS NOT KNOWN. BUT FROM THE PHOTOGRAPH OF THE BURN PIT DATED AUG. 1959, A GUESS MIGHT PUT THE DEEPEST PART AT AROUND ELEV. 560'.

PIT OPERATION: BURNABLE ITEMS WERE ROUTINELY DISPOSITED INTO THE BURN PIT FROM DISCARDS FROM PRODUCTION PLANTS AND BUILDINGS, CAFETERIA AND CONSTRUCTION WASTE ACTIVITIES. THE REMAINS AFTER THE BURN WERE SCOOPED UP AND PUT INTO PIT 4. AT ABOUT THE TIME PIT 5 OPENED, THE BURN PIT FUNCTIONALITY CHANGED TO BECOMING A LANDFILL AREA. ON JUNE 19, 1974, THE SANITARY LANDFILL BEGAN OPERATIONS, AND THE BURN PIT WAS BACKFILLED WITH EARTH AND ABANDONED.

PIT CONTENTS: A VARIETY OF "TRASH" ITEMS WERE DEPOSITED AND BURNED IN THE BURN PIT. ITEMS INCLUDED: TIN CANS, WOOD ALLEYS AND BOXES, GRAVEL, SCRAP IRON, CLAY, ASHES, HEELS OF SHOE, GREEN SALT, CHIPS, RAGS, PAPER, FLOOR SWEEPINGS, WIRE, GLASS, PIPE COVERINGS, CANS, OIL FILTERS, CERAMICS, LIGHT BULBS, INSULATION, VACUUM HOSES AND OTHER MISC. ITEMS. MOST CONTAINED RADIOACTIVE CONTAMINATION. THE BURN PIT WAS SEGREGATED WITH PRODUCTIONS BURNABLES ON THE WEST SIDE. CONSTRUCTION MATERIALS IN THE MIDDLE AND MATERIALS FROM THE CAFETERIA ON THE EAST SIDE.

DATA SOURCE: "FMPC WASTE INVENTORY DATA" REPORT (MARCH 12, 1985)



PIT 4

CONSTRUCTED: 1960 COST: 835,716.00

IN USE: AUGUST 1960 - 1986

CONSTRUCTION: PIT 4 WAS CONSTRUCTED IN THE SAME MANNER AS PIT 3, BY EXCAVATING DOWN INTO THE UNDERLYING CLAY STRATA TO PROVIDE IMPERVIOUS MATERIAL FOR LINING THE PIT WALLS AND BOTTOM. A MINIMUM OF 12" OF COMPACTED CLAY WAS USED TO LINE THE INNER SLOPES OF THE PIT WALLS.

DIMENSIONS: MAXIMUM DEPTH = 24 FEET; VOLUME = 53,000 CU.YD., PER DRAWING 08X-5500-G-01304, 2/26/60. IT WAS LATER LOWERED TO ELEV. 559.0'

PIT OPERATION: SOLID WASTES WERE DUMPED FROM CONCRETE AND MACADAM ROADS ON THE EAST AND SOUTH SIDES AND PUSHED INTO THE PIT BY A BULLDOZER. RAINWATER WHICH COLLECTED IN THE PIT; AS WELL AS WATER FROM HOSING DOWN THE EAST PAD, WAS DRAINED INTO PIT 3 UNTIL IT BECAME FILLED (~1977). AFTER THAT IT WAS PUMPED TO PIT 5 AS NECESSARY. PIT 4 WAS SEGGREGATED FOR VARIOUS DISPOSAL OF RADIOACTIVE WASTES.

PIT CONTENTS: PIT 4 RECEIVED THE FOLLOWING TYPES OF WASTE: PLANT 8 TRAILER CASES, CONTAMINATED GRAPHITE, NON-BURNABLE TRASH (SUCH AS CONCRETE, ROCKS, STONES, BRICK AND GLASS) AND POSSIBLY THE ASHES AND NON-BURNABLES FROM THE BURN PIT.
BETWEEN MAY 1981 AND APRIL 1983, PIT 4 ALSO RECEIVED 23,499 POUNDS OF LOW LEVEL RADIOACTIVE WASTE CONTAINING BARIUM CHLORIDE SALT.

COMMENTS: PIT 4 WAS SCHEDULED FOR USE SEPT. 1, 1960 AND LAST RECEIVED REFUSE ~1986. CONTAMINATED SOIL FROM THE PADS AROUND PIT 6 WAS SPREAD ONTO PIT 4 DURING THE PROJECT 40-86302 ("PIT 4 DIRT COVER"). PROJECT 40-07601 ("COVER FOR PIT 4") PUT IN AN INTERIM CLOSURE STATUS. IT INCORPORATED SOME CONTAMINATED SOILS FROM VARIOUS PILES AROUND THE PRODUCTION SITE. THE CLEAN SOIL THAT WAS GENERATED FROM THE S.W.R.B. PROJECT WAS THEN PLACED ON TOP AND GRADED. A TWO (2) FOOT LAYER OF COMPACTED CLAY (A MIXTURE OF NATIVE BLUE CLAY AND BENTONITE) EXTENDING ELEVEN (11) FEET BEYOND THE EDGE OF PIT 4 WAS THEN INSTALLED. A 40 MIL SYNTHETIC RUBBER HYPALON LINER THEN WAS INSTALLED AND ANCHORED.

DATA SOURCE: "FMPC WASTE INVENTORY DATA" REPORT (MARCH 12, 1985)

LEGEND

- GLACIAL OVERBURDEN
- CLAY LINER
- FILL SOIL
- SAND AND/OR GRAVEL
- SOIL MIXED WITH WASTE
- WASTE
- PIT OUTLINE COVERED
- PIT OUTLINE DIKE
- PIT OUTLINE BOTTOM
- SLOPE
- 560 MAJOR CONTOUR
- FENCE
- RAILROAD
- PAVED ROAD
- GRAVEL ROAD
- POST INDICATOR VALVE (PIV)
- FIRE HYDRANT (FH)
- MANHOLE (MH)
- CATCH BASIN (CB)
- POWER POLE
- VALVE BOX
- MONITORING WELL

PRELIMINARY

000080

0 15 30 75 150
SCALE IN FEET

1992 PHOTOGRAMMETRY PREPARED BY: WOOLPERT CONSULTANTS

WASTE PITS GEOMETRIC CONFIGURATION PREPARED BY: PARSONS

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
										08C-5500-G-01302
										08C-5500-G-01303
										08X-5500-G-01305
										75X-5900-G-00247
										08X-5500-G-01304

NOTE: FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/16
ANGLES ± 0°-30'
DECIMALS
.X ± 0.1
.XX ± 0.02
.XXX ± 0.005
.XXXX ± 0.0050
DRG. RELEASE DATE

APPROVALS

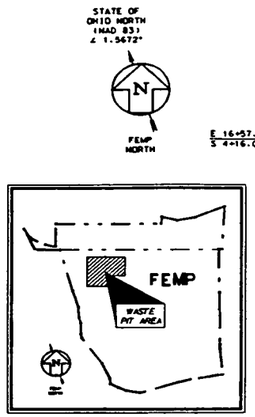
CIVIL & STR.		SAFETY ENG.	
ELECTRICAL		MAINTENANCE	
ENGINEER		Q.A.	
INSTRUMENT		FIRE PROTECT.	
MECHANICAL		WASTE MANAGE.	
		SECURITY	
		CRU	
CHECKED			
APPROVED			

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

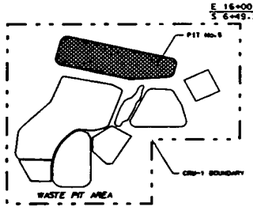
CRU-1 WASTE PITS AREA
CERCLA/RCRA UNIT ONE AREA
WASTE PITS No.4 & BURN PIT
HISTORICAL CONFIGURATION
SCALE: 1"=30'-0"

RES 2060
DATE 4 MAR 93
DRAWN M.E. TILLMAN
21A-5500-G-00255 | 0

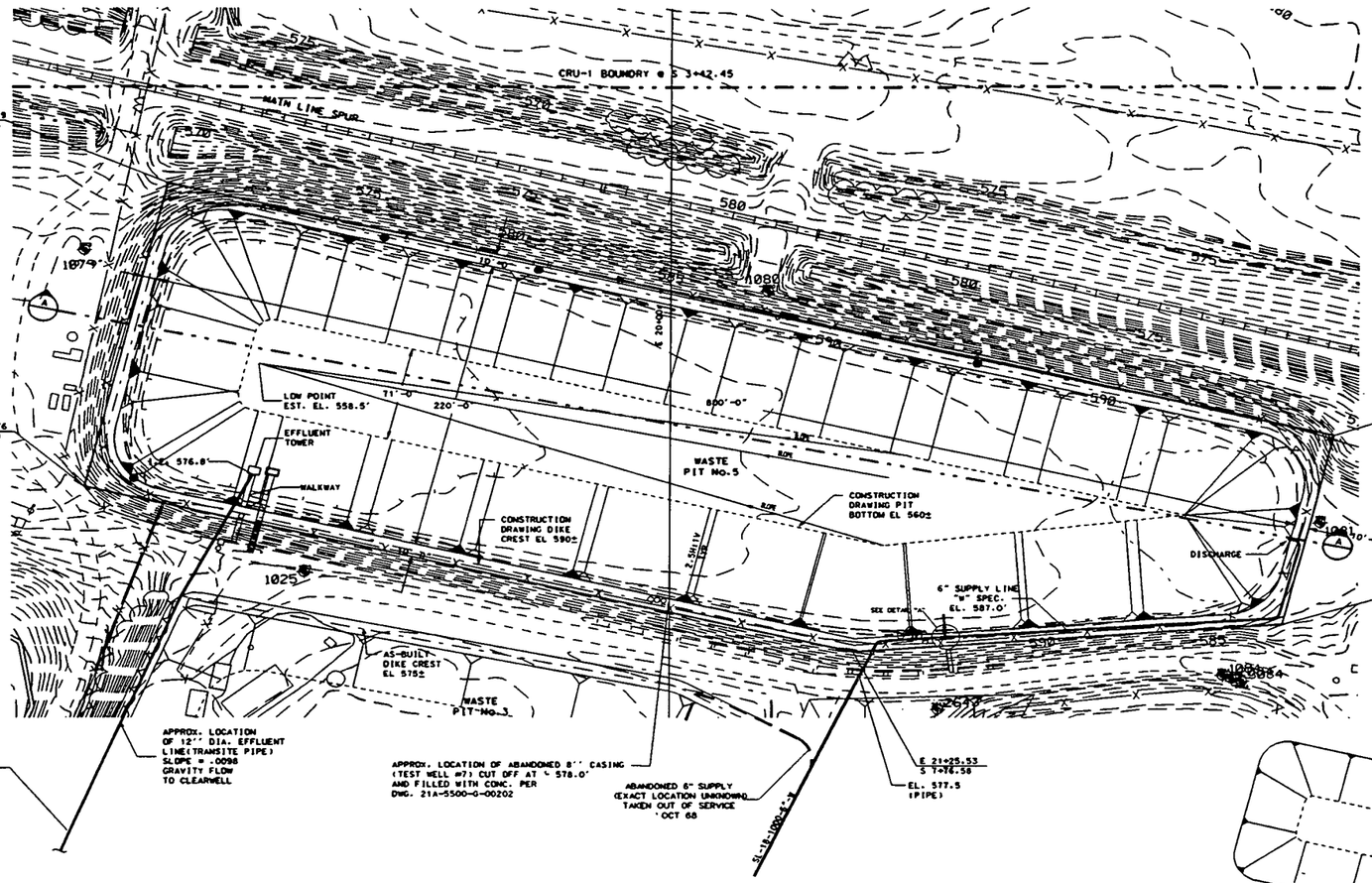
FILE NAME: /res2060/cru1db008.dgn



VICINITY MAP



KEY PLAN



NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   AERIAL TOPOGRAPHY, 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

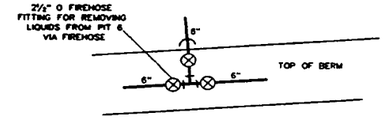
2. THESE (5) COORDINATE CONTROL POINTS WERE GENERATED FROM THE 1992 AERIAL FLYOVER. THE CONTROL POINTS INDICATED ON DWG. 21A-5500-C-00196 WERE DETERMINED TO BE INCORRECT

3. GROUNDWATER SEEPAGE AT DESIGN DEPTH ON SOUTH END OF PIT 5 WAS WITNESSED FOR THE ENTIRE EAST/WEST DIRECTION. CLAY PLUGS WERE INSTALLED SEVERAL TIMES AS WELL AS FIBER BOARD IN SOME. PLACES(CP68-13). APPROX. (3)60' 4'x8' SHEETS OF FIBER BOARD WERE PLACED.

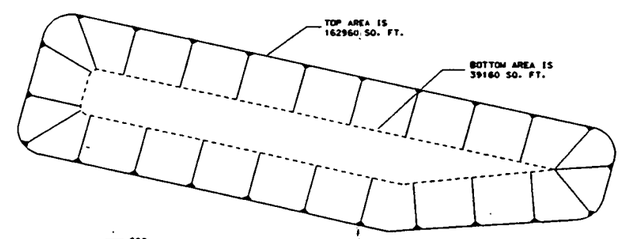
4. NOT SHOWN ON PLAN IS THE LINER SHEET LAYOUT BY UNIROYAL. SEE DWG 21A-5500-M-00251

5. SOIL BORINGS DATA LOCATED IN CP68-13.

551

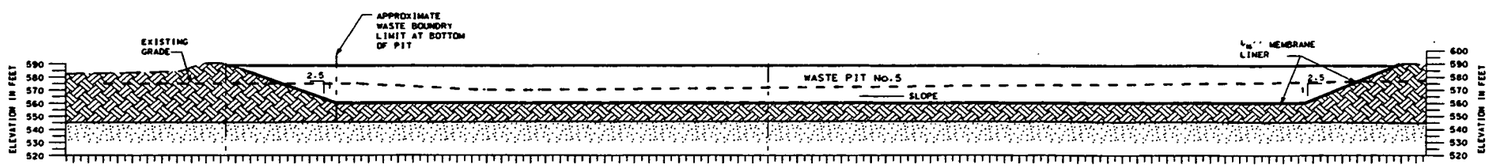


DETAIL "A"



LEGEND

- GLACIAL OVERBURDEN
- CLAY LINER
- FILL SOIL
- SAND AND/OR GRAVEL
- SOIL MIXED WITH WASTE
- WASTE
- PIT OUTLINE COVERED
- PIT OUTLINE DIKE
- SLOPE
- MAJOR CONTOUR
- FENCE
- RAILROAD
- PAVED ROAD
- GRAVEL ROAD
- POST INDICATOR VALVE (PIV)
- FIRE HYDRANT (FH)
- MANHOLE (MH)
- CATCH BASIN (CB)
- POWER POLE
- VALVE BOX
- MONITORING WELL



SECTION (A)
SCALE: 1"=40'

PLACED IN SERVICE OCT 68

CONSTRUCTED:	JULY 11,1968 - DECEMBER 13,1968 COST: $220,014.00
IN USE:	OCTOBER 21, 1968 - AUGUST 1983
CONSTRUCTION:	PIT 5 WAS CONSTRUCTED BY CUT AND FILL, USING THE EVACUATED MATERIAL TO BUILD THE DIKE, EXTENDING THE PIT APPROXIMATELY 10 FEET ABOVE GRADE. THE PIT IS LINED WITH 60 MIL THICK ROYAL-SEAL (FROM ELASTOMERIC MEMBRANE (UNIROYAL)
DIMENSIONS:	MAXIMUM DEPTH = 30 FEET; VOLUME=115,000 CU.YD., LIQUID CAPACITY=23,225,400 GAL.
PIT OPERATION:	WASTES FROM THE REFINERY AND PLANT 8 WERE PUMPED IN THE FORM OF A THIN SLURRY TO THE PIT WHICH SERVERD A SETTLING BASIN. THE CLARIFIED EFFLUENT FLOWED BY GRAVITY TO THE CLEARWELL FROM WHICH IT WAS DISCHARGED TO THE GREAT MIAMI RIVER. AS OF AUGUST 1983, SOLIDS IN THE WASTE STREAMS WERE REMOVED BY FILTRATION PRIOR TO BEING PUMPED TO PIT 5. THE PIT IN NO LONGER USED FOR SETTLING SOLIDS. THERE ARE 3 VALVES LOCATED ON THE SOUTHERN BERM THAT CONTROL DISCHARGES INTO PIT 5. ONLY AN OCCASIONAL DISCHARGE OF WATER IS PERMITTED TO ENTER TO COVER DRYING MATERIALS. ONE VALVE (THE WESTERN ONE) HAS A FIRE HOSE FITTING TO PERMIT THE PUMPING OF LIQUIDS FROM PIT 6 (VIA FIRE HOSE) BACK TO THE GENERAL SUMP.
PIT CONTENTS:	PIT 5 CONTAINS THE FOLLOWING RADIOACTIVE WASTES: SETTLED SOLIDS FROM NUETRALIZED RAFFINATE, SLAG LEACH SLURRY, AND SUMP SLURRIES. WATER TRATMENT PLANT LIME SLUDGE WAS ALSO ADDED TO SUPPLEMENT THE LIME USED FOR RAFFINATE NEUTRALIZATION.
COMMENTS:	THE EDPM LINER IN PIT 5 HAS PROVEN TO BE EXTREMELY DURABLE AND RESISTANT IN REGARD TO ATTACK BY CHEMICALS AND SUNLIGHT. OCCASIONAL JOINT FAILURES AND TEARS HAVE BEEN OBSERVED AND REPAIRED.
DATA SOURCE:	FMPC WASTE INVENTORY DATA" MARCH 12, 1985.

PRELIMINARY

000081

0 20 40 100 200
SCALE IN FEET

1992 PHOTOGRAMMETRY
PREPARED BY: WOOLPERT CONSULTANTS

WASTE PITS GEOMETRIC CONFIGURATION
PREPARED BY: PARSONS

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
										75X-5900-G-00247
										75X-5900-G-00239
										21A-5500-P-00203
										21A-5500-G-00201
										21A-5500-G-00199
										21A-5500-S-00200
										21A-5500-G-00198
										21A-5500-G-00197
										21A-5500-G-00202
										21A-5500-G-00196

NOTE:
FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/16
ANGLES ± 0°-30'
DECIMALS
.X ± 0.1
.XX ± 0.03
.XXX ± 0.005
.XXXX ± 0.0005
CRAS RELEASE DATE

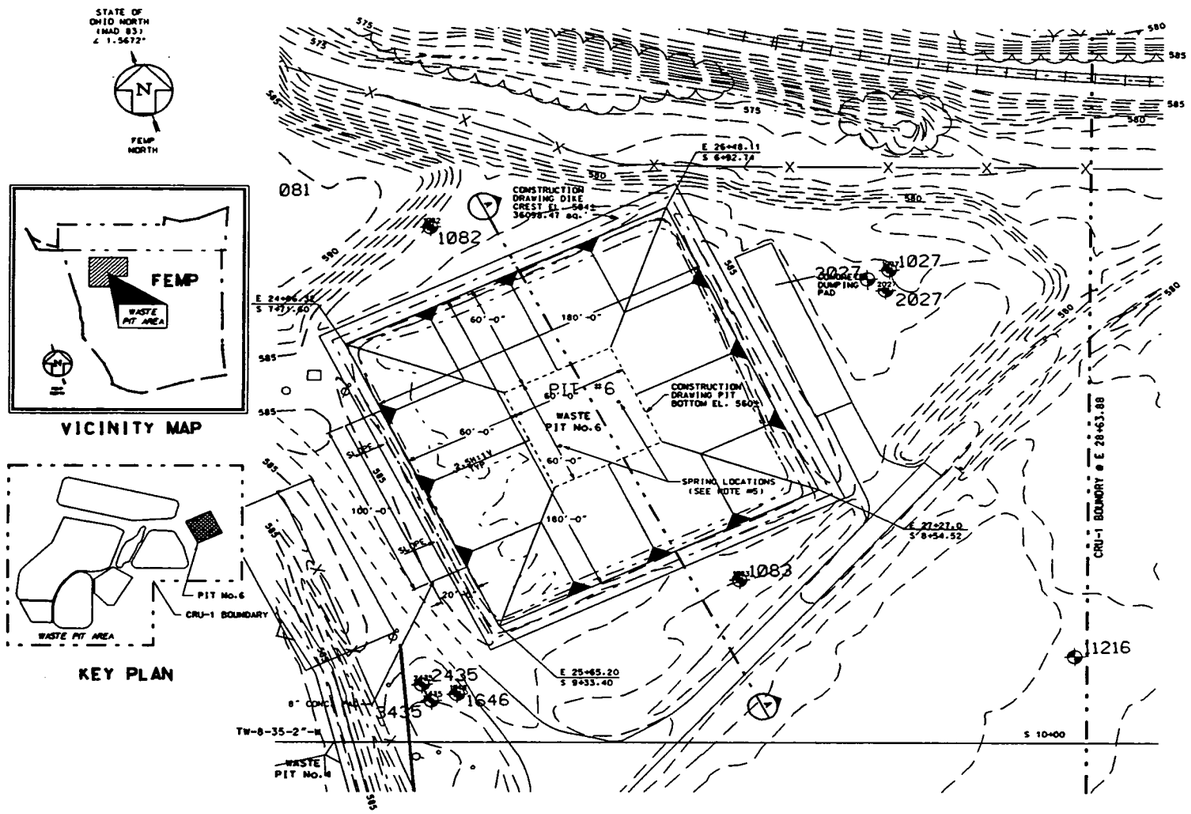
APPROVALS					
			SAFETY ENG.		
			MAINTENANCE		
CIVIL & STR.			Q.A.		
ELECTRICAL			FIRE PROTECT.		
ENGINEER			WASTE MANAGE.		
INSTRUMENT			SECURITY		
MECHANICAL			CPU		
CHECKED					
APPROVED					

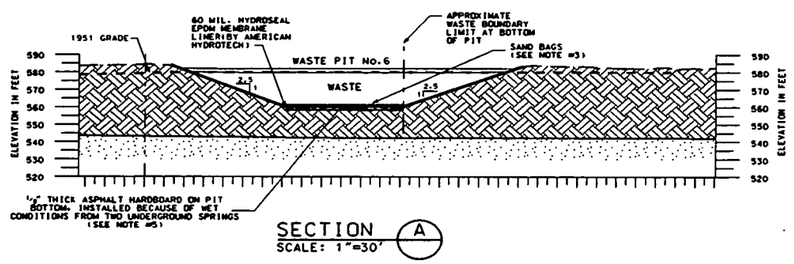
FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald Environmental Management Project
U.S. DEPARTMENT OF ENERGY

CRU-1 WASTE PITS AREA
CERCLA/RCRA UNIT ONE AREA
WASTE PIT No.5
HISTORICAL CONFIGURATION
SCALE: 1"=40'-0"

RES 2040
DATE 10 MAR 93
DRAWN M.E. TILLMAN
21A-5500-G-00256 0

FILE NAME: /r662080/cru1ab009.dgn





SECTION (A)
SCALE: 1"=30'

NOTES

1. EXISTING CONDITIONS SHOWN ON THIS DRAWING WERE PREPARED FROM FEMP SITE PROVIDED DATA FROM THE DOCUMENTS LISTED BELOW.

   EXISTING SITE DATA SOURCE (IN PLANT FILES)
   AERIAL/TOPOGRAPHY: 1992
   FEMP CADD GRID/UTILITY DRAWINGS
   FEMP CONTRACTOR PROJECT DESIGN DOCUMENTS

2. THE GEOMETRIC CONFIGURATIONS, THE LINER THICKNESSES, AND THE BOTTOM ELEVATIONS OF THE WASTE PITS WERE DETERMINED FROM THE BEST AVAILABLE DATA AT THIS TIME. THIS DATA WAS GATHERED FROM CONSTRUCTION, AS-BUILT, SURVEY, AND FEASIBILITY STUDY DRAWINGS (1/31/92, REV 13, AND FROM THE EXISTING PLANT ENGINEERING FILES.
   THE DIKE CREST SHOWN AROUND THE WASTE PITS REPRESENTS THOSE BUILT AT THE TIME OF CONSTRUCTION. MOST OF THE DIKES HAVE BEEN BURIED WITH COVER MATERIAL OF DIFFERENT THICKNESSES.

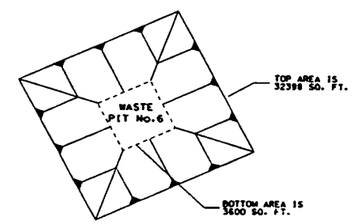
3. SAND BAGS WERE PLACED ON BOTTOM OF PIT 6 TO REDUCE THE PROBABILITY OF PUNCTURING LINER. PER MONTHLY PROJECT CP77-2, 12-1-79 ENTRY, PLANT 5 SLAG FINES WERE DUMPED FROM UNLOADING PAD(ON WEST SIDE) TO SERVE AS A PROTECTIVE SHIELD WHEN DUMPING LARGER WASTE INTO THE PIT.

4. A LETTER DATED JUNE 22, 1979 INDICATE THAT ENGINEERING RECOMMENDED THAT A 2"-0" THICK LAYER OF RAFFINATE FROM PIT #6 BE PLACED OVER THE PIT LINER. ALTHOUGH THE ENGINEER'S MONTHLY PROJECT RECORD DOES NOT INDICAT THEY DID SO. (CP77-2)

5. PER CORRESPONDENCE BETWEEN BEN T. YOUNG AND MR. C. HUEY (MLO-ENGINEERING) DATED 5-11-79 STATES THE CONCERN WITH THESE SPRINGS AND POSSIBLE SOLUTIONS. CHANGE ORDER DATED 1-31-1979 ORDERS PLACEMENT OF HARDBOARD (CP77-2)

6. NOT SHOWN ON THE PLAN IS THE LINER SHEET LAYOUT BY AMERICAN HYDROTECH, INC. SEE DWG 21A-5500-M-00258 FOR DETAILS

5517



LEGEND

- GLACIAL OVERBURDEN
- CLAY LINER
- FILL SOIL
- SAND AND/OR GRAVEL
- SOIL MIXED WITH WASTE
- WASTE
- PIT OUTLINE COVERED
- PIT OUTLINE DIKE
- PIT OUTLINE BOTTOM
- SLOPE
- MAJOR CONTOUR
- FENCE
- RAILROAD
- PAVED ROAD
- GRAVEL ROAD
- POST INDICATOR VALVE (PIV)
- FIRE HYDRANT (FH)
- MANHOLE (MH)
- CATCH BASIN (CB)
- AND POWER POLE
- VALVE BOX
- MONITORING WELL

CONTRUCTED:	SEPTEMBER 1,1978 - JUNE 1, 1979 COST: $127,654
IN USE:	JUNE 1979 - MARCH 1985
CONSTRUCTION:	PIT 6 WAS CONSTRUCTED IN THE SAME FASHION AS PIT 5, WITH A 60 MIL EPDM HYDROSEAL LINER FROM AMERICAN HYDROTECH. DURING EXCAVATION WATER PERCOLATION WAS ENCOUNTERED.
DIMENSIONS:	MAXIMUM DEPTH = 24 FEET; VOLUME = 14,000 CU.YDS.
PIT OPERATION:	CONTAMINATED SOLID WASTES ARE DUMPED INTO PIT 6 AND THEN BULLDOZED OR CLAM-SHELLED INTO THE CENTER OF THE PIT. ONLY NON-COARSE, NON-PYROPHORIC WASTES HAVE BEEN PLACED IN THE PIT AS OF MARCH, 1985. COLLECTED RAINFALL IS PUMPED VIA PORTABLE PUMP AND FIREHOSE TO A CONNECTION LOCATED ON THE SOUTHERN BERM OF PIT 5, WERE IT TRAVELS IN AN EXISTING UNDERGROUND 6" LINE BACK TO THE GENERAL SUMP.
PIT CONTENTS:	PIT 6 HAS THE FOLLOWING RADIOACTIVE WASTES: DEPLETED SLAG, SCRAP GREEN SALT, PROCESS RESIDUES, AND FILTER CAKE.
COMMENTS:	FILLING OPERATIONS OF PIT 6 WERE DONE FROM EAST AND WEST CONCRETE PADS.
DATA SOURCE:	"FMPC WASTE INVENTORY DATA" MARCH 12, 1985

PRELIMINARY

000082

0 15 30 75 150
SCALE IN FEET

1992 PHOTOGRAMMETRY
PREPARED BY: WOOLPERT CONSULTANTS

WASTE PITS GEOMETRIC CONFIGURATION
PREPARED BY: PARSONS

NO.	REVISIONS	DATE	DWN. BY	APPD.	NO.	REVISIONS	DATE	DWN. BY	APPD.	REF. DWG. NO.
										21A-5500-G-00258
										75X-5900-G-00239
										75X-5900-G-00247
										21A-5500-G-00222

NOTE:
FERMCO C.A.D. DRAWING NOT TO BE REVISED MANUALLY

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE
FRACTIONS ± 1/8
ANGLES ± 0°-30'
DECIMALS
.X ± 0.1
.XX ± 0.03
.XXX ± 0.005
.XXXX ± 0.0005
ORIG. RELEASE DATE

APPROVALS					
			SAFETY ENG.		
			MAINTENANCE		
CIVIL & STR.			Q.A.		
ELECTRICAL			FIRE PROTECT.		
ENGINEER			WASTE MANAGE.		
INSTRUMENT			SECURITY		
MECHANICAL			CRU		
CHECKED					
APPROVED					

FERNALD ENVIRONMENTAL RESTORATION MANAGEMENT CORPORATION
FERMCO
Fernald
Environmental Management Project
U.S. DEPARTMENT OF ENERGY

CRU-1 WASTE PITS AREA
CERCLA/RCRA UNIT ONE AREA
WASTE PIT No.6
HISTORICAL CONFIGURATION
SCALE: 1"=30'-0"

RES 2080
DATE 10 MAR 93
DRAWN H.E. TILLMAN
21A-5500-G-00257 | 0

FILE NAME: /res2080/cru1ab010.dgn

Section 4

groundwater were considered to be waste-related regardless of their concentration. The full range of statistical tests applied to identify CPCs is presented in Section 6.

33-US Table 4-2 presents the ~~UTLs~~ ***95th percentile*** for background concentrations of radiological and inorganic constituents in surface soil, subsurface soil, perched groundwater, and Great Miami Aquifer groundwater. The values presented for surface and subsurface soil correspond to the statistics presented for the 0- to 6-inch sample set and the 48- to 54-inch sample set,
24-US respectively, in the CERCLA/RCRA Background Soil Study (US DOE 1993d). ***Sampling locations of the background soil samples are presented in Figure 2-11. These sample locations were chosen because of their physical similarity to the soils encountered within the FEMP site and their (unlikely) minimal contamination from the FEMP via the wind or***
180 ***other transport mechanisms.*** The values presented for groundwater and Great Miami River water were taken from the Characterization of Background Water Quality for Streams and Groundwater (US DOE 1993).} All data are as-reported in the background studies, with the exception of the following:

- The background studies did not obtain adequate frequencies of detection for Ac-227 and Pr-231 to generate summary statistics. Because the background studies sampled uncontaminated soil and groundwater in which isotopes are assumed to be in secular equilibrium, the activity of the analyzed parent, U-235/236, is substituted as the activity of the progeny, Ac-227 and Pa-231.

198 - The background soil study did not analyze for Po-210, Bi-210, and Bi-214. As indicated in the example previously discussed, the activity concentrations of Po-210 and Bi-210 are assumed to be in secular equilibrium with their parent, Pb-210. Thus, the reported activity concentration is identical to Pb-210, which was analyzed and had adequate detection in the background study. However, Bi-214 concentration cannot be estimated from the concentration of its analyzed parent, Ra-226, as there is a gaseous progeny product Radon-222 in the decay series between Ra-226 and Bi-214. The loss of gaseous radionuclides by diffussion precludes the estimation of the activity of any radionuclides that occur at later stages of the decay chain from parents of the gaseous progeny. Consequently, the assumption was made to report Bi-214 at the same activity concentration as the analyzed progeny, Pb-210.}

- Four unnaturally occurring radionuclides were examined during the background soil study; Cs-137, Ru-106, Sr-90, and Tc-99. These isotopes are fission products and their presence in the background soil study area could only be due to fallout from atmospheric releases of radiation such as weapons testing. They would only be expected to be present at detectable levels in surface soils. In accordance with expectations, Cs-137 was detected only in the surface soil set. Sr-90 was detected only once in the 81 soil samples collected. Ru-106 and Tc-99 were not detected in any background soil study samples. Summary statistics are presented for Cs-137 in surface soil. In all other cases, the surface soil background concentrations of the

fission products are below levels of detection used in the study (lower than RI/FS levels of detection) and are assumed to have concentrations of zero.

4.1.1 Radioactive Decay Process

093, ***All of the waste pits contained Th-230 concentrations that were above background levels.***
US Waste Pits 3 and 5 showed higher Th-230 activity concentrations, confirming that these pits received raffinate from the FEMP Refinery (Plant 2/3). The highest average value for
5-US Th-230, ~~10,500~~ ***11,000*** pCi/g, was reported for Waste Pit 2. The 1991 RI/FS sampling program revealed elevated Th-230 activity concentrations in a portion of Waste Pit 2.} Historical records show that raffinate was disposed in Waste Pit 2 during 1958 and 1959, prior to the
094 opening of Waste Pit 3. Operational records also show that the drum-equivalent volumes of approximately 2300 55-gallon drums of cold metal oxides from another AEC facility were placed into Waste Pit 2.} Waste Pit 2 also was used as a test pit for above-grade storage of raffinate filter cake in 1975, and these raffinate pathways could contribute to the cause of elevated Th-230 levels.

The waste pits also contain elevated concentrations of radionuclides in the thorium decay series (Th-232, Ra-228, and Th-228). Detected thorium-228 levels are greatest in Waste Pits 2 and 4 (Th-232 at 220 to 235 pCi/g), but are closely followed by Waste Pits 1 and 3 (Th-232 at 170 to 185 pCi/g). The estimated amount of thorium that was disposed of in the waste pits was obtained from Table 1-12. When compared to the total thorium quantities derived from the analytical results presented in table 4-1, the analytical values were much higher.

096, 097, Fission products (Tc-99, Sr-90, Cs-137) were found in the pit materials at concentrations that
095 were generally lower than those of the uranium or thorium series radionuclides. High concentrations of technetium were found in Waste Pit 5 and the Clearwell, which received overflow from Waste Pit 5. The average activity concentrations of Tc-99 found during the RI/FS studies for Waste Pit 5 and the Clearwell were 1490 pCi/g and 358 pCi/g, respectively. The presence of fission products in these pits was the result of the reprocessing of irradiated materials, which occurred in the latter years of the operation of the FEMP.} Site inventories of fission by-products could not be estimated, so comparison to the analytical results could not be made.

4.2.0.5 Chemical Characterization

Waste material and pit leachate in Waste Pits 1 through 4 and the Burn Pit were sampled for inorganic and organic chemical parameters under the CIS and the 1991 RI/FS waste pit sampling program. Waste material and surface water in Waste Pits 5 and 6 and the Clearwell

202 were sampled under the CIS and the 1992 RI/FS treatability study. The 1992 RI/FS sampling was performed for the purpose of treatability studies, as discussed in Section 2.3.2.2. The samples were drummed and held for an extended period of time prior to sampling and analysis. Although the sampling and preservation protocols were valid for providing analytical data regarding the drum contents, the length of time and storage conditions within the drums prevented the samples from representing the organic chemical composition of the "wet" pits at the time that the drums were filled. As a result of the validation process, the organic chemical data were rejected for use as a supplement to the organic chemical data obtained during the CIS.} Therefore, the data were not considered for the evaluation of nature and extent of contamination. The CIS inorganic parameter results are presented in Table 4-6 and Figure 4-6. The inorganic parameter results from the 1991 and 1992 RI/FS sampling events are combined and presented in Table 4-7 and Figure 4-7.

High detection limits were noted when the CIS organic chemical were compared results to the RI/FS results. High detection limits for CIS VOCs resulted because VOCs were extracted from the pit materials with methanol prior to purge-and-trap sampling and analysis. As a result of these higher detection limits, VOCs of lower concentration than the
098 elevated detection limits may have been undetected. Detection limits of the CIS data for semivolatile organic constituents of the wet pits (Pits 5 and 6 and the Clearwell) were elevated because the moisture content of the samples was very high. The 1992 RI/FS treatability study organics data were not used to determine the nature and extent of contamination; therefore, a comparison of CIS and RI/FS results for the wet pits could not be made. } Correction to dry weight concentrations led to elevated detection limits. When a constituent was never detected in a particular pit as a result of elevated detection limits, a value of "U" was entered into the summary table (Table 4-9). If even one detection was made, the statistical average calculated may have reflected a high bias to the result by averaging detected values that were much lower that the highest nondetect values with one-half the detection limit of each of the nondetect values.

099, ~~The concentrations of major inorganic constituents of the waste pits were consistent between~~
6-US ~~data sets. The concentrations of minor inorganic constituents of the waste pits vary because inconsistent disposal of these minor constituents of the waste streams led to variations in the distribution of these constituents in the pits. Variations in the physical distribution of minor constituents led to sample heterogeneity and corresponding variability in the results for these~~

6-US ~~constituents between data sets.~~ ***Although the concentrations of all analytes determined were not consistent between both data sets, there did exist consistency among many of the metals. Generally, the results for calcium, magnesium, sodium, potassium, aluminum, and iron compared well between the two studies. This is most likely due to the high concentrations found of these analytes resulted in less error. Whereas, the results for antimony, beryllium, cadmium, cobalt, and nickel compared between data sets more poorly, probably due to the fact that these analytes were reported out at concentrations close to the detection limit resulting in a greater associated error. The remaining metals varied in their consistency, generally determined by the concentration reported.*** Several consistent, general trends in the data are noted.} For both data sets, arsenic, barium, chromium, cobalt, copper, lead, magnesium, and vanadium are the prominent species. Waste Pits 1 and 6 and the Burn Pit contain the lowest levels of inorganics. Waste Pits 3, 4, 5, and the Clearwell contain the highest concentrations of inorganics. All of the pits contained high levels of magnesium, consistent with the disposal of large quantities of magnesium fluoride slag.

128 140 All material disposed of in the waste pits is considered to be unnatural because it was placed into the pits by man. However, some inorganic chemical parameters which resided in the pits occurred at concentrations which were below the background levels of environmental media from similar strata. If a particular constituent, such as calcium, was found to be resident in a waste pit at a concentration that was lower than the subsurface soil background level, it was considered benign. Extensive discussions of waste pit materials that occurred at concentrations below subsurface soil levels were not considered germane to discussion of the waste pit materials as sources of environmental contamination.}

Waste Pit 1 was characterized by reduced levels of cadmium, chromium, and magnesium from the other pits. Waste Pit 2 was characterized by significant levels of arsenic, cobalt, copper, lead, manganese and nickel. Waste Pit 3 had the highest levels of arsenic and manganese, but the CIS values were much lower than the RI/FS 1991 values. Waste Pit 4 was characterized by significant levels of manganese and barium. Waste Pit 5 was characterized by high levels of arsenic, barium, copper, manganese, nickel, selenium, thallium, and vanadium. Waste Pit 6 was relatively free of metals contamination. The Burn Pit was also of lower metals contamination than the other pits but had significant levels of barium, copper, lead and silver. The Clearwell contained significant amounts of barium,

copper, manganese, and vanadium. This mirrored the concentrations in Waste Pit 5, consistent with the Clearwell's use as a collection pit for supernatant liquid from Waste Pit 5.

100 The CIS organic results are presented in Table 4-9 and Figure 4-8. The RI/FS organic parameter results are combined and presented in Table 4-10} and Figure 4-9. PAHs (from coal tars, flyash, ash or kerosene) were concentrated in Waste Pit 2. PCBs were generally distributed throughout the pits but were present in only small amounts in Waste Pit 6 and the Clearwell. Tributyl phosphate exhibited significant concentrations in Waste Pits 1, 2, and 4. CDDs and CDFs are problematic even at low concentration and have been reported in Waste

disposed in the pit. It is apparent from the boring logs that localized stratification has occurred within Waste Pit 1. The observance of varying strata suggests a scattered distribution of process and production wastes. Wide distributions in the data obtained from the analysis of the pit material from Waste Pit 1 would, therefore, be expected.

4.2.1.3 Geophysical Characterization of Waste Pit 1

The anomaly map resulting from the integration of Waste Pit 1 geophysical data is represented in Figure 4-10. Magnetic anomalies were indicated across 60 percent of the pit, denoted as
10-US areas A, B, C, and D. Sharp magnetic highs and lows in the southeastern quarter (***area*** A) indicate a substantial volume of buried ferrous metal or other magnetically susceptible debris at relatively shallow depths. Magnetic anomalies in the northern and western edge (B, C, and D) indicate smaller volumes of buried ferrous debris at greater depths. EM data were extremely elevated in the southern quadrant (~~A~~ ***area E***) of the pit ***(within area A)*** indicating the presence of electrically conductive materials such as metal, graphite, or ash. The northern section (~~B and C~~ ***area F***) yielded less elevated EM results indicating lesser amounts, but still considerable, conductive material. GPR data indicates that Waste Pit 1 contains the largest concentration of buried objects within the Waste Storage Area. Both southern and northern sections (***areas G, H, I and J***) contain a high density of buried objects.

Concurrent signatures by magnetic, EM, and GPR in the southern section (A, ***G and E***) indicate a large volume of buried objects, consisting predominantly of ferrous metal debris. Anomal~~y~~***ies*** B, ***F, and H give*** ~~gives~~ a strong indication of EM and GPR, but the magnetic anomaly is weak. ~~Anomaly B~~ ***These anomolies*** probably consists of a large quantity of conductive materials that are less ferromagnetic than those materials in anomaly A (such as graphite or nonferrous metal). Anomalies ~~C and D~~ ***C, D, G and H*** display weak to moderate signatures for all three techniques indicating fewer buried objects in these areas, with the presence of some buried ferrous material having been indicated.

4.2.1.4 Radiological Characterization of Waste Pit 1

Waste Material

Radionuclide analytical results from the CIS and RI/FS sampling efforts are summarized in Tables 4-4 and 4-5, respectively. The data are presented graphically in Figures 4-11 and

4-12. Complete analytical results are provided in Appendix A. The summary information for pit contents is provided in Table 4-1.1.A.

Predominant radiological constituents include U-238, U-234, Th-230, and Ra-226, all of which come from the uranium decay series. Other radionuclides with elevated activity concentrations include Th-232, Ra-228, and Th-228, from the thorium decay series, and

107, U-235. U-238, U-234, ~~and~~ Th-230, ***and Ra-226*** are the predominant radiological constituents

9-US found in Waste Pit 1. Th-228, Th-232, U-235/236, ***and*** Ra-228 ~~and Ra-226~~ were found at concentrations ~~elevated~~ above background. Additionally, Sr-90 was reported at low levels in five of the six RI/FS samples, Cs-137 was reported at the detection limit in one CIS sample and Tc-99 was reported in one CIS sample at an elevated concentration (15 pCi/g) and in one RI/FS sample at slightly above the detection limit (1.1 pCi/g).} Results of both the CIS and RI/FS reveal that the enrichment level of uranium in Waste Pit 1 is, on average, consistent with depleted uranium.

All Waste Pit 1 waste material samples were within RCRA established limits for corrosivity, reactivity, ignitability, and EP toxicity. All inorganic analytes were detected at above background levels in at least one sample. In general, the RI/FS inorganic results were

108 different than those measured under the CIS. The differences between the two sampling programs were attributable to both different sample locations and the differing depths to which the programs' borings were drilled. A complete explanation of the sampling protocols can be found in Section 2.3.}

The Waste Pit 1 materials contained polychlorinated dioxins and dibenzofurans, PAHs, 207 phthalates, phenols, chlorinated solvents, benzene, toluene, ethyl benzene, and total xylenes} (BTEX) compounds. These findings are consistent with known or suspected plant activities, and the visual classification of the pit materials. Combustion by-products were disposed of in the pits, as evidenced by the appearance of ash in some of the borings. CDD/CDFs, PAHs, and phenols all are linked by their common occurrence in ash from municipal/industrial incinerators. The use of PCBs at the FEMP is well known and the presence of PCBs in Waste Pit 1 is consistent with plant activities. PCBs could have entered the waste stream by leakage from equipment, direct disposal, or disposal of PCB-contaminated combustion by-products. The presence of polychlorinated dioxins and dibenzofurans is possibly the result of the disposal of PCBs, the by-products of combustion of PCBs or ash. Miscellaneous solvents and volatile organic constituents of the pit may have origins in plant maintenance activities, including the use of hydrocarbon mixtures as fuels and solvents, paints, degreasers, glues, and other light industrial activities. Some chlorinated VOCs were detected in Waste Pit 1 pit

the top soil covering read 200 cpm for this core and 100 to 200 cpm for other cores from this area.} In CIS boring 02-02, lime green material, which may be associated with green salt, was field measured at 30,000 cpm. The appearance of localized green strata may be an indication that green salt (uranium tetrafluoride) was disposed of in Waste Pit 2 on a batch basis. The pit materials exhibiting the highest levels of uranium contained green or greenish strata.

The deposition of flyash from on-property coal-fired boilers has only been documented for Waste Pit 3. It is most likely that any ash that was disposed of in Waste Pit 2 originated from incinerators that were used to reduce waste volume prior to uranium recovery.

It is apparent from the boring logs that localized stratification has occurred within Waste Pit 2. The observance of varying strata suggests a scattered distribution of process and production wastes. Wide distributions in the data obtained from the analysis of the pit material from Waste Pit 2 would, therefore, be expected.

4.2.2.3 Geophysical Characterization of Waste Pit 2

An anomaly map resulting from the integration of Waste Pit 2 geophysical data is presented in Figure 4-18. Magnetic anomalies were noted across 35 percent of the pit, denoted as areas A, B, and C, indicating the possible presence of buried ferrous metal in these areas.
208 Anomaly C extends beyond the boundary of Waste Pit 2, possibly because there was buried ferromagnetic debris near the pit cover but just outside the as-built pit boundaries.} EM data were elevated over more than 70 percent of the pit. The high apparent conductivity values can result from the presence of highly conductive material disposed in the pit or high
117 concentrations of dissolved solids in the pit leachate. Since the inorganic constituents within the Waste Pit 2 leachate are lower in concentration than in other pits, the primary responsible source for elevated EM readings is probably due to the presence of highly conductive material.} Metal debris, graphite, and flyash all represent highly conductive material disposed in Waste Pit 2.

GPR data indicate that Pit 2 has the lowest density of buried objects of Waste Pits 1 through 4 and the Burn Pit. A small area, within Area A as designated on the map, directly west of the pit center was interpreted as containing low to moderate densities of buried objects. The

remaining area within Waste Pit 2 produced little evidence of buried objects on the GPR profiles.

The concurrent occurrence of magnetic, EM, and GPR anomalies within Area A, just west of
10-US the pit center, ***(consisting of portions of areas A, E, and F)*** indicates a high probability for the presence of buried metal such as metal debris or drums. The absence of GPR anomalies coincident with the magnetic data throughout the remainder of the pit could be caused by deeper burial of ferrous or other magnetically susceptible material. Elevated EM levels throughout most of Waste Pit 2 are likely due to the presence of highly conductive materials, such as graphite or ash, that were disposed of in the pit. High concentrations of dissolved solids within the pit leachate may also contribute to elevated EM levels.

4.2.2.4 Radiological Characterization of Waste Pit 2

Nine borings were completed in Waste Pit 2 as part of the CIS and RI/FS programs; five during the CIS and four during the RI/FS.

Waste Material

Radionuclide analytical results from the CIS and RI/FS sampling efforts are summarized in Tables 4-4 and 4-5, respectively. The data are presented graphically in Figures 4-11 and 4-12. Complete analytical results are provided in Appendix A. The radiological profile of Waste Pit 2 is presented in Table 4-1.2.A.

Predominant radiological constituents in terms of activity concentrations include U-238, U-234, Th-230, and Ra-226, all of which come from the uranium decay series. Other radionuclides with elevated activity concentrations include Th-232, Ra-228, and Th-228, from the thorium decay series, and U-235. This is consistent with process knowledge that material deposited in Waste Pit 2 contained primarily U-238 and its decay products. The RI/FS average activity concentrations reported for Ra-226 and Ra-228 in Waste Pit 2 were the highest reported for any waste area reported (437 and 177 pCi/g, respectively).

089, 110 Analytical results from the CIS yielded U-238/U-234 and U-238/U-235 activity concentration ratios in the ranges of depleted uranium or natural uranium. RI/FS analytical data yielded U-238/U-234 and U-238/U-235 activity concentration ratios in common with natural uranium, indicating that uranium contamination in Waste Pit 2 varies from depleted to natural.

Differences in CIS and RI/FS analytical results may be attributed to the heterogeneous nature of the waste pit contents combined with differences in sample locations. As noted in Section 2.3, while the CIS boreholes were placed randomly after geophysical anomalies had been avoided, the 1991 RI/FS Waste Pit Study boreholes were intended to be placed near the deepest portion of each pit. The activity concentration ratio analysis is presented in Table F.2.38.2.}

The average activity concentrations reported for U-234 (3,867 pCi/g) and U-235 (1,793 pCi/g) were the highest averages reported for CIS pit data.

A wide variation exists with respect to the Thorium-230 concentrations within Waste Pit 2. The RI/FS boring 1768 in the 7- to 14-foot segment reported the highest activity concentration within the Operable Unit 1 Waste Storage Area (18,400 pCi/g). This is a six-fold elevation of concentration compared to the 14- to 17.5-foot segment of the same boring (2630 pCi/g). The activity concentration from the lower segment compares well with the concentrations of CIS borings 2 (3,980 pCi/g) and 3 (2,040 pCi/g), which are located within the same general vicinity of the waste pit. The average RI/FS concentration for total thorium is 2,600 μg/g, which is the highest Th-total concentration within the Waste Storage Area. These three boreholes located in the east central section of Waste Pit 2 surpass the Th-230 concentrations
111 of the remaining boreholes for the waste pit by more than an order of magnitude. Process knowledge indicates that sometime in the late 1950s or early 1960s, the contents of several thousand drums of mixed oxide raffinate ("cold raffinate") were buried in Waste Pit 2. The drums were not buried in the pit.} The raffinate which is very high in Th-230, was thought to have originated from mixed oxide raffinate. This cold raffinate is most probably the source of the elevated radium reported for Waste Pit 2 from the RI/FS program.

Waste Pit 2 also contains elevated concentrations of radionuclides in the thorium decay series
112 (Th-232, Ra-228, and Th-228). As shown in Table 4-5, Th-232 and Ra-228 are in secular equilibrium.} Th-228, however, is present in concentrations approximately three times that of Ra-228. This is not possible, since the Th-228 had passed through at least 10 half-lives since being placed in the pit and, consequently, would have achieved secular equilibrium with
49-US Ra-228 and Th-232. ~~The value listed for Th-228 in Table 4-5, therefore, is considered to be an anomalous analytical result.~~ ***Although the statistical average of both the CIS and RI/FS data indicate that the Th-228 is not in secular equilibrium with Th-232, the individual***

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results indicate the activity concentrations are within secular equilibrium and the other three sample results portray high results for the Th-228 isotope.

4.2.3.2 Sample Physical Description of Waste Pit 3

A conceptual cross section of Waste Pit 3, based on the RI/FS boring logs, is presented in Figure 4-19. The cross section extends from points C to C', that are shown in Figure 4-8. The material encountered was predominantly brown in color, although the material exhibited many large regions of variation. Consistent with the historical use of the pit, the pit materials in Waste Pit 3 were characterized in the boring logs by thick strata of varying colors, including yellowish brown, pale brown, white, olive brown, lime green. Layers of coarse black material were identified as flyash by the field investigators, and probably were
209 composed of the coal flyash that was used to stabilize} the pit. The presence of thick layers of black sand-sized material (with occasional black gravel) was possibly related to the deposition of flyash or slag leach residue in Waste Pit 3. Magnesium fluoride slag was milled prior to extraction and a sandy consistency was described. Dark grey or black colors were described for magnesium fluoride slag and were coincident with its disposal. Layers of yellow-green or lime-green material, consistent with the occasional batch disposal of green salt (uranium tetrafluoride), were observed in CIS boring 03-07. Very thick regions of reddish brown clay-like material may be related to the disposal of neutralized raffinate. In addition, the appearance of thick layers of wood in boring 1772 gave evidence that wooden pallets were disposed of in Waste Pit 3, as discussed in Sections 1.2.2.3 and 4.2.3.1. Acidic fluids from the general sump were neutralized by the addition of excess lime to form slurries which, when pumped to Waste Pit 3, may have formed the white or pale yellow strata in the pit. It is apparent from the boring logs that the strata described in the Waste Pit 3 boring logs are much thicker than the strata described for other pits. The occurrence of these thick strata were an indication of the bulk disposal of miscellaneous wastes such as coal flyash, broken concrete and wood, that were described in Section 1.2.2.3. The heterogeneity of the appearance of the pit materials is consistent with the pit history and partially accounts for wide distributions in the analytical results.

4.2.3.3 Geophysical Characterization of Waste Pit 3

The anomaly map resulting from the integration of Waste Pit 3 geophysical data is presented
119, 125, in Figure 4-20.} Magnetic anomalies were indicated across more than 40 percent of the pit
210, eleven areas), denoted as A, B~~1, B2~~, C, D, E, F, G, H, I, ***J*** and ~~***J***~~ ***K***, consisting of relatively
10-US broad and weak magnetic highs. The weak magnetic highs might indicate ferrous or other magnetically susceptible material buried at a considerable depth. EM conductivity anomalies,

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Predominant radiological constituents in terms of activity concentrations include U-238, U-234, and Th-230, all of which come from the uranium decay series. The mean Th-230 activity reported from the CIS program was the highest Th-230 average activities (4,636 pCi/g) reported for the CIS program. This is high relative to the U-238 average activity concentration (442 pCi/g), which is the second lowest average activity concentration reported for the Waste Storage Area. This is consistent with process knowledge in that the material deposited into Waste Pit 3 included refinery raffinates that contained elevated levels of Th-230
11-US and reduced levels of uranium. ***Although 40 percent of the actual sample data points indicate depleted uranium present; when all samples are integrated into the analysis, the resulting ratios indicate the presence of natural uranium. Natural uranium means that the ratio of the activity concentration of U-234 to U-238 is one and the ratio of U-235 to U-238 is twenty.***

All six samples generated from the three RI/FS boreholes reported average activity concentrations of Ra-226 (172 pCi/g) and Ra-228 (123 pCi/g) that were second highest
089 overall next to Waste Pit 2 activity concentration average. The results of the CIS and RI/FS investigations reveal that the U-238/U-234 activity concentration ratios varied from 0.9 to 8.3. The U-238/U-235 ratios varied from 9.9 to 98.6. Evaluations of the ratios for each sample indicate that uranium disposed of in Waste Pit 3 varies from depleted to natural uranium. The activity concentration ratio analysis has been presented in Table F.2.38.3 }

Waste Pit 3 also contains concentrations of radionuclides in the thorium decay series (Th-232, Ra-228, and Th-228) that are, within the limits of uncertainty, in secular equilibrium.

Leachate

121 Three leachate samples were collected under the RI/FS program and analyzed for selected radionuclides. The samples contained high amounts of dissolved solids, especially magnesium and calcium ions. This resulted in precipitation of the corresponding sulfates when the radiological samples were prepared, which caused recovery problems for several radionuclides. Pu-238, Pu-239/240, Ra-226, Ra-228, Sr-90, Th-228, Th-230, Th-232, and total thorium were requested for analysis for all three Waste Pit 3 leachate samples. However, the matrix interference caused by the dissolved solids was so severe that Pu-238, Pu-239/240, and Sr-90 for only one sample, and no radium or thorium determination was

possible due to matrix effects. The Sr-90 value (106 pCi/L) obtained for the one successful leachate sample from Waste Pit 3 was the highest obtained for any leachate from the pits. Technetium was reported for each of three leachate samples and the average activity concentration (227 pCi/L) was the highest for all pit leachate samples determined. The occurrence of high values for Sr-90 and Tc-99 in the Waste Pit 3 leachate indicates that this

pit received a major portion of the raffinate from the refining of irradiated uranium-bearing materials received from the Hanford site. The U-238/U-234 activity ratio is approximately 1 and the U-238/U-235 activity ratio is approximately 20, indicating that the uranium found in the leachate from Waste Pit 3 was, on average, natural uranium. This is consistent with the activities presented for the waste material. The data are presented in Table 4-6.} Technetium was reported for each of three leachate samples and the average activity concentration was the highest for all pit leachate samples determined. The U-238/U-234 activity ratio is approximately 1 and the U-238/U-235 activity ratio is approximately 20, indicating that the uranium found in the leachate from Waste Pit 3 is, on average, natural uranium. This is consistent with the activities presented for the waste material. The data are presented in Table 4-6.

4.2.3.5 Chemical Characterization of Waste Pit 3

Waste Material

Composite samples were analyzed from seven borings installed in Waste Pit 3 as part of the CIS program and from six samples (three borings) installed in the pit under the RI/FS program. The samples were analyzed for the Inorganic HSL. The CIS boring samples were within RCRA established limits for corrosivity (pH), reactivity, ignitability, and EP toxicity.
122 Results of the CIS data are summarized in Table 4-7 and Figure 4-13. The the average CIS results for arsenic, lead, manganese, and selenium are the highest average concentration values reported for the CIS. The high levels of arsenic (1021 mg/kg), lead (194 mg/kg) and vanadium (2650 mg/kg) are from the neutralized raffinate consisting of both the water soluble nitrates and the insoluble metal species. An additional source of the arsenic in Waste Pit 3 could be the ash from the coal-fired furnace that was deposited into the waste pit during the time period during which the pit was being filled. Nickel (137 mg/kg), copper (912 mg/kg), barium (4146 mg/kg), and thallium (3.2 mg/kg) were reported during the CIS investigation at the second highest reported concentration of each listed parameter for all CIS waste pit
12-US determinations. Antimony, chromium, ***cobalt,*** mercury, silver, and zinc were reported at concentrations exceeding those of the background soil.}

Results of the RI/FS data set are summarized in Table 4-8 and Figure 4-14. Results of the RI/FS program indicate that concentration averages for arsenic (9042 mg/kg), cadmium (13.3 mg/kg), tin (69 mg/kg), and manganese (9434 mg/kg) were reported at the highest average

There is no direct record of the disposal of organic materials in Waste Pit 4, but several possible routes of entry of organic materials have been identified. Miscellaneous wastes were placed into the pit to fill it prior to capping. Construction rubble was disposed in Waste Pit 4 and may have contained roofing products such as coal tar. Miscellaneous organic constituents, including PAHs, CDD/CDFs, PCBs, phenols, or other organic material may have been present in ash which was not radionuclide-contaminated and was disposed in Waste Pit 4.

No direct dumping of waste oils into Waste Pit 4 has been documented. PCBs may have been introduced into Waste Pit 4 by leakage from the heavy equipment which was used to handle the waste in the vicinity of the pit. Ash from solid waste incinerators or the oil burner may have contained PCB residues.

4.2.4.2 Sample Physical Description of Waste Pit 4

The conceptual cross sectional drawing for Waste Pit 4 is presented in Figure 4-21. The material encountered was predominantly gray in color, although the material in some borings contained little gray material. The presence of gray clayey or silty material may indicate the disposal of magnesium fluoride slag. There was no consistent color of material at any depth exhibited by the samples from the borings of Waste Pit 4, although localized stratification was evident. Visual descriptions of the borings cited strata of varying colors and grain sizes, including brown and red tinted gray, pale brown, dark brown and other colors. Frequently, the field investigators encountered trash in the samples, including paper, sheets of clear plastic, stringy material like mop yarn and other varied debris. A large amount of the pit material was reported as fluid in consistency, sometimes flowing like jello or old motor oil. Some borings contained material which was so liquid that sample recovery was not possible. Thin layers of yellow-green material may indicate occasional dumping of green salt. The boring logs verify that a variety of materials have been disposed in Waste Pit 4, leading to thick, localized stratification of the pit material. Wide variation in the sample results from different borings would be expected as a result of the heterogeneous nature of the pit materials.

4.2.4.3 Geophysical Characterization of Waste Pit 4

The anomaly map resulting from the integration of Waste Pit 4 geophysical data is presented

213 Figure 4-22.} Magnetic anomalies were noted across more than 50 percent of the pit, denoted as areas A and B along the southern boundary of the pit and ***area*** C in the northwest section which strongly indicate the presence of buried ferrous material. Additionally, during the magnetic survey, it was noted that an extensive amount of metal strapping, wire, cans, rebar, and other scrap were present over much of the pit's surface. EM anomalies ***(area D)*** are located throughout the southern half of the pit area. One anomaly is located within section B, as indicated in the figure. This anomaly indicates the presence of buried conductive debris such as metal, graphite, or flyash of either greater quantities or buried at a shallower depth than the anomaly in the southwest corner (~~Section~~ ***area*** A). The gradual increase of EM conductivity in the southwest corner might be indicative of the presence of dissolved solids in water near the surface of the pit.

GPR data were limited to the northern half of the pit due to accessibility problems preventing data acquisition. Anomalous areas consistent with the northern section of the magnetic anomaly A and anomaly C were detected. These anomalies indicated several areas of moderate to high buried object densities at shallow depths relative to the pit depth.

Anomaly A was characterized by concurrent high magnetic intensities, EM, and moderate to high GPR signatures indicating buried ferrous material at least in the northern section. The EM signature indicates the existence of nonferrous and possibly nonmetallic wastes are also present. Anomaly B is characterized by magnetic and EM highs. High volumes of ferrous metal debris is supported by the magnetic data and nonferrous/nonmetallic material supported by the EM. High conductivity readings to the north of this anomaly may be indicative of either flyash or high dissolved solids in water at shallow depths. A large volume of buried ferrous metal debris is supported by the concurrence of magnetic and GPR data in anomaly C. Anomalies D and E have been characterized by GPR data only, indicating buried nonmetallic waste as the source of the anomaly.

4.2.4.4 Radiological Characterization of Waste Pit 4

Four boreholes were sampled as part of the CIS program (Figure 4-4) and three boreholes were sampled as part of the RI/FS program (Figure 4-5). The three RI/FS samples were subsampled which resulted in six composite samples, two from each of the original RI/FS boreholes which were composited according to depth.

Sampling for chemical characterization was accomplished under both the CIS and RI/FS programs. The CIS samples were found to be within RCRA limits for corrosivity, reactivity, ignitability, and EP toxicity. ***Arsenic,*** barium, ***beryllium,*** cadmium, copper, ***lead,*** and silver were the inorganic metal constituents which exceeded the background soil concentrations during both sampling programs.}

140, 13-US

Organic analyses were also performed under both sampling programs. Compounds to be noted which were found in one or both of these studies include PCBs, pentachlorophenol, polynuclear aromatic compounds, and low levels of polychlorinated dibenzo-p-dioxins and dibenzofurans.

Some common organic compounds found in the Burn Pit include acetone, 2-butanone, methylene chloride, di-n-butyl phthalate, di-n-octyl phthalate, and bis-(2-ethylhexyl) phthalate. The presence of the common solvents is consistent with their use at the site. The presence of phthalates is consistent with their wide variety of applications as plasticizers and their link to combustion by-products.

Volatile chlorinated organics included small amounts of 1,1-dichloroethane, 1,1-dichlorethene, 1,2-dichloroethane, 1,1,1-trichloroethane, chloroform, trichloroethene, chlorobenzene, and vinyl chloride. Most of these were used as solvents or degreasers at the site, and others may be present as progeny from a parent contaminant. Volatile aromatic compounds in the pit included ethyl benzene, xylenes, and toluene. These are indicators of gasoline or solvent contamination.

Leachate samples were collected from the Burn Pit. The inorganic analyses showed calcium, magnesium and sodium in excess concentrations. Organic constituents included acrolein and acrylonitrile which were not found in the pit materials, and indicates their aqueous solubility. Benzene, toluene, ethylbenzene, and xylenes were also detected in the leachate. They are common constituents in combustibles such as gasoline. Also found in the leachate were PAHs which are common constituents of oils. In summary, the organic compounds found in the leachate are consistent with compounds commonly disposed of in the Burn Pit.

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One removal action, the Waste Pit Area Storm Water Runoff Control Removal Action, has been completed to address Operable Unit 1 impacts on surface water and sediment in Paddys Run. An Engineering Evaluation/Cost Analysis (EE/CA) was performed to support this removal action (ASI/IT 1990). The EE/CA provides summary and analysis of surface water impacts resulting from surface contaminants in the Operable Unit 1 area. The removal action redirects surface runoff from the waste pit area away from Paddys Run to a catchment basin.
170 This allows treatment prior to release via the FEMP main effluent line. Because the sump is anticipated to remain in operation until at least after the Operable Unit 1 ROD has been issued, the structure was not sampled as part of the RI. Concrete sampling will occur prior to dismantling of the structure.}

The implementation of the removal action in June 1992 reduced contaminant loading from
169, 171, Operable Unit 1 runoff to Paddys Run. ~~By diverting contaminated surface waters to the~~
172, ~~BSL and the effluent treatment system as described in Section 1.5.4.2, the contaminant~~
17-US ~~loading to Paddys Run has been reduced. Semi-quantitative information has shown that low levels of uranium are currently diverted to the effluent treatment system where the stormwater runoff from Operable Unit 1 is treated prior to release to the Great Miami River.~~ Other potential impacts to Paddys Run may exist under current site conditions, but to the extent that the majority of the surface water impacts discussed in the EE/CA (ASI/IT 1990) have been eliminated by the engineering design of the stormwater collection and treatment system, contaminant loading to Paddys Run has been reduced.} ***Although there does not exist any analytical data prior or subsequent to the completion of the Stormwater Run-off Removal Action, the loading of contaminant run-off into Paddys Run has been considered to have been reduced. If the stormwater run-off from the waste pit area has been diverted to the Clearwell (with eventual removal to the biodenitification surge lagoon), it should be apparent that the contaminant loading to Paddys Run has been diverted.*** For these reasons, historical data on Paddys Run do not represent current conditions. Nonetheless, impacts have been demonstrated and documented in the EE/CA and must be addressed by the remedial action, through incorporation of the ongoing removal action activities or through other engineering controls.

4.5.1 Surface Water

Characterization for surface water in Waste Pits 4, 5, 6 and the Clearwell has been discussed in Section 4.2, along with the Waste Material in the pits. Hence this section addresses surface water runoff from the waste units of Operable Unit 1.

The sampling locations under the different studies are shown in Figures 2-4, 2-5, and 2-6. Samples were collected from Paddys Run and various drainage ditches across the waste pit area. The summary discussion on significant findings from the major sampling programs

focuses on uranium since it represents the predominant and consistently sampled contaminant on the site.

4.5.1.1 Operable Unit 1 Runoff

DOE has conducted three storm water runoff sampling studies in the waste storage area. These are the 1) Best Management Practices Plan, 2) the 1984 Groundwater Study, and 3) the FEMP RI/FS.

Best Management Practices Plan

As stated in Section 2.5, surface water samples were collected as part of the BMP plan in order to evaluate the condition of liquid discharges from the FEMP. Samples were analyzed for selected radiological and chemical constituents as listed in Table 4-33. Only two samples were within Operable Unit 1 boundaries. Results for the two surface water samples collected are summarized in Table 4-33. As shown in the table, the sample collected from location
173, 174, DD07 ~~(Figures 2-5 and 4-36)~~ ***2-6***} contains the highest uranium-238 concentration of 740
18-US pCi/L. This sampling site is located on the west side of Waste Pit 3 close to Paddys Run. The source of this uranium is likely to be surface runoff from Waste Pit 3 and 5. Also Total Dissolved Solids (TDS) in this sample appear to be relatively high.

1984 Groundwater Study

The objective of the 1984 Groundwater Study, was to identify the source of groundwater
175 contamination in three off-site wells. To meet this objective, several samples of surface water runoff were collected from the Waste Storage Area.} Collected samples of surface water runoff from drainage ditches in the waste pit area that fall within Operable Unit 1 boundaries were analyzed for total uranium. The results show total uranium concentrations ranging from 0.007 to 34 mg/L (Table 4-34).** The highest concentration was from location RO8, south of Waste Pit 2 and east of Waste Pit 1. Two other locations, RO4 and RO5, located between Waste Pits 4 and 5 showed elevated concentrations of 24 and 28 mg/L, respectively. At the time of sampling both Waste Pits 4 and 5 were open. It is possible that surface runoff from disposal operations conducted at these pits is the source of contamination at these locations.

In addition to the water samples from the drainage ditches, two seep samples from within
177 Operable Unit 1 were collected and analyzed for total uranium. The reported results of the two samples were similar. RO9, located between Waste Pits 3 and 5, reported 3 mg/L and

would affect flow from the area, the settling of contaminated suspend solids and the existence of a contaminant source upgradient of the sampling location.

The highest concentration of contaminants in surface water were detected at drainageways
22-US which received surface runoff from Waste Pits 3, 4, 5 and 6 (Figure 4-36). The predominant contaminant is uranium. The two drainageways running east-west between Waste Pits 3, 4, and 5 are contaminated along their total lengths. Uranium contamination in the surface water is as high as 8,148 pCi/L. Another drainageway running southeast and turning southwest between Waste Pits 4 and 6 contained water with elevated uranium concentrations. The drainageways in the north part of Operable Unit 1 are contaminated the least.

Most of the sampling activities took place before the surface runoff was controlled. At that time surface runoff from the waste pit area discharged into Paddys Run. With the implementation of the Waste Pit Area Runoff Control Removal Action, potentially contaminated surface water runoff now flows into a catchment basin for treatment before being discharged into the Great Miami River.

Sediment were sampled along drainageways which were considered downstream of potential releases within Operable Unit 1. The highest contaminants were detected at locations downgradient from Waste Pit 4. The predominant contaminant was depleted uranium.
191 Uranium-238 activity was detected at concentrations as high as 761 pCi/g. As shown in Figure 4-37}, the drainageway located south of Waste Pit 4 and 6 revealed elevated levels of uranium along its entire length. Another drainageway between Waste Pits 4 and 5 showed elevated uranium concentrations.

4.6 AIR AND DIRECT RADIATION

4.6.1 Airborne Radon

Airborne radon measurements are routinely collected both on and off the FEMP property as part of the ongoing FEMP Environmental Monitoring Program. In addition to the Monitoring Program, a radon flux survey was conducted on the Waste Pits 1, 2, 3, and 4 to determine the average radon emissions from the waste pits and to verify that the average radon emission from each waste pit was below the NESHAP limit of 20 pCi/m^2/s. A summary of the results from the Chem-Nuclear Geotech (1992) radon-flux survey, and the Environmental Monitoring

Section 4

Tables and Figures

TABLE 4-2
BACKGROUND CONCENTRATIONS FOR SOILS AND GROUNDWATER

Analyte	Background Concentrations[a]				
	Soils		Groundwater		Riverwater
	Surface (0-6 inches)	Subsurface (48-54 inches)	Perched [b]	Shandon Tributary[c]	Great Miami River
Radionuclides	(pCi/g)	(pCi/g)	(pCi/L)	(pCi/L)	(pCi/g)
Actinium-227	0.15[d]	0.13[d]	0.0[e]	0.0[e]	NA
Bismuth-210	1.33[f]	0.7[f]	0.0[e]	0.0[e]	NA
Bismuth-214	1.33[f]	0.7[f]	0.0[e]	0.0[e]	NA
Cesium-137[g]	0.71	0.0[e]	0.0[e]	0.0[e]	NA
Lead-210	1.33	0.70	0.0[e]	0.0[e]	NA
Neptunium-237	0.0[e]	0.0[e]	<1[h]	<1[h]	1[h]
Plutonium-238	0.0[e]	0.0[e]	<1[h]	<1[h]	1[h]
Plutonium-239	0.0[e]	0.0[e]	<1[h]	<1[h]	1[h]
Plutonium-240	0.0[e]	0.0[e]	<1[h]	<1[h]	1[h]
Polonium-210	1.33[f]	0.7[f]	0.0[e]	0.0[e]	NA
Protactinium-231	0.15[f]	0.13[f]	0.0[e]	0.0[e]	NA
Radium-224	0.90	0.96	0.0[e]	0.0[e]	NA
Radium-226	1.45	1.27	1[i]	1.77	1[h]
Radium-228	1.19	1.25	4.57	4.8	3[h]
Ruthenium-106[g]	<0.07	<0.06	0.0[e]	0.0[e]	NA
Strontium-90[g]	<0.5	<0.5	0.0[e]	0.0[e]	5
Technetium-99[g]	<0.9	<0.9	0.0[e]	0.0[e]	30
Thorium-228	1.43	1.25	1.6[i]	1.6[i]	1[h]
Thorium-230	1.97	1.85	2[i]	2.5[i]	1[h]
Thorium-232	1.36	1.24	<1[h]	<1[h]	1[h]
Total Thorium	12.4 mg/kg[j]	13.3 mg/kg[j]	3µg/L[i]	2.47µg/L[i]	NA
Uranium-234	1.24	0.94	1.88	2.43	1.1
Uranium-235/236	0.15	0.13	<1[j]	<1[j]	1[h]
Uranium-238	1.22	0.92	1.5[i]	4.4[i]	1[h]
Total Uranium	3.17 mg/kg[j]	3.68 mg/kg[j]	1.23 µg/L[j]	2.92 µg/L[j]	1 µg/L

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TABLE 4-2
BACKGROUND CONCENTRATIONS FOR SOILS AND GROUNDWATER

Analyte	Background Concentrations[a]				
	Soils		Groundwater		Riverwater
	Surface (0-6 inches)	Subsurface (48-54 inches)	Perched [b]	Shandon Tributary[c]	Great Miami River
Metals(mg/kg)	(mg/kg)	(mg/kg)	(mg/L)	(mg/L)	(mg/L)
Aluminum	11,880	14,700	0.123	0.188	NA
Antimony	7.7[h]	6.7[h]	0.0[e]	0.038[i m]	NA
Arsenic	8.45	8.79	0.058[m]	0.088[m]	0.002
Barium	91.3	99.2	0.477	.077	0.1
Beryllium	0.60[i]	0.62	0.002[m]	0.002[m]	NA
Boron	21.8[k]	42.7	0.0[e]	0.0[e]	NA
Cadmium	0.82	0.59[i]	0.006[m]	0.006[m]	0.0098[m]
Calcium	4340	145,000	124,000	142,000	77
Chromium	15.5	19	0.034	0.067[m]	0.02
Cobalt	15.2	15.7	<0.01[h]	<0.01[h]	NA
Copper	14.1	16.3	0.029	0.022	0.01
Cyanide	0.25	0.11[h]	0.0[e]	0.0[e]	NA
Iron	22,300	28,000	9.22	4.67[m]	0.22
Lead	25.6	13.4	0.021[m]	0.028[m]	0.01
Magnesium	3350	43,100	48.5	40.7	34.9
Manganese	1770	922	0.15[m]	0.514[m]	0.02
Mercury	0.3[i]	0.29[i]	0.004[m]	0.0004	0.0095[m]
Molybdenum	2.6[h]	2.7[i]	0.028[i]	0.02	0.02
Nickel	20.9	28.5	0.026	0.026	0.0105
Potassium	1230	2100	27	4.31	6.2
Selenium	0.7[i]	0.6[h]	<0.003[h]	0.006[i]	0.002
Silicon	1760	1700	0.0[e]	0.0[e]	NA
Silver	2.6[h]	2.2[h]	0.038	0.014	0.1
Sodium	51.1	198	57.6	52.9	77.2
Thallium	0.58[i]	0.43[h]	0.0[e]	<0.012[h m]	NA
Vanadium	30.4	36.9	0.002	0.026	NA
Zinc	62.2	59	0.032[i]	0.48	NA

TABLE 4-2
BACKGROUND CONCENTRATIONS FOR SOILS AND GROUNDWATER

Analyte	Background Concentrations[a]				
	Soils		Groundwater		Riverwater
	Surface (0-6 inches)	Subsurface (48-54 inches)	Perched [b]	Shandon Tributary[c]	Great Miami River
All Organic Compounds	0.0 [c]	0.0 [c]	0.0 [c]	0.0 [c]	0.0 [c]
General Water Chemistry	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
Ammonia	NA [l]	NA	4.58	18.2	1.2
Chloride	NA	NA	97	83.5	325
Fluoride	NA	NA	1.3	1.24	0.9
Nitrate	NA	NA	0.286	1.25	6.58
Total Phosphorus	NA	NA	0.208	0.979	101
Sulfate	NA	NA	138	346[m]	4310 [m]

a Source: DOE 1993b (soils), DOE 1993a (Groundwater). Background concentrations are based on the 95th percentile of the data distribution from site-specific background data except as noted.

b Wells used to evaluate the perched groundwater background concentrations include 1040, 1059, and 1060.

c Wells used to evaluate the Shandon Tributary background concentrations include 2043, 2050, 2056, 2066, 2383, 3024, 3043, and 4011.

d Because of poor SQL values, this nuclide was assumed to be in secular equilibrium with its present, U-235.

e Value assumed to be zero.

f Value assumed based on secular equilibrium for radioactive decay chain.

g This radionuclide is a fission product, and its presence in the environment is due only to atmospheric releases of radiation (e.g., weapons testing). This radionuclide is not naturally occurring and is only expected to be present at or near detectable activities in the surface soil.

h All of the values in the data set were not detectable. The average SQL was substituted as the best representatives value for the 95th percentile.

i Less than or equal to 10 percent of measured concentrations were above the SQL. The maximum detected value was substituted as the 95th percentile.

j Individual activity concentrations of the three isotopes for uranium and thorium were converted to mass concentrations. The three isotope mass concentrations were added to obtain the total thorium or uranium mass concentration.

k The calculated standard deviation was greater than 2.00. This was caused by the combination of only 12 values out of 30 above SQL and the maximum concentration of 1140 µg/g. Summary statistics for 0 to 6 inches without suspected outliers were used as the representative statistics for this data set.

l NA - Not applicable

m 95th percentile values which exceed the Federal Maximum Contaminant Levels:

Arsenic 0.05 mg/L	Lead 0.015 mg/L
Antimony 0.006 mg/L	Manganese 0.05 mg/L
Cadmium 0.005 mg/L	Mercury 0.002 mg/L
Chromium 0.05 mg/L	Sulfate 300 mg/L
Iron 0.3 mg/L	Thallium 0.002 mg/L

TABLE 4-20
RI/FS SUBSURFACE SOIL
RESULTS ABOVE RADIOLOGICAL BACKGROUND CONCENTRATION
(pCi/g)

Depth (feet)	Zone	Boring #	Sample #	Ra-226	Ra-228	Sr-90	Tc-99	Th-228	Th-230	Th-232	U-234	U-235/236	U-238
3.0	1	1078	007676	-	-	-	-	2.3	3	1.8	97.2	6.1	320.2
3.0	1	1079	007370	-	-	-	-	-	2.3	-	4.4	-	8.9
3.0	1	1644	033092	-	-	0.784	1.07	4.11	44.6	4.21	4712	278	4682
3.0	1	1944	033025	-	-	0.715	-	-	-	-	158	7.66	178
3.5	1	1838	098406	1.4	-	-	-	0.6	0.96	-	-	-	-
4.0	1	1836	098372	0.59	1.03	-	-	1.4	1.9	1.4	1.43	0.12	1.32
4.5	1	1028	007819	1.4	1.8	-	-	1.7	2.8	1.5	13.6	2.9	89.4
4.5	1	1643	033221	2.12	1.97	-	-	-	6.46	-	90.1	9.14	128.7
6.0	1	1838	098411	-	-	-	-	-	-	0.71	-	-	-
6.0	1	1082	007660	-	-	0.9	-	-	-	-	4.4	0.8	22.5
6.0	1	1943	033009	-	-	1.13	-	1.76	2.59	-	14.9	-	36.7
7.0	1	1836	098376	1	0.72	-	-	1.1	1.4	0.84	0.95	-	1.12
13.5	1	1073	008487	19.7	18.6	-	6.1	22.9	710	33.1	112	4.7	125
15.0	1	1074	008472	-	-	-	-	-	-	-	-	-	-
15.0	1	2649	033203	-	-	-	-	-	-	-	2.52	-	6.77
16.5	1	1031	008843	-	-	-	1.9	-	4.7	-	6.9	0.8	28
16.5	1	2027	007851	-	-	-	-	-	-	-	-	-	-
18.0	1	1076	008159	1210	160	-	-	-	2.4	-	-	-	-
19.5	1	1080	008792	-	-	-	0.9	-	-	-	-	-	-
19.5	1	3004	007922	-	-	-	-	-	-	-	-	-	-
22.5	1	3084	007526	-	-	-	-	-	-	-	-	-	-
22.5	1	1973	008142	1180	165	8.9	-	581	24.1	761	429	144	1404
24.0	1	1075	008573	-	-	-	-	-	-	-	-	-	-
27.0	1	2649	033211	-	-	-	-	-	-	-	-	-	-
33.0	1	1081	007655	-	-	-	-	-	-	-	-	-	-
34.5	1	2648	033140	-	-	-	-	-	-	-	1.13	-	-
35.0	2	3004	007932	9.5	-	6.9	-	-	-	-	4.1	-	3.8
36.0	1	2643	033179	-	-	-	-	-	-	-	-	-	-

Zone 1 = Glacial Overburden
Zone 2 = Upper sand and gravel layer
Zone 3 = Lower saturated sand and gravel layer
Zone 4 = Deep saturated sand and gravel layer

- = Concentration below background (Table 4-2)

TABLE 4-20
RI/FS SUBSURFACE SOIL
RESULTS ABOVE RADIOLOGICAL BACKGROUND CONCENTRATION
(pCi/g)

Depth (feet)	Zone	Boring #	Sample #	Ra-226	Ra-228	Sr-90	Tc-99	Th-228	Th-230	Th-232	U-234	U-235/236	U-238
37.5	1	1648	033142	-	-	-	-	-	-	-	1.64	-	-
37.5	1	3011	007589	-	-	-	-	-	-	-	-	-	-
39.0	2	2028	032684	-	-	-	-	-	-	-	-	-	-
61.5	2	3084	007546	-	-	-	-	-	-	-	-	-	-
66.5	2	2027	007874	-	-	-	-	-	-	-	-	-	-
66.5	2	2028	032700	-	-	1.03	-	-	-	-	1.24	-	-
66.5	2	3011	007595	-	-	-	-	-	-	-	-	-	-
76.5	2	2027	007876	-	-	-	-	-	-	-	-	-	-
116.5	3	3004	008179	-	-	-	-	-	-	-	-	-	-
121.5	3	3084	007558	-	-	-	-	-	-	-	-	-	-
181.5	4	4011	032899	-	-	-	-	-	-	-	-	-	-

Zone 1 = Glacial Overburden
Zone 2 = Upper sand and gravel layer
Zone 3 = Lower saturated sand and gravel layer
Zone 4 = Deep saturated sand and gravel layer

- = Concentration below background (Table 4-2)

5511

TABLE 4-33

SURFACE WATER ANALYTICAL RESULTS

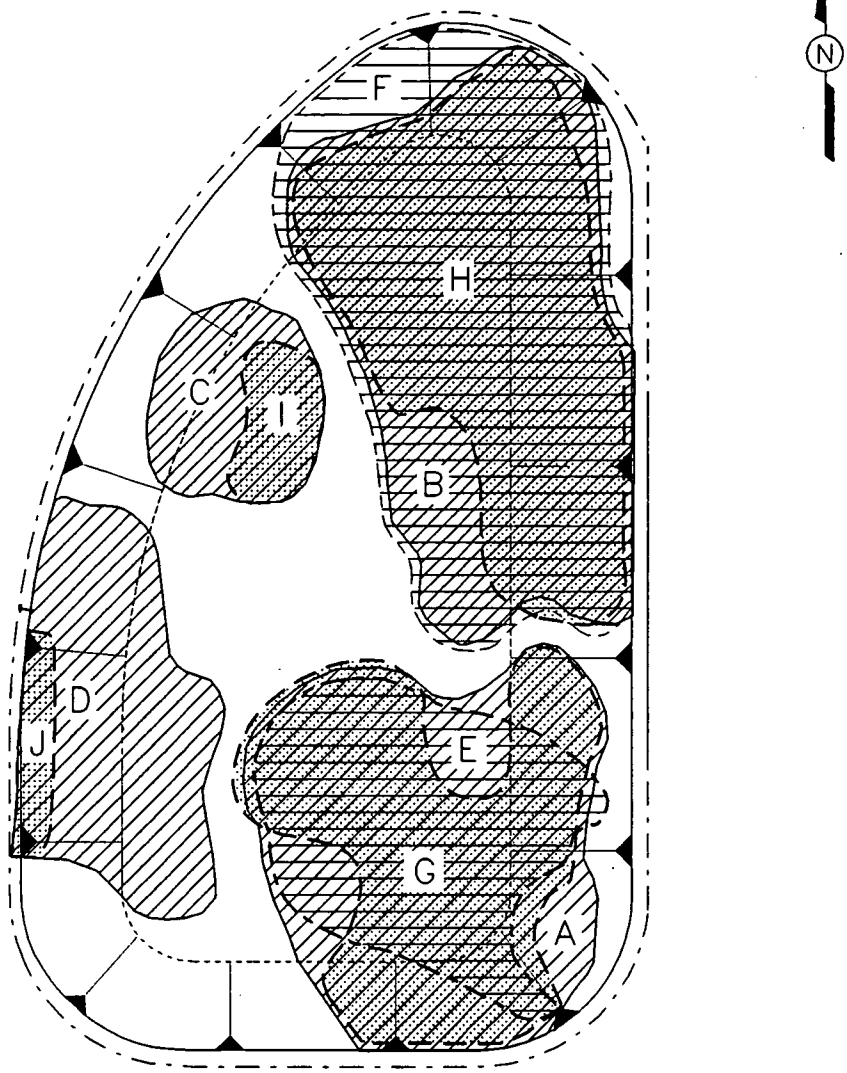
Analyte	Units	DD-01	DD-07	DD-09
Aluminum	µg/L	869	456	964
Barium	µg/L	217	320	209
TOC	mg/L	14.4	118	7.6
TOX	µg/L	41	260	37
TDS	mg/L	692	1190	414
TSS	mg/L	266	20	148
Chloride	mg/L	11.3	28.1	39.3
Fluoride	mg/L	0.24	1.2	1.3
Nitrate	mg/L	1.0 U	0.2 U	2.6
Gross Alpha	pCi/L	8 ± 5	850 ± 50	420 ± 30
Gross Beta	pCi/L	13 ± 3	560 ± 20	380 ± 10
Thorium-228	pCi/L	NR	NR	0.1 ± 0.3
Thorium-230	pCi/L	NR	NR	1.4 ± 0.5
Thorium-232	pCi/L	NR	NR	0.1 ± 0.2
Uranium-234	pCi/L	0.6 ± 0.5	160 ± 30	57 ± 30
Uranium-235	pCi/L	0.3 ± 0.2	5 ± 10	1.0 ± 8.6
Uranium-238	pCi/L	2.4 ± 0.5	740 ± 60	310 ± 40
Radium-226	pCi/L	NR	NR	NR
Radium-228	pCi/L	NR	NR	NR
Chromium	µg/L	10.0 U	10.0 U	10.0 U
Sulfate	mg/L	317	38.3	89.9

TABLE 4-38

SUMMARY OF SEDIMENT RADIOLOGICAL RESULTS - CIS
(pCi/g)

Location	Cs-137	Np-237	Pu-238	Pu-239/240	Ru-106	Sr-90	Tc-99	Th-228	Th-230	Th-232	U-234	U-235	U-238
SD-21-017	U	U	U	U	U	U	U	0.1	0.4	0.1	2.3	0.2	8.6
SD-21-019	U	U	U	U	U	U	U	0.3	0.2	0.2	1.7	0.1	6.3
SD-26-001	U	U	U	U	U	U	U	0.4	1.3	0.2	11	0.9	46
SD-26-005	U	U	U	U	U	U	U	0.3	1.9	U	3.6	0.2	12
SD-26-007	U	U	U	U	U	U	U	0.1	0.9	U	3.3	0.2	12
SD-28-002	0.5	U	U	U	U	U	8.6	0.3	0.9	0.2	19	2.4	111
SD-28-008	U	U	U	U	U	U	13	0.2	0.1	0.1	133	26	761
SD-28-010	U	U	0.3	0.2	U	U	17	2.6	7.6	1.1	62	14	338
SD-28-011	U	U	U	U	U	U	16	0.2	0.9	U	85	18	446
SD-36-001	1.1	U	0.1	0.3	U	U	8.6	1	4	0.6	89	27	480
SD-36-002	U	U	0.3	0.3	U	U	7	1.1	5.1	0.6	131	29	746
SD-36-003	0.4	U	U	0.2	U	U	8.3	0.2	0.5	0.1	71	9.4	369
SD-36-004	U	U	0.3	0.2	U	U	17	1.3	6.1	0.5	126	33	696
SD-36-006	U	U	0.2	0.1	U	U	9.3	0.7	4.4	0.3	126	33	696

U = Undetected



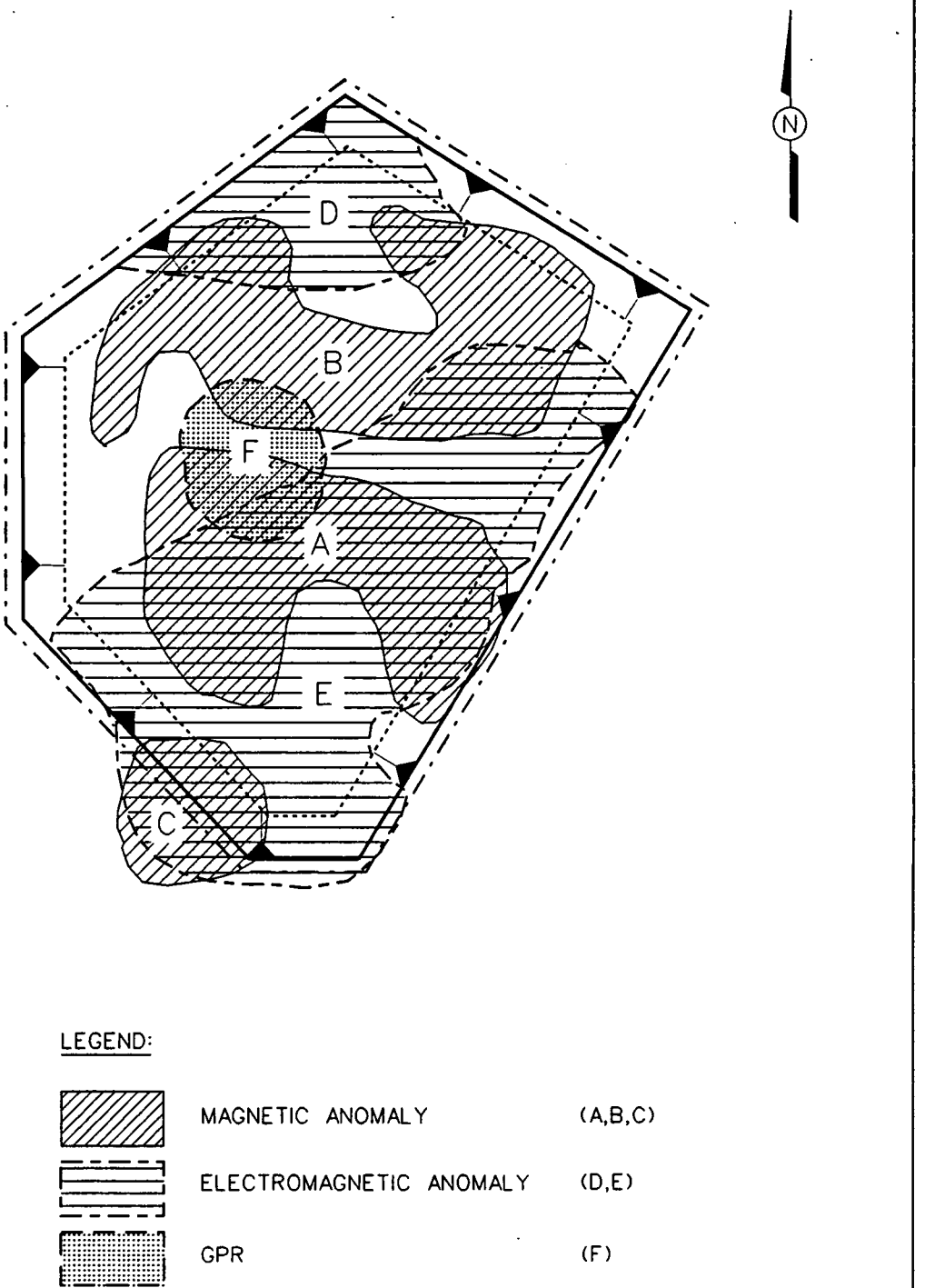
LEGEND:

	MAGNETIC ANOMALY	(A,B,C,D)
	ELECTROMAGNETIC ANOMALY	(E,F)
	GPR	(G,H,I,J)

409191-A-389/ OU1/ KNOX/ DS
40919389.OU1 04-18-94 DON GOSS

000116

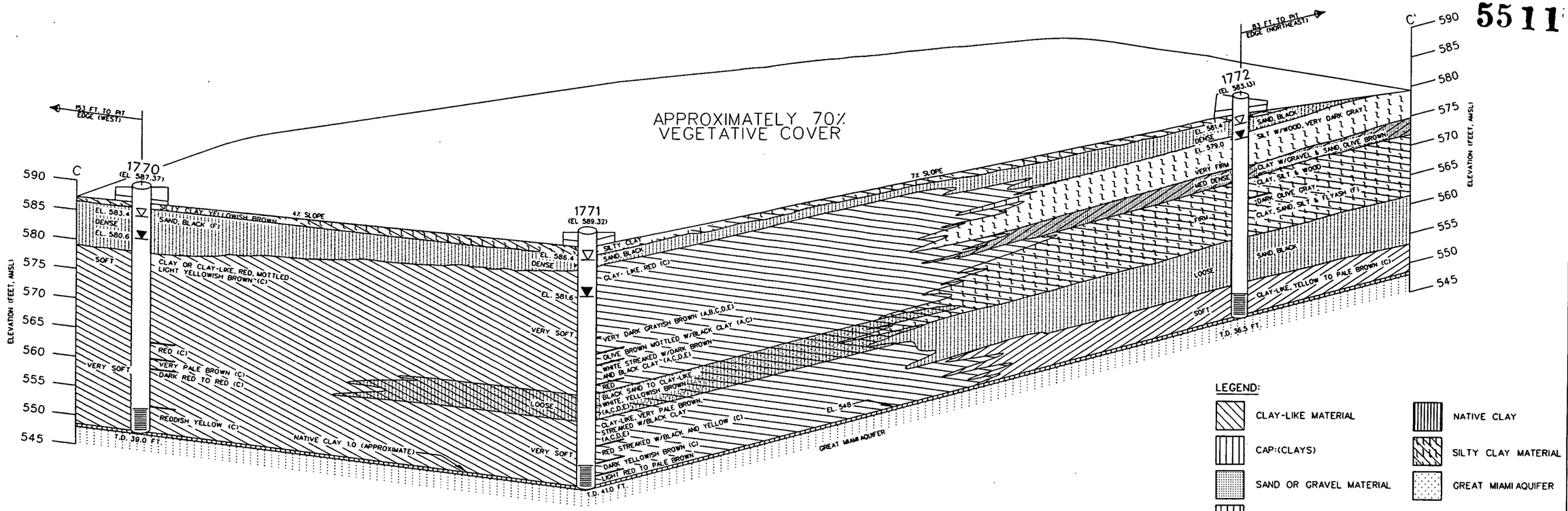
FIGURE 4-10. GEOPHYSICAL ANOMALY MAP OF WASTE PIT 1



409191-A-390/ OU1/ KNOX/ DS
40919390.OU1 04-18-94 DON GOSS

000117

FIGURE 4-18. GEOPHYSICAL ANOMALY MAP OF WASTE PIT 2



LEGEND:

- CLAY-LIKE MATERIAL
- CAP:(CLAYS)
- SAND OR GRAVEL MATERIAL
- SILT MATERIAL
- CLAY W/SAND OR GRAVEL (OLIVE BROWN)
- SANDY CLAY
- CLAY-LIKE MATERIAL OLIVE BROWN
- NATIVE CLAY
- SILTY CLAY MATERIAL
- GREAT MIAMI AQUIFER
- WATER LEVEL APRIL 19, 1993
- WATER LEVEL OCTOBER 14, 1993
- SCREENED INTERVAL

ABBREVIATIONS

EL.	ELEVATION
FT.	FEET
AMSL	ABOVE MEAN SEA LEVEL
ID	INSIDE DIAMETER
T.D.	TERMINATION DEPTH.

000118

WASTE DESCRIPTIONS

	WASTE STREAMS	MASS QUANTITY (MT)	VOLUME (M^3)	CHARACTERISTICS
A	TRAILER CAKE	30,072	20,900	WHITE TO GRAY GRANULAR LIKE SAND. PARTICLE SIZE: 100% < 0.03 INCH AND 90% <50 MICRONS. SCREENED MAG FLUORIDE BEFORE TREATMENT IN PLANT 8.
B	SLAG LEACH FILTER CAKE	12,605	8,700	WHITE TO GRAY PARTICLES SLURRIED TO THE PITS AS A LIQUID. PARTICLE SIZE SIMILAR TO TRAILER CAKE. WAS FILTERED, RESLURRIED AND PUMPED TO THE PIT AS A LIQUID.
C	NEUTRALIZED RAFFINATE	32,712	34,130	RED, BROWN, ORANGE, YELLOW, OR BLUE (MOSTLY ANY COLOR) DEPENDING ON THE PRIMARY IMPURITIES ASSOCIATED WITH THE ORE CONCENTRATE. PASTY CONSISTENCY WITH HIGH PLASTICITY. NEUTRALIZED WITH LIME.
D	GENERAL SUMP SULDGE	41,720	29,000	LIME NEUTRALIZED, FILTERED WASTE STREAMS. GRAY TO WHITE LIQUID CONTAINING 2.5-10% SOLIDS (MOSTLY LIME). PASTEY MATERIAL FOLLOWING SOLIDS SEPARATION.
E	WATER TERATMENT SLUDGE	4,212	2,925	WHITE TO GREY. PASTEY.
F	FLYASH	---	---	BLACK TO DARK GRAY FINE LIGHT MATERIAL FROM THE BOILER AND ONSITE INCINERATOR. SHOULD CONTAIN HIGH LEVELS OF DIOXIN AND PAH'S.
G	THORIUM-232 WASTES	89	100	WHITE, RAFFINATE, SUMP CAKE

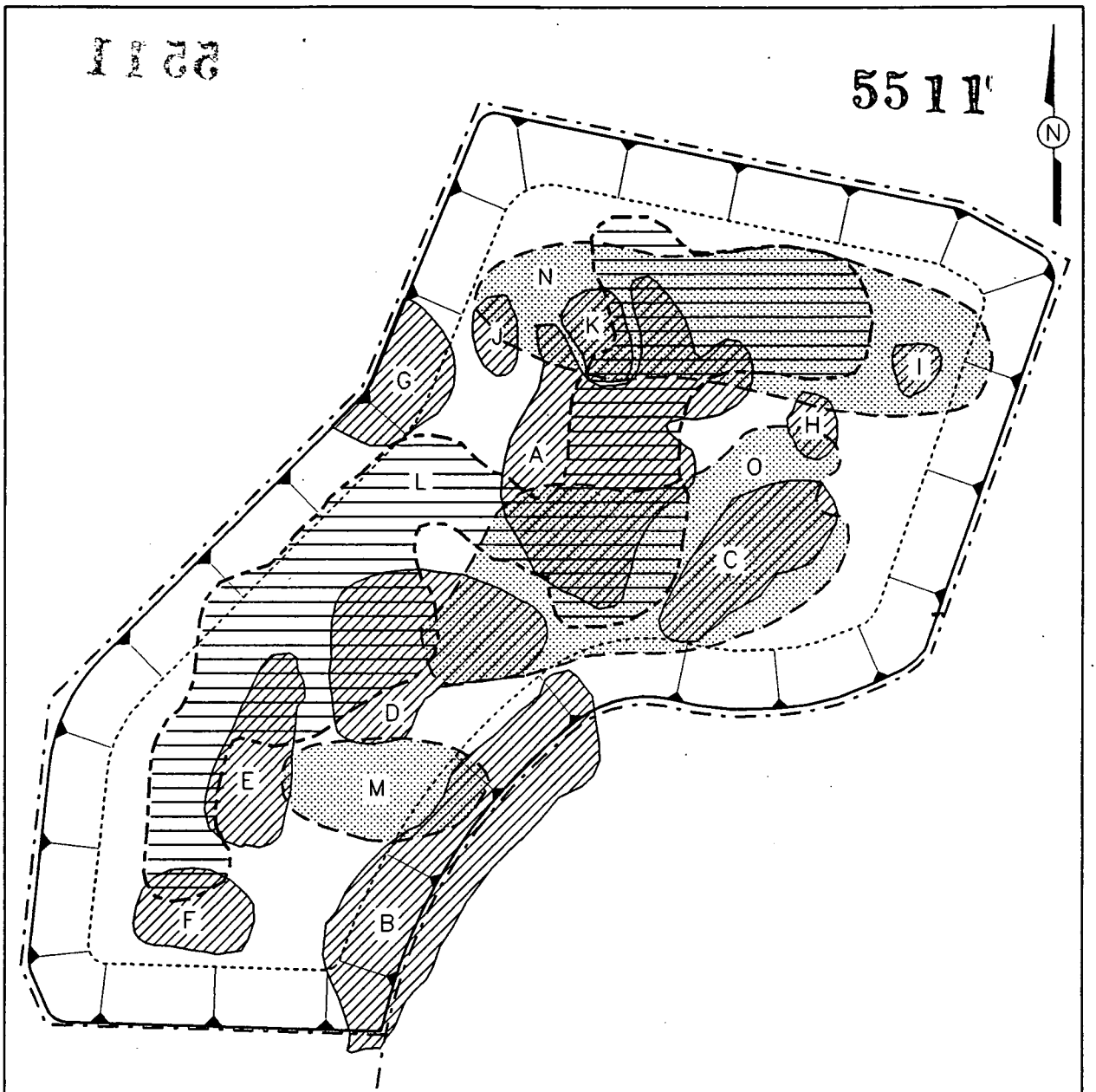
NOTES:

1. PERIOD OF OPERATION 1958-1977
2. EXTREME VARIATION AND SCATTERED PATTERNS OF RED CLAY INTERSPERSED WITH SEAMS OF YELLOW, BROWN, GREY, AND BLACK SEAMS, WITH HIGH (PASTEY, MUSHY)PLASTICITY. WOOD ALSO ENCOUNTERED IN BORING 1772. FLYASH ALSO ENCOUNTERED IN BORINGS 1772.
3. PREDOMINANT RADIOLOGICAL CONSTITUENTS ARE U238 (17,900 PCI/G).
4. PLANT RECORDS DO NO INDICATE QUANTITIES OF ORGANICS DISPOSED IN WASTE PIT 3.
5. AROCLOR 1248/1254 CONCENTRATIONS IN PIT MATERIAL ARE 4.8 AND 3.4PPM, RESPECTIVELY, ALL VALUES ARE MAXIMUM. DIOXINS ARE MAXIMUM IN PIT MATERIAL AT 19.4PPB AND PAH'S, ON AVERAGE ARE MAXIMUM AT 1 PPM.
6. SEE TABLE 4-1, TABLE 1-1 AND SECTION 1.2.2.3 FOR DETAILED DISCUSSION OF WASTESTREAMS IN PIT 3.
7. COVER MATERIAL IS APPROXIMATELY 14 FT. AND CONSISTS OF SILTY CLAY AS WELL AS SLAG LEACH, FILTER CAKES, LIME SLUDGE, FLY ASH AND COAL FINES.

WASTE STREAM VOLUMES AND CALCULATIONS ARE BASED ON MATERIALS CONTROL AND ACCOUNTING (MC&A) PLANT RECORDS, CRU3 DRAFT WORK PLAN ADDENDUM (1992), AND INTERVIEWS WITH KNOWLEDGEABLE PLANT PERSONNEL.

FIGURE 4-19 CONCEPTUAL CROSS SECTION OF WASTE PIT 3 CONTENTS

409191-A-395 /OU1/KNOX /DS
4091939S.OU1 09/30/93/CP
REVISED ON SITE - FIG4_19.2d - 04/21/94 deg (CLAY)



LEGEND:

	MAGNETIC ANOMALY	(A,B,C,D,E,F,G,H,I,J,K)
	ELECTROMAGNETIC ANOMALY	(L)
	GPR	(M,N,O)

000119

409191-A-391/OU1/KNOX/DS
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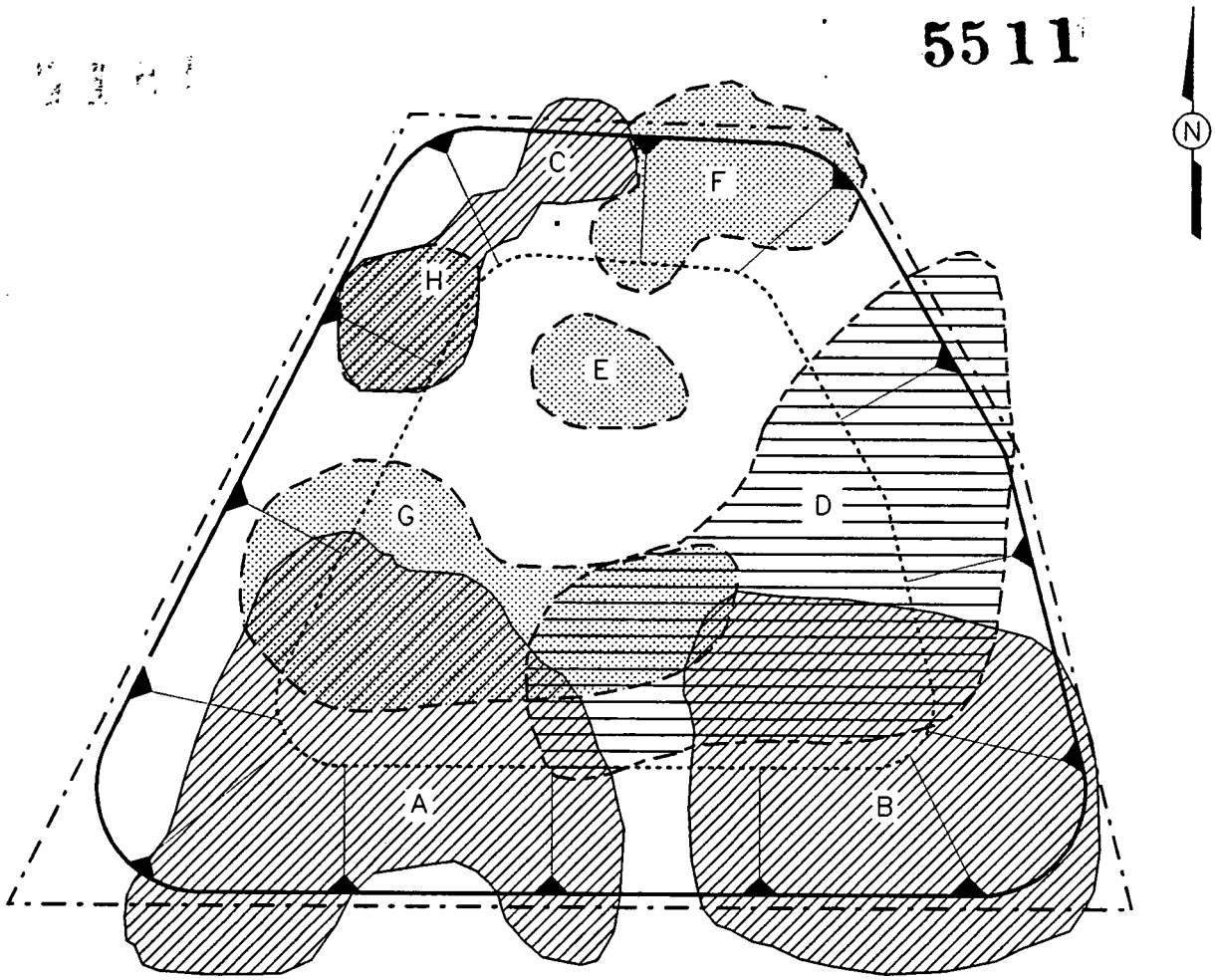
FIGURE 4-20. GEOPHYSICAL ANOMALY MAP OF WASTE PIT 3

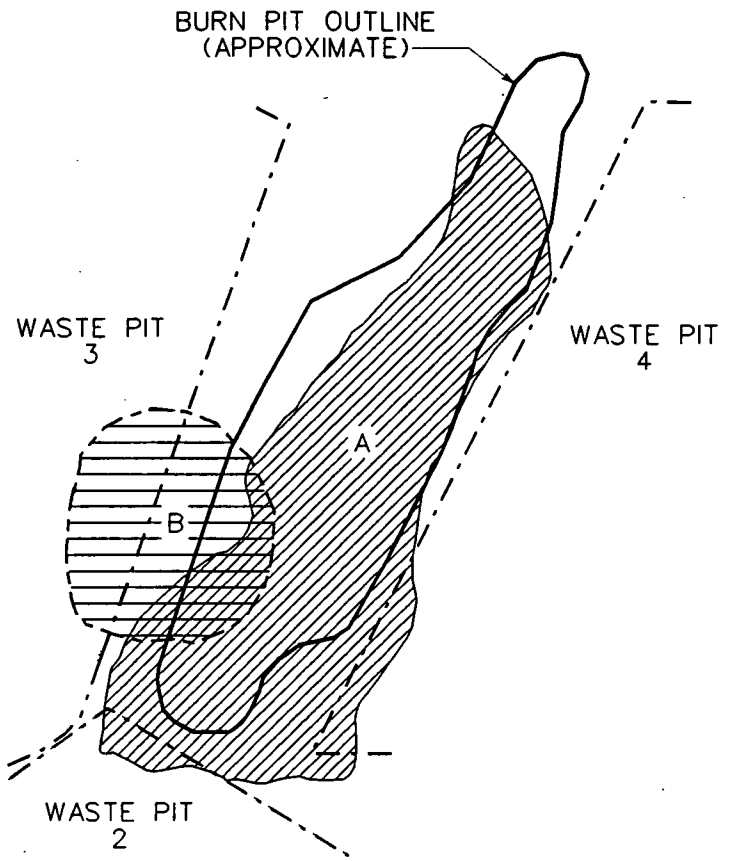


LEGEND:

	MAGNETIC ANOMALY	(A,B,C)
	ELECTROMAGNETIC ANOMALY	(D)
	GPR	(E,F,G,H)

409191-A-392/ OU1/ KNOX/ DS
40919392.OU1 04-18-94 DON GOSS

FIGURE 4-22. GEOPHYSICAL ANOMALY MAP OF WASTE PIT 4



LEGEND:

MAGNETIC ANOMALY (A)

ELECTROMAGNETIC ANOMALY (B)

409191-A-393/ OU1/ KNOX/ DS
409191393.OU1 04-15-94 DON GOSS

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FIGURE 4-24. GEOPHYSICAL ANOMALY MAP OF BURN PIT

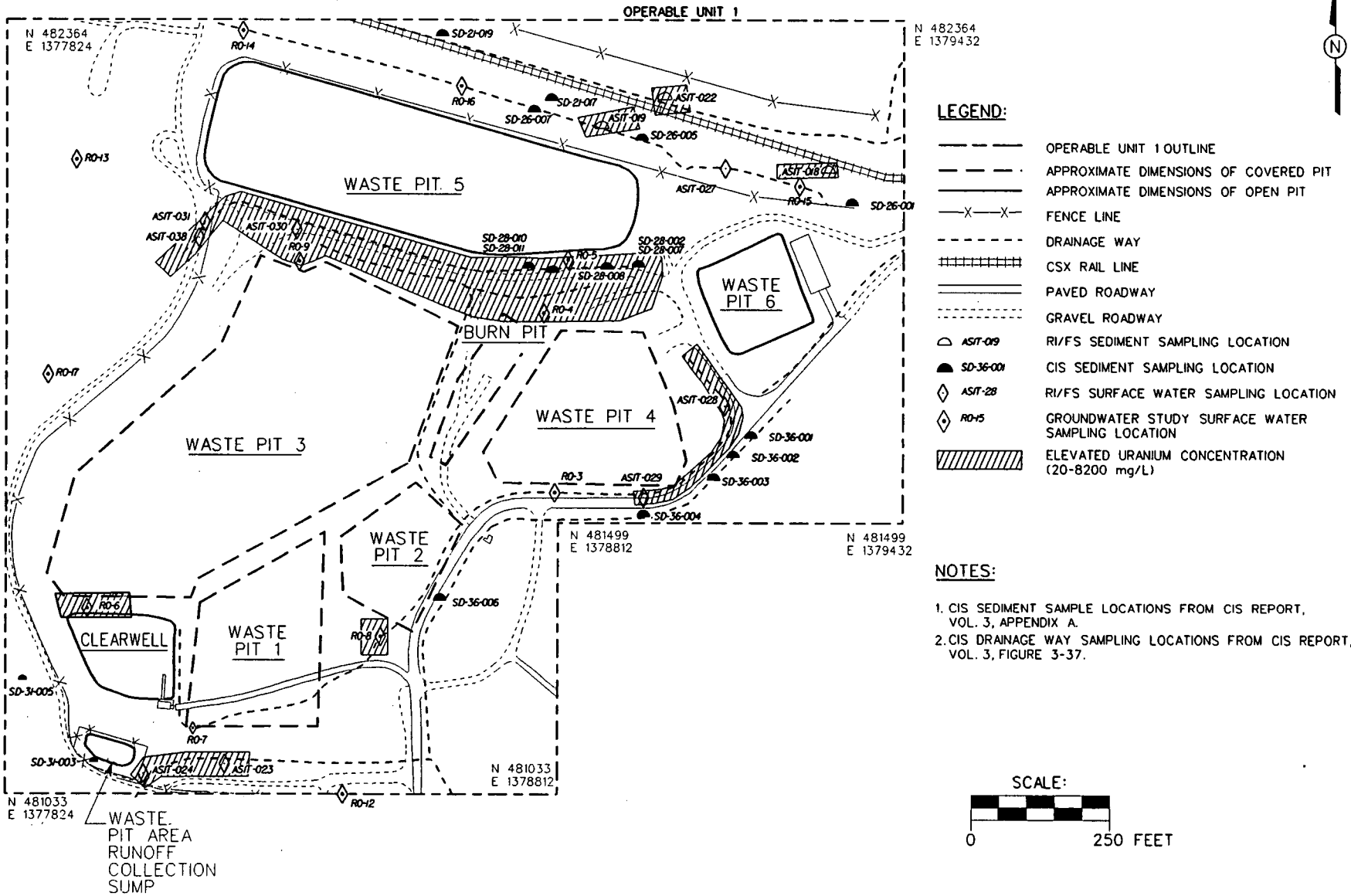

FIGURE 4-36. DISTRIBUTION OF URANIUM IN SURFACE WATER AND SEDIMENT

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Section 6

were examined. One such land use, the government reserve, postulates that ownership of the site is retained by the government, but that site maintenance and strict access controls are relaxed. Six receptors were evaluated under this scenario. They are the off-property farmer, the off-property child, the groundskeeper, the extended trespasser, the off-property user of meat and milk, and the Great Miami River user.

If the government were to relinquish all control over the site, unrestricted use of the site could permit exposure routes associated with development of residences, such as a home and farm, within the boundaries of Operable Unit 1. Access controls are assumed to be absent and no additional remedial actions are assumed to have been taken. Hypothetical receptors under this scenario are a RME resident farmer, a central tendency (CT) resident farmer, a resident child, and an on-property home builder.

Two source term configurations are an integral part of these five land-use scenarios: the current source term and the future source term. The current source-term configuration
8-O considers the Waste Storage Area as it exists today; ***Waste Pits 1, 2, and 3 are covered with fill and have 70 percent vegetative covering. Waste Pit 4 is covered by a polyethylene cover with compacted clay. Pits 5 and 6 are water covered (refer to Table E.1-1)***. The future source-term assumes that all maintenance activities within Operable Unit 1 have been discontinued. The cap on the unstable portion of Waste Pit 3 is assumed to have failed, exposing 30% of the waste pits contents. Caps and covers on Waste Pits 1, 2, and 4 and the Burn Pit are assumed to have remained intact. Water in Waste Pits 5 and 6 is assumed to have evaporated, exposing waste pit contents over half of the surface area of each waste pit. The Clearwell is assumed to have remained filled with water. The surface-water-runoff-control system is assumed to have become nonfunctional under the future source-term scenario as maintenance ceases.

The future source-term configuration was developed as described for a number of reasons. Since the currently submerged surface of Waste Pits 5 and 6 is uneven and higher at one level than the other, a decrease in the water level could result in a significant amount of exposed pit material. For that reason, half of the total surface area is assumed to have become exposed in the future scenario. Sediments on the bottom of the Clearwell are assumed to have remained covered with water. The sides of the Clearwell are steep, and removal of part of the water would not result in exposure of this material.

The pit material in Waste Pit 3 is semi-solid and, consequently, unstable. This instability may affect the integrity of the cover material, resulting in failure. Therefore, it was assumed that part of the cover over this pit will subside, exposing waste materials. The covers of Waste Pits 1, 2, and 4 and the Burn Pit are assumed to have remained intact in the future scenario. This assumption is made because the materials deposited within these waste pits consisted of solid (dry) wastes. Solid wastes are assumed more stable and less likely to settle and result in
257 failure of the cover. Waste Pit 4 is covered with a RCRA cap (a 6-foot-thick clay cover and a polyethylene liner) that is assumed to significantly reduce the potential for failure. Waste Pits 1 and 2 and the Burn Pit are covered with soil and are assumed to have become covered with vegetation, which would increase pit stability.

Of all the pits, Waste Pit 4 is considered to be the most stable. In addition, the groundwater beneath this pit is the most contaminated, thus future installation of a well at this location was chosen as the most conservative assumption. A home also was assumed to have been constructed over this pit. The presence of the RCRA cap over Waste Pit 4, however, would preclude grass growth, so topsoil was assumed to have been placed over the cap after its construction.

Finally, since the resident farmer is also being evaluated, the only area that would be left for growing crops is the area of Waste Pits 1 and 2, the soil cover of which makes this location suitable for agriculture. It is assumed that the soil covers will have remained intact, otherwise crop growth would be unlikely to occur.

Exposure pathways quantified in the risk assessment for each scenario are shown in Appendix E of this report, Figures E.3-2 and E.3-3, and are discussed in greater detail in Section E.3.0 of Appendix E. That section includes a description of the calculation methods for quantifying receptor exposures and a tabulation of the numerical parameter values (Tables E.3-17 and E.3-18) employed in exposure calculations. The conceptual model depicted in Figures E.3-2 and E.3-3 indicates which exposure routes are quantitatively evaluated in the risk assessment for each receptor and land-use scenario, and the basis for excluding other exposure routes.

Estimated receptor point concentrations used in exposure calculations are tabulated in Tables E.3-2 through E.3-16. Exposure point concentrations for soil, surface water, on-site groundwater, and waste pit material are based on analytical results of the CIS and the RI/FS

data. Exposure point concentrations in air, surface water in Paddys Run and the Great Miami River, sediment, and groundwater are based on environmental transport modeling from source terms within Operable Unit 1. Exposures to the RME resident farmer due to consumption of groundwater considers two scenarios—water obtained from the Great Miami Aquifer and water obtained from the perched aquifer beneath Operable Unit 1. Section 5 and Appendix D of this RI report address these modeling results in detail. The conceptual model described in Appendix E.3.0 contains the assumptions regarding source terms and potential release mechanisms on which the transport modeling is based.

6.4 TOXICITY ASSESSMENT

Two primary human health hazards are addressed in the toxicity assessment for Operable Unit 1: cancer induction and chemical toxicity. Cancer is a genotoxic effect and may be induced by exposure to a chemical carcinogen or from ionizing radiation from a radionuclide. Chemical noncarcinogenic toxicity refers to general toxicity that does not affect the genetic material and includes organ tissue effects. These effects are numerous and range from systemic effects such as kidney or liver damage to localized effects such as skin or eye irritation. For both cancer induction and chemical toxicity, dose-response data from human and animal studies are used to determine the reference doses of each constituent.

For cancer induction, it is assumed that no dose threshold exists, so for any dose of a carcinogen, there exists a possibility, however small, of developing cancer. Incremental lifetime cancer risks (ILCR) are expressed in terms of the probability that a given receptor (person) will develop cancer due to estimated exposures. For example, if the receptor has an additional 1 chance in 10,000 of contracting cancer due to these exposures, the probability is expressed as a 10^{-4} (1/10,000) risk. Chemical intakes calculated in the exposure assessment are used in conjunction with the cancer slope factor (CSF) to determine the ILCR. Cancer risks from exposure to chemical carcinogens and exposure to ionizing radiation are considered separately in the Operable Unit 1 risk assessment.

In the evaluation of potential exposures for the noncarcinogenic assessment, it is assumed that a dose threshold exists below which no toxic effect will occur. This threshold is used to develop an acceptable intake level (the reference dose/reference concentration [RfD/RfC]). To determine if Operable Unit 1 constituents may cause toxic effects, the estimated intake

(calculated from the exposure assessment) is divided by the acceptable intake. This ratio is called the hazard quotient (HQ). When HQs for multiple CPCs are summed for a particular pathway, the resultant value is the hazard index (HI). If the ratio of estimated intake to the acceptable intake is greater than 1, the site-related intake may increase the risk of adverse health effects.

Quantitative toxicity factors (i.e., cancer slope factors [CSFs] and reference doses [RfDs]) are presented in Appendix E, Tables E.4-1 and E.4-2 for radionuclides and chemical constituents, respectively.

For risk assessment purposes, mixtures of CDDs and CDFs are evaluated using EPA's toxicity equivalency method. This approach uses derived toxic equivalent factors (TEFs) to convert the concentration of CDD or CDF congeners into an equivalent concentration of 2,3,7,8 TCDD. Table E.4-3 presents the TEFs for a variety of CDD and CDF congeners.

Carcinogenic risks associated with PAHs are also evaluated using a TEF approach. This approach considers the relative potency of the individual PAHs and allows site-specific relative concentrations to be expressed in the risk assessment. The relative potency factors for PAHs are presented in Table E.4-4. Results were also presented under the assumption that all carcinogenic PAHs were as potent as benzo(a)pyrene.

6.5 RISK CHARACTERIZATION RESULTS

Risk estimates are derived by combining the results of the exposure assessment and the toxicity information to quantitatively estimate the degree of hazard associated with exposure to
258 CPCs. The results were characterized based on ranges of generally acceptable risk under CERCLA, an ILCR of 10^{-4} to 10^{-6} or an HI equal to or less than 1 (EPA 1992d).

Tables 6-3 through 6-10 present summary results of the baseline risk assessment by land use. This information was derived by combining the results of the exposure assessment and the toxicity information to qualitatively estimate the degree of hazard associated with exposure to CPCs. These results may be compared to the ranges of generally acceptable risk under CERCLA, which are an incremental lifetime cancer risk of 10^{-6} to 10^{-4} or a Hazard Index equal to or greater than unity (1).

6.5.1 Current Land Use

Currently, the operable unit is used to store waste. Three of the receptors listed in Tables 6-3 and 6-4 - the groundskeeper, the off-property farmer, and the off-property ***young*** child - were evaluated under the assumption that this use continues, and that both active maintenance and access controls will continue at the site. The maximally exposed individual in this case is
DOE determined to be the groundskeeper, with ILCR approaching 10^{-4} ~~(Table 6-4)~~ ***(Table 6-3)***. These risks are dominated by radiation exposures from isotopes of uranium, thorium, and radium in pit contents and surface soil. The hazard index of systemic toxic effects for the groundskeeper is less than unity (1). Calculated risks to the off-property farmer are just over
DOE 10^{-6}, while ~~calculated risks~~ ***ILCR*** to the ***off property*** ~~resident~~ ***young*** child are well below 10^{-6}. The HI for both the farmer and child are less than unity (1).

If access controls are relaxed, two additional receptors are assumed to become plausible - the trespassing youth, and the off-property user of meat and milk. The greatest health effects could then be expected to occur in the off-property users of meat and milk products. Most of the total calculated risks to this receptor (about 10^{-3}) are from the uptake of PCBs by grazing cattle. Radionuclides contribute risks on the order of 10^{-4}. The HI for this receptor exceeds 1.0 (2.4), due primarily to antimony, cadmium, and uranium uptake by cattle. Impacts on the hypothetical trespassing youth are much lower (ILCR = 10^{-5} and HI = 0.5). Risks to the groundskeeper, the off-property farmer, and the off-property child are unchanged.

If access controls are relaxed and maintenance of engineering controls ceases, waste may be exposed due to erosion and subsidence of pit covers. To reflect these conditions, the groundskeeper was deleted from the list of receptors and a person using water from the Great Miami River was added. Tables 6-5 and 6-6 present the ILCRs and HIs for the trespassing youth and the Great Miami River user. Tables 6-9 and 6-10 present the same information for the off-property user of meat and milk products and the off-property farmer and child. Risk calculations indicate the MEI's under these conditions are the off-property farmer and the off-property user of meat and milk products (ILCR = 10^{-3}). Total pcb's and arsenic in on-property soil, and uranium in groundwater are the most important contributors to these risks. The off-property child has the highest potential for systemic toxic effects (HI = 90), and uranium is the only constituent producing an HI exceeding unity (1). The trespassing

youth (ILCR = 10^{-4}, and HI = 2) is also a receptor of concern under these conditions, but impacts to the Great Miami River User are minimal.

6.5.2 Future Land Use

Continued government ownership of the site is one plausible future land use. If the government maintains the site as a federal preserve, general access to the site could be restricted. It is also possible that the operable unit's engineering controls would not be maintained. As part of the effort to assess the potential for these conditions to impact human health, two hypothetical receptors were created to evaluate on-property exposures - the groundskeeper and the expanded trespasser (Tables 6-7 and 6-8). In addition to these receptors, the calculated risks to several off-property receptors were examined: the off-property farmer and child, the off-property user of meat and milk products, and the Great Miami River user (Tables 6-5, 6-6, 6-9, and 6-10). The groundskeeper, the off-property adult, and the off-property user of meat and milk are projected to incur risks in the order of 10^{-3}. The off-property child would experience the highest HI (HI = 90) because of his lower body weight. Uranium is the single most important contributor to all of these exposures.

While it is unlikely, complete unrestricted access to the site is a possible future land use. To explore this possibility, calculated risks to a number of various receptors on Tables 6-5, 6-6, 6-10 and 6-11 were examined: the off-property farmer and child, the off-property user of meat and milk products, the Great Miami River User, the on-property farmer and child, and the homebuilder. All receptors, with the exception of the Great Miami River user, were calculated to incur risks of 10^{-4} or greater. The greatest calculated risks are incurred by the hypothetical on-property farmer (ILCR = 10^{-1}). If domestic use of perched groundwater is included in the analysis, the risks approach unity (1). Uranium and arsenic in groundwater dominate risks to this receptor. Similarly, predicted exposures to all receptors except the Great Miami River user produce HI's exceeding 1. The highest HI, 6100, is produced when the on-property farmer uses perched water. If this potential source is discounted, the highest HI is incurred by the resident child using groundwater from beneath the operable unit (1600).

266 Risks associated with using groundwater from the perched aquifer for drinking and domestic purposes are evaluated in Appendix E. The results of this evaluation are presented concurrently with risks to the future on-property farmer using the Great Miami Aquifer.}

6.5.3 Background Risks

All site-related risks in the risk assessment are calculated without accounting for the contribution from natural background. In many cases, the concentrations of CPCs in the soil at the Operable Unit 1 waste pits are only slightly above natural background concentrations, but the ILCRs or HIs for these site-related concentrations are often greater than 10^{-4} and 1, respectively. Background contributions provide a useful point of comparison for site-related risk estimates.

Risks and hazard quotients are calculated for background concentrations of CPCs in soil.
DOE These results are presented in ~~Tables 6-5 and 6-6~~ *E-7.9 and E-7.10*. Exposure assumptions and models used for these background calculations are the same as those used for evaluating site-related risks to the RME on-property resident farmer. Soil concentrations used for background risk calculations are the UCL values determined for the site-specific background soil sample analytical results.

DOE Background risks from radionuclides and their short-lived progeny ~~(Table 6-5)~~ ***Table E-7.9*** are 7 x 10^{-4}. The exposure pathway that contributes nearly all of this risk is external radiation exposure from Ra-226, Th-228, and Ra-228 (and their short-lived progeny) in surface soil. The health risk attributable to the naturally occurring radioactive isotope of potassium, K-40, is slightly larger (within the same order of magnitude) than all other radioisotopes combined. The risk from K-40 was not included in the total risk because K-40 was not selected as a CPC for this operable unit. Including it in the total risk from background could bias decisions, if the total background risk were compared directly with the total site-related risks calculated in this report. It is included here because it is a ubiquitous component of background. It is important to note that, using CERCLA methodology, the overall lifetime risk from natural background radiation sources (such as cosmic radiation, primordial radionuclides in surface soil, and radon) is approximately 1 x 10^{-2}. Background risks from arsenic and beryllium in soil at background concentrations also exceed 1 x 10^{-4}.

Background hazard quotients were calculated for natural background concentrations of inorganic chemicals in soil. Results of these calculations for the RME on-property resident
DOE adult are given in Table ~~6-6~~ ***E-7.10***. Again, the soil concentrations used are the site-specific background soil sample analytical result UCLs. The HI for background concentrations of inorganics is 8. The HQs estimated using the background UCLs and the method described in

Section 6

Tables

TABLE 6–3

INCREMENTAL LIFETIME CANCER RISK SUMMARY
CURRENT LAND USE, CURRENT SOURCE TERM

Media	Groundskeeper	Off–property Farmer	Off–property Young Child	Trespassing Youth	Off–property User of Meat and Milk Products
Air					
Radiocarcinogenic Risk	6E–06	3E–06	2E–07	7E–07	NA
Chemical Carcinogenic Risk	1E–08	2E–07	8E–08	2E–09	NA
Total[a]:	6E–06	3E–06	2E–07	7E–07	NA
Surface Soil					
Radiocarcinogenic Risk	8E–05	NA	NA	3E–05	5E–04
Chemical Carcinogenic Risk	1E–05	NA	NA	9E–06	9E–04
Total:	9E–05	NA	NA	4E–05	1E–03
Buried Pit Material					
Radiocarcinogenic Risk	5E–05	NA	NA	2E–05	NA
Chemical Carcinogenic Risk	NA	NA	NA	NA	NA
Total:	5E–05	NA	NA	2E–05	NA
On–property Surface Water					
Radiocarcinogenic Risk	NA	NA	NA	NA	2E–04
Chemical Carcinogenic Risk	NA	NA	NA	NA	6E–06
Total:	NA	NA	NA	NA	2E–04
Sum All Media					
Radiocarcinogenic Risk	1E–04	3E–06	2E–07	5E–05	7E–04
Chemical Carcinogenic Risk	1E–05	2E–07	8E–08	9E–06	9E–04
Total:	1E–04	3E–06	2E–07	5E–05	2E–03

NA – Not applicable. Exposure route not evaluated for receptor.
[a] Radiocarcinogenic and chemocarcinogenic risks are not truly additive. A total is provided for reference only.

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TABLE 6–4

HAZARD INDEX SUMMARY
CURRENT LAND USE, CURRENT SOURCE TERM

Media	Groundskeeper	Off–property Farmer	Off–property Young Child	Trespassing Youth	Off–property User of Meat and Milk Products
Air	0.0E+00	2.7E–04	1.3E–03	0.0E+00	NA
Surface Soil	3.0E–01	NA	NA	4.9E–01	2.7E+00
On–property Surface Water	NA	NA	NA	NA	2.3E–01
Sum All Media	3.0E–01	2.7E–04	1.3E–03	4.9E–01	2.9E+00

NA – Not applicable. Exposure route not evaluated for receptor.

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TABLE 6-5

INCREMENTAL LIFETIME CANCER RISK SUMMARY CURRENT LAND USE, FUTURE SOURCE TERM

Medium	Trespassing Youth	Great Miami River User
Air		
Radiocarcinogenic Risk	8E-05	NA
Chemical Carcinogenic Risk	4E-05	NA
Total[a]:	1E-04	NA
Surface Soil		
Radiocarcinogenic Risk	1E-04	NA
Chemical Carcinogenic Risk	7E-05	NA
Total[a]:	2E-04	NA
Buried Pit Material		
Radiocarcinogenic Risk	7E-06	NA
Chemical Carcinogenic Risk	NA	NA
Total[a]:	7E-06	NA
Paddys Run Surface Water		
Radiocarcinogenic Risk	7E-08	NA
Chemical Carcinogenic Risk	6E-08	NA
Total[a]:	1E-07	NA
Paddys Run Sediment		
Radiocarcinogenic Risk	4E-06	NA
Chemical Carcinogenic Risk	9E-06	NA
Total[a]:	1E-05	NA
Great Miami River Surface Water		
Radiocarcinogenic Risk	NA	3E-07
Chemical Carcinogenic Risk	NA	3E-08
Total[a]:	NA	3E-07
All Media		
Radiocarcinogenic Risk	2E-04	3E-07
Chemical Carcinogenic Risk	1E-04	3E-08
Total[a]:	3E-04	3E-07

NA – Not Applicable. Exposure route not evaluated for this receptor.
[a] Radiocarcinogenic risk and chemocarcinogenic risk are not truly additive. A total is provided for reference only.

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TABLE 6-6

HAZARD INDEX SUMMARY
CURRENT LAND USE, FUTURE SOURCE TERM

Medium	Trespassing Youth	Great Miami River User
Air	2.5E-01	NA
Surface Soil	1.5E+00	NA
Paddys Run Surface Water	3.9E-02	NA
Paddys Run Sediment	1.1E-01	NA
Great Miami River Surface Water	NA	4.2E-03
All Media	1.9E+00	4.2E-03

NA – Not Applicable. Exposure route not evaluated for this receptor.

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TABLE 6-7

INCREMENTAL LIFETIME CANCER RISK SUMMARY
FUTURE LAND USE (GOVERNMENT RESERVE)
FUTURE SOURCE TERM

Medium	On-property Groundskeeper	Expanded Trespasser
Air		
Radiocarcinogenic Risk	7E-04	1E-04
Chemical Carcinogenic Risk	2E-04	6E-05
Total[a]:	9E-04	2E-04
Surface Soil/Exposed Pit Material		
Radiocarcinogenic Risk	4E-04	3E-04
Chemical Carcinogenic Risk	2E-04	2E-04
Total[a]:	7E-04	5E-04
Buried Pit Material		
Radiocarcinogenic Risk	5E-05	3E-05
Chemical Carcinogenic Risk	NA	NA
Total[a]:	5E-05	3E-05
Paddys Run Surface Water		
Radiocarcinogenic Risk	NA	7E-08
Chemical Carcinogenic Risk	NA	6E-08
Total[a]:	NA	1E-07
Paddys Run Sediment		
Radiocarcinogenic Risk	NA	4E-06
Chemical Carcinogenic Risk	NA	9E-06
Total[a]:	NA	1E-05
All Media		
Radiocarcinogenic Risk	1E-03	4E-04
Chemical Carcinogenic Risk	4E-04	3E-04
Total[a]:	2E-03	7E-04

NA – Not Applicable. Exposure route not evaluated for this receptor.
[a] Radiocarcinogenic risk and chemocarcinogenic risk are not truly additive. A total is provided for reference only.

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TABLE 6-8

HAZARD INDEX SUMMARY
FUTURE LAND USE (GOVERNMENT RESERVE)
FUTURE SOURCE TERM

Medium	Groundskeeper	Expanded Trespasser
Air	6.2E-01	2.9E-01
Surface Soil/Exposed Pit Material	1.6E+00	3.5E+00
Paddys Run Surface Water	NA	3.9E-02
Paddys Run Sediment	NA	1.1E-01
All Media	2.2E+00	4.0E+00

NA – Not Applicable. Exposure route not evaluated for this receptor.

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TABLE 6-9

INCREMENTAL LIFETIME CANCER RISK SUMMARY
FUTURE LAND USE (AGRICULTURAL USE)
FUTURE SOURCE TERM

Media	On-property RME Farmer[b]	On-property RME Farmer[b] (User of Perched GW)	On-property CT Farmer	On-property Young Child	Off-property Farmer	Off-property Young Child	Homebuilder	Off-property User of Meat and Milk Products
Air								
Radiocarcinogenic Risk	5E-03	5E-03	4E-04	9E-05	2E-04	4E-06	1E-04	1E-05
Chemical Carcinogenic Risk	5E-03	5E-03	3E-04	1E-03	3E-04	7E-05	4E-05	8E-04
Total[a]:	1E-02	1E-02	7E-04	1E-03	5E-04	8E-05	2E-04	8E-04
Exposed Waste Pit Materials								
Radiocarcinogenic Risk	2E-02	2E-02	2E-03	2E-03	NA	NA	7E-05	NA
Chemical Carcinogenic Risk	9E-03	9E-03	6E-04	4E-03	NA	NA	2E-04	NA
Total[a]:	3E-02	3E-02	3E-03	6E-03	NA	NA	2E-04	NA
Surface Soil								
Radiocarcinogenic Risk	7E-04	7E-04	4E-05	1E-04	NA	NA	NA	5E-04
Chemical Carcinogenic Risk	1E-03	1E-03	6E-05	5E-04	NA	NA	NA	9E-04
Total[a]:	2E-03	2E-03	1E-04	6E-04	NA	NA	NA	1E-03
Buried Pit Material								
Radiocarcinogenic Risk	1E-03	1E-03	2E-04	2E-07	NA	NA	7E-09	NA
Chemical Carcinogenic Risk	NA	NA	NA	NA	NA	NA	NA	NA
Total[a]:	1E-03	1E-03	2E-04	2E-07	NA	NA	7E-09	NA
On-property Surface Water								
Radiocarcinogenic Risk	3E-04	3E-04	1E-05	4E-05	NA	NA	NA	3E-04
Chemical Carcinogenic Risk	6E-06	6E-06	4E-07	1E-06	NA	NA	NA	6E-06
Total[a]:	3E-04	3E-04	1E-05	4E-05	NA	NA	NA	3E-04
Groundwater								
Radiocarcinogenic Risk	2E-02	5E-01 b	2E-03	1E-03	2E-03	9E-05	NA	NA
Chemical Carcinogenic Risk	4E-02	9E-01 b	3E-03	9E-03	0E+00	0E+00	NA	NA
Total[a]:	6E-02	1E+00 b	4E-03	1E-02	2E-03	9E-05	NA	NA
All Media								
Radiocarcinogenic Risk	5E-02	5E-01 b	4E-03	3E-03	2E-03	1E-04	2E-04	8E-04
Chemical Carcinogenic Risk	5E-02	9E-01 b	4E-03	1E-02	3E-04	7E-05	2E-04	2E-03
Total[a]:	1E-01	1E+00 b	8E-03	2E-02	2E-03	2E-04	4E-04	2E-03

NA – Not applicable. Exposure route not evaluated for receptor.
[a] Radiocarcinogenic and chemocarcinogenic risks are not truly additive. A total is provided for reference only.
[b] Risks calculated and total summed based on the use of the 1-hit equation for calculating risks from higher doses (EPA 1989a), therefore, total risks will not exceed 1.0.

TABLE 6-10

HAZARD INDEX SUMMARY
FUTURE LAND USE (AGRICULTURAL USE)
FUTURE SOURCE TERM

Media	On-property RME Farmer	On-property RME Farmer (User of Perched GW)	On-property CT Farmer	On-property Young Child	Off-property Farmer	Off-property Young Child	Homebuilder	Off-property User of Meat and Milk Products
Air	8.4E+00	8.4E+00	4.3E+00	2.8E+01	5.2E-01	1.7E+00	6.4E+00	1.9E+00
Exposed Waste Pit Materials	2.3E+01	2.3E+01	9.9E+00	9.8E+01	NA	NA	5.4E+01	NA
Surface Soil	5.3E+00	5.3E+00	2.6E+00	2.7E+01	NA	NA	NA	2.7E+00
On-property Surface Water	3.3E-01	3.3E-01	1.5E-01	2.7E+00	NA	NA	NA	3.3E-01
Groundwater	5.0E+02	6.0E+03	2.7E+02	1.4E+03	3.1E+01	8.8E+01	NA	NA
All Media	5.4E+02	6.1E+03	2.9E+02	1.6E+03	3.2E+01	9.0E+01	6.0E+01	4.9E+00

NA – Not applicable. Exposure route not evaluated for receptor.

TABLE 6-11

UNCERTAINTIES ASSOCIATED WITH ESTIMATED RISKS FROM OPERABLE UNIT 1

Source of Uncertainty	Magnitude [a]	Expected Direction [b]	Remark
Selection of CPCs			
• Adequacy of database	Low to Moderate	Increases or decreases conservatism	CPCs may be underestimated. Principal constituents were identified.
Exposure Assessment			
• Calculated exposure point concentrations			
- positive bias in sampling	Moderate	Increases conservatism	Source concentrations based on 95% UCL or maximum. Sampling was biased for radiological CPCs
- conservative modeling assumptions	High	Increases conservatism	Modeled concentrations were conservative.
• Determination of land uses			
- current scenario	Low	Increases conservatism	Scenario based on current environmental setting
- future scenario	High	Increases conservatism	Worst case scenario assumed.
• Assumptions for source terms			
- current source term	Low	Increases or decreases conservatism	Current source term assumes waste pits covered and surface water runoff treated.
- future source term	Moderate	Increases conservatism	Future source term assumes failure of Waste Pit 3 cap.
• Selection of receptors			
- current scenario			
- future scenario	Low	Increases conservatism	Scenario based on current environmental setting.
• Determination of exposure factors	High	Increases conservatism	Worst case scenario assumed.
	Low to moderate	Increases conservatism	Receptor and exposure pathway specific.

TABLE 6-11
(Continued)

Source of Uncertainty	Magnitude [a]	Expected Direction [b]	Remark
Toxicity Assessment			
• Dose-response assessment			
- chemical CPCs	High	Increases conservatism	Dose-response based on animal data.
- radiological CPCs	Low	Increases conservatism	Dose-response based on human data.
internal	Moderate to high	Increases conservatism	Conservative assumptions made for external exposure.
external			
• Other OU1 CPCs	Low	Increases conservatism	PAHs pose low risk.
- dose-response for PAHs	Low	Increases conservatism	PCBs pose relatively low risk.
- dose-response for PCBs	Low	Increases conservatism	Furans/dioxins relatively low risk.
- dose-response for dioxins/furans	Low to moderate	Increases conservatism	Assumptions for indoor Rn-222 differ from those made for the CSF.
- dose-response for Rn-222 (indoors)			
Risk Characterization			
• Additivity	Low to moderate	Increases conservatism	Health effects dominated from few CPCs and exposure pathways.
• Effect of tentatively identified compounds (TICs)	Low	Decreases conservatism	Relatively few TICs.
• Failure to consider antagonism	Unknown	Increases conservatism	Data unknown.
• Failure to consider synergism	Unknown	Decreases conservatism	Data unknown.
• Failure to consider segregation of HIs	Low	Increases conservatism	HIs dominated by few CPCs and exposure pathways.
Overall	High	Increases conservatism	High uncertainty from combining low, moderate, and highly uncertain parameters.

[a] Magnitude is assessed qualitatively based on professional judgment and includes the following:
Low-impact risk by a factor of 10 or less.
Moderate-impact risk by a factor of 10 to 100.
High-impact risk by a factor of 100 or more.

[b] Direction is assessed qualitatively where an increased conservatism increases final health effects and a decreased conservatism decreases final health effects calculated in risk assessment.

Section 7

As a basis for comparison, calculations of the risk associated with the natural background concentration of radionuclides and inorganic metals in soil were performed using the same assumptions as used in the resident farmer scenario. The radiocarcinogenic risk associated with background concentrations of radionuclides under these conditions was calculated as 7×10^{-4} for the soil pathways. A calculation for the risk from natural cosmic radiation yielded a risk of 2×10^{-3}. A hazard index of approximately 8 was calculated for background metals concentrations in soil.

Of the scenarios presented, the current land use with access controls most closely approximates current conditions at the FEMP. However, conservative assumptions were made, consistent with those made for other scenarios, to ensure that the calculated baseline risk represents an upper bound.

Risk estimates are derived by combining the results of the exposure assessment and the toxicity information to quantitatively estimate the degree of hazard associated with exposure to CPCs. The ranges of generally acceptable risk under CERCLA are an ILCR less than 10^{-4} (1 in 10,000) and an hazard quotient of less than 1.

7.5.3.1 Current Land Use With Access Controls - Current Source Term

Risks for various receptors from all transfer media are presented for the current source term scenario in Table 7-5. The maximally exposed individual in this scenario is the groundskeeper. This person,
TBL through routine exposure over a period of 25 years, could incur a risk of ~~9×10^{-5}~~ 1×10^{-4} (1 in 10,000) from radiocarcinogens. The majority of the risk is due to exposure to penetrating radiation from buried waste pit materials (under extremely conservative assumptions) and external exposure from surface soil.

The total chemical carcinogenic risk for this receptor was estimated at 1×10^{-5} and is due solely to dermal contact with soil. Beryllium and PCBs are the major contributors to the total chemical risk.

The total hazard index for this receptor was estimated at 0.3, due to dermal contact with soil.

7.5.3.2 Current Land Use Without Access Controls - Current Source Term

Under this scenario, the maximally exposed individual is assumed to be the off-property user of meat and milk products. This receptor is exposed only to those contaminants which result from cattle

grazing on the FEMP property. Because the current source term is considered, only those contaminants identified in the surface soil and surface water were evaluated.

TBL The total radiocarcinogenic risk for this receptor was ~~4×10^{-4}~~ 7×10^{-4} due primarily to milk consumption. Uranium-238, U-234, Sr-90, and Cs-137 were the major contributors to this risk.

TBL The total chemical carcinogenic risk for the off-property user of meat and milk was ~~8×10^{-4}~~ 9×10^{-4}. This risk was due primarily through root uptake. PCBs and BAPs were the primary chemical carcinogens in this assessment.

TBL The hazard index for this receptor was estimated at ~~2~~ *2.9*, due primarily to cadmium, uranium, and antimony uptake via milk.

The trespassing ~~child~~ youth could also experience significant risk. The total radiocarcinogenic risk
TBL was estimated at ~~3×10^{-5}~~ 5×10^{-5} (5 in 100,000), which is comprised of several components roughly similar in magnitude of risk. Penetrating radiation exposures from buried waste pit materials, external exposure from surface soil, and inhalation of dust and radon make up 100 percent of the total risk. The most significant contributors to the risk, in descending order, are U-238, Th-230, U-234, and Rn-222 for air exposures, and Ra-226 and Th-228 for the external exposures. The hazard index for this receptor was 0.5.

7.5.3.3 Current Land Use - Future Source Term

Table 7-6 is a summary of risk to various receptors based on the future source term scenario for the current land use (industrial) and future land use (agricultural). The receptor subject to the greatest ILCR for the current land use/future source term configuration is the off-property resident farmer. This receptor is only exposed to those media and contaminants subject to transport from the site. Since the source term is varied to account for erosion of caps, etc., this receptor would experience additional risks over those of the current source term scenario. For example, exposure to contaminants migrating in the Great Miami aquifer are considered for the future source term.

While the risks are presented as a total for both air and groundwater exposures, it should be noted that the points of maximum risk for these two media do not coincide temporally. Risk sums did assume these two occur during the same time frame.

The total carcinogenic risk from exposure to radionuclides is projected at ~~2×10^{-3}~~ 2×10^{-4}, and the
TBL total chemical carcinogenic risk is ~~3×10^{-4}~~ 2×10^{-3}. Uranium and thorium isotopes and radon are the primary CPCs in the radiologic risk via inhalation, and U-238 and other radionuclides control the groundwater risks from all pathways. Arsenic and nickel are the primary chemical carcinogens, and affect the receptor only via inhalation of fugitive dust emissions from the site.

TBL The total hazard index for this receptor is ~~30~~ *32*, with ingestion of drinking water, fruits and vegetables presenting the majority of the risk. An off-property child would experience a hazard index of 90.

7.5.3.4 Future Land Use - Future Source Term

Table 7-6 also summarizes the risk to various receptors based on the future source term scenario and future land use. The RME receptor for this configuration is obviously the on-property RME resident. This receptor, as discussed in the exposure assessment, is assumed to live in a home in the vicinity of Waste Pit 4, use water from the Great Miami aquifer for all potable and agricultural purposes, and grow food in the area of Waste Pits 1 and 2. The soil caps over Waste Pit 3 is assumed to have eroded, and waste material in Waste Pits 5 and 6 is exposed after the waste pits partially dry up.

Risks associated with ingestion of groundwater from the perched aquifer was not included in the total risk estimates. The aquifer is discontinuous, and is unlikely to yield enough water for anything other than ingestion alone. Therefore, while risks were calculated, they are not summed with the other pathway risks.

The total radiocarcinogenic risk for this receptor is estimated at 5×10^{-2}; these are primarily risks associated with the inhalation of dust and radon and external exposure to soil and exposed waste pit material. As with the other scenarios discussed above, uranium and thorium isotopes and radon drive the inhalation risks, and uranium, thorium, and radium isotopes drive the external exposure risks.

The chemical carcinogenic risks for this hypothetical receptor are 5×10^{-2}, and are due primarily to ingestion of drinking water from the Great Miami aquifer and ingestion of fruits and vegetables irrigated with groundwater or affected by particulate emissions from the waste pits. Arsenic is the primary contributor to the chemical carcinogenic risk, although other carcinogenic compounds such as

Section 7

Tables

TABLE 7-5

SUMMARY OF BASELINE RISK BY MEDIA AND RECEPTOR
CURRENT LAND USE, CURRENT SOURCE TERM

Media	Groundskeeper	Off-Property RME Resident Farmer	Off-Property Young Child	Trespassing Youth	Off-Property User of Meat and Dairy Products
Incremental Lifetime Cancer Risk Summary					
Air					
Radiocarcinogenic risk	6×10^{-6}	3×10^{-6}	2×10^{-7}	7×10^{-7}	NA[a]
Chemical carcinogenic risk	1×10^{-8}	2×10^{-7}	8×10^{-8}	2×10^{-9}	NA
Total[b]	6×10^{-6}	3×10^{-6}	2×10^{-7}	7×10^{-7}	NA
Buried Pit Material					
Radiocarcinogenic risk	5×10^{-5}	NA	NA	2×10^{-5}	NA
Chemical carcinogenic risk	NA	NA	NA	NA	NA
Total[b]	5×10^{-5}	NA	NA	2×10^{-5}	NA
Surface Soil					
Radiocarcinogenic risk	8×10^{-5}	NA	NA	3×10^{-5}	5×10^{-4}
Chemical carcinogenic risk	1×10^{-5}	NA	NA	9×10^{-6}	9×10^{-4}
Total[b]	9×10^{-5}	NA	NA	4×10^{-5}	1×10^{-3}
Surface Water					
Radiocarcinogenic risk	NA	NA	NA	NA	2×10^{-4}
Chemical carcinogenic risk	NA	NA	NA	NA	6×10^{-6}
Total[b]	NA	NA	NA	NA	2×10^{-4}
All Media					
Radiocarcinogenic risk	1×10^{-4}	3×10^{-6}	2×10^{-7}	5×10^{-5}	7×10^{-4}
Chemical carcinogenic risk	1×10^{-5}	2×10^{-7}	8×10^{-8}	9×10^{-6}	9×10^{-4}
Total[b]	1×10^{-4}	3×10^{-6}	2×10^{-7}	5×10^{-5}	2×10^{-3}

TABLE 7-5
(Continued)

Media	Groundskeeper	Off-Property RME Resident Farmer	Off-Property Young Child	Trespassing Youth	Off-Property User of Meat and Dairy Products
Toxicity Summary					
Air	0	0.0003	0.001	0	NA
Surface Soil	0.3	NA	NA	0.5	2.7
Surface Water	NA	NA	NA	NA	0.2
Total - All Media	0.3	0.0003	0.001	0.5	2.9

[a]NA - Not applicable. Exposure route not evaluated.
[b]Radiocarcinogenic and chemocarcinogenic risks are not truly additive. Provided for reference only.

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TABLE 7-6

SUMMARY OF BASELINE RISK BY MEDIA AND RECEPTOR FUTURE SOURCE TERM

	Current Land Use		Future Land Use Government Reserve		Future Land Use Agricultural				
	Trespassing Youth	Great Miami River User	Groundskeeper	Expanded Trespasser	On-Property RME Adult Farmer	On-Property CT Adult Farmer	On-Property RME Child	Home Builder	Off-Property Farmer
Incremental Lifetime Cancer Risk									
Air									
Radiocarcinogenic Risk	8×10^{-5}	NA[a]	7×10^{-4}	1×10^{-4}	5×10^{-3}	4×10^{-4}	9×10^{-5}	5×10^{-5}	2×10^{-4}
Chemical Carcinogenic Risk	4×10^{-5}	NA	2×10^{-4}	6×10^{-5}	5×10^{-3}	3×10^{-4}	1×10^{-3}	2×10^{-5}	3×10^{-4}
Total[b]	1×10^{-4}	NA	9×10^{-4}	2×10^{-4}	1×10^{-2}	7×10^{-4}	1×10^{-3}	7×10^{-5}	5×10^{-4}
Buried Pit Material									
Radiocarcinogenic Risk	7×10^{-6}	NA	5×10^{-5}	3×10^{-5}	1×10^{-3}	2×10^{-4}	2×10^{-7}	7×10^{-9}	NA
Chemical Carcinogenic Risk	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total[b]	7×10^{-6}	NA	5×10^{-5}	3×10^{-5}	1×10^{-3}	2×10^{-4}	3×10^{-7}	7×10^{-9}	NA
Surface Soil/Exposed Pit Material	1×10^{-4}	NA	4×10^{-4}	3×10^{-4}	7×10^{-4}	4×10^{-5}	2×10^{-3}	7×10^{-5}	NA
Radiocarcinogenic Risk	7×10^{-5}	NA	2×10^{-4}	2×10^{-4}	1×10^{-3}	6×10^{-5}	4×10^{-3}	2×10^{-4}	NA
Chemical Carcinogenic Risk	2×10^{-4}	NA	6×10^{-4}	5×10^{-4}	2×10^{-3}	1×10^{-4}	6×10^{-3}	2×10^{-4}	NA
Total[b]									
Sediment									
Radiocarcinogenic Risk	4×10^{-6}	NA	NA	4×10^{-6}	NA	NA	NA	NA	NA
Chemical Carcinogenic Risk	9×10^{-6}	NA	NA	1×10^{-5}	NA	NA	NA	NA	NA
Total[b]	1×10^{-5}	NA	NA	1×10^{-5}	NA	NA	NA	NA	NA
Groundwater									
Radiocarcinogenic Risk	NA	NA	NA	NA	2×10^{-2}	2×10^{-3}	1×10^{-3}	NA	2×10^{-3}
Chemical Carcinogenic Risk	NA	NA	NA	NA	4×10^{-2}	3×10^{-3}	9×10^{-3}	NA	0
Total[b]	NA	NA	NA	NA	6×10^{-2}	4×10^{-3}	1×10^{-2}	NA	2×10^{-3}

TABLE 7-6
(Continued)

	Current Land Use		Future Land Use Government Reserve		Future Land Use Agricultural				
	Trespassing Youth	Great Miami River User	Groundskeeper	Expanded Trespasser	On-Property RME Adult Farmer	On-Property CT Adult Farmer	On-Property RME Child	Home Builder	Off-Property Farmer
Incremental Lifetime Cancer Risk									
Surface Water									
Radiocarcinogenic Risk	NA	3×10^{-7}	NA	7×10^{-8}	3×10^{-4}	1×10^{-5}	4×10^{-5}	NA	NA
Chemical Carcinogenic Risk	NA	3×10^{-8}	NA	6×10^{-8}	6×10^{-6}	4×10^{-7}	1×10^{-6}	NA	NA
Total[b]	NA	3×10^{-7}	NA	1×10^{-7}	3×10^{-4}	1×10^{-5}	4×10^{-5}	NA	NA
All Pathways[c]									
Radiocarcinogenic Risk	2×10^{-4}	3×10^{-7}	1×10^{-3}	4×10^{-4}	5×10^{-2}	4×10^{-3}	3×10^{-3}	2×10^{-4}	2×10^{-4}
Chemical Carcinogenic Risk	1×10^{-4}	3×10^{-8}	4×10^{-4}	3×10^{-4}	5×10^{-2}	4×10^{-3}	1×10^{-2}	2×10^{-4}	2×10^{-3}
Total[b]	3×10^{-4}	3×10^{-7}	2×10^{-3}	7×10^{-4}	1×10^{-1}	8×10^{-3}	2×10^{-2}	4×10^{-4}	2×10^{-3}
Toxicity Summary									
Air	0.3	NA	0.6	0.3	8	4.3	30	6.4	0.5
Surface Soil/Exposed Pit Material	1.5	NA	1.6	3.5	23	13	100	54	NA
Sediment	0.1	NA	NA	0.1	NA	NA	NA	NA	NA
Groundwater	NA	NA	NA	NA	500	300	1,000	NA	31
Surface Water	NA	0.004	NA	0.04	0.3	0.2	3	NA	NA
Total - All Media[b]	1.9	0.004	2.2	4	500	300	2,000	60	32

[a]NA - Not applicable. Exposure route not evaluated.
[b]Radiocarcinogenic and chemical risks not readily summable. Provided for reference only.
[c]Totals do not include ingestion of perched water.

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TABLE 7-7

DATA LIMITATIONS AND RECOMMENDED ACTIONS

Data Limitation	Significance to Alternatives Evaluation	Significance to Baseline Risk Assessment	Recommended Action/Justification
The site characterization did not obtain samples of materials from beneath the waste pits to allow evaluation of contaminant migration through the pit bottom.	Increased uncertainty in the depth to which contaminants have migrated will increase the uncertainty in the excavation cost estimate for ex situ options and increase the uncertainty in residual risk for in situ options.	Increased uncertainty in the baseline risk due to reliance on transport modeling to establish rate of contaminant movement.	DOE and U.S. EPA reached a consensus that sampling of the soils beneath the waste pits was deemed impractical. Any attempt to collect samples by boring through the bottom of the pits ran the risk of releasing pit leachate into the Great Miami Aquifer. Transport modeling is used to establish the movement of contaminants from the waste pits into the soil beneath the pit. This allows the estimation of the quantity of contaminants beneath the pits and their volume to a sufficient level of confidence to meet the objectives of the detailed analysis of alternatives. No additional action is warranted nor advisable at this time. Additional characterization to limit uncertainty in residual risk could be obtained using extraordinary measures (e.g., tunnelling) at a later time if in situ options are not eliminated during the feasibility study. While additional samples from beneath the pits might slightly increase the confidence in the baseline risk assessments, conservative assumptions were used to ensure that risks to potential receptors were not underestimated. Such sampling would only allow one to determine the magnitude of the positive bias introduced by the conservative assumption used in the risk assessment.

TABLE 7-7
(continued)

Data Limitation	Significance to Alternatives Evaluation	Significance to Baseline Risk Assessment	Recommended Action/Justification
Limited organic analyses for the waste contained in Pits 5, 6 and the Clearwell. All organic analyses collected under the 1992 RI/FS treatability program were rejected due to missed holding times.	Limited information on which to base treatment options for these waste units. This requires a conservative approach in assuming these contaminants to be present in the waste stream when evaluating process options.	Increased uncertainty in the total source available for leaching from the waste pit. Uncertainty in the selection of constituents of potential concern (CPC).	No additional sampling is warranted. Organic analytical results were available from the CIS for both waste material and leachate. These data were not collected in order to meet the objectives of the RI but were to be evaluated to supplement and confirm the limited data set available from the CIS thereby increasing the confidence level of any decision made. The level of confidence is high for decision making for treatment options based on the extensive treatability studies currently being conducted on all Operable Unit 1 wastes. Further, based on process knowledge there is no reason to assume that significant differences exist in the organic waste characteristics between the waste pits. Because many organics are present in the waste stream from other waste pits, the treatment options must accommodate their presence. Little impact to the overall uncertainty in the baseline risk assessment arises from the total inventory of organics in these waste units. Sufficient information is available to characterize the leachate migrating from these areas by using the surface liquid collected from each unit. For transport via air, organic constituents in general contributed little to the overall risk for any of the modelled waste units. Finally, risks projected for most receptors already exceed the regulatory threshold recommending remedial actions be conducted. In June/July 1993, four additional samples were collected from the surface of Pits 5, 6 and the Clearwell and analyzed for organic constituents. The samples were collected to supplement available data used to describe nature and extent of contamination in OU1, to reduce uncertainties in calculations and modeling supporting risks assessment, and to support preliminary remedial design. An analysis of the sample data indicates no significant impact to the baseline risk assessment.

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TABLE 7-7
(continued)

Data Limitation	Significance to Alternatives Evaluation	Significance to Baseline Risk Assessment	Recommended Action/Justification
Analytical data for dioxins and furans for Waste Pits 5 and 6 and the Clearwell are unavailable. No analyses were performed for the CIS and all organic analyses were rejected for the 1992 RI/FS Treatability Sampling Program due to extended holding times and unacceptable storage methods.	Limited information on which to base treatment options for these waste units.	Increased uncertainty in the total source available for leaching from the waste pit. Uncertainty in the selection of constituents of potential concern. Potential for negative bias in risk characterization for future source term scenario via the air pathway.	Waste Pit 5 and Waste Pit 3 are similar in the types of waste placed within them. Waste Pit 3 was found to have measurable concentrations of dioxins and furans. Based on process knowledge, these constituents are thought to have been generated during the incineration of paper and its subsequence processing through Plant 2/3 to remove uranium. During uranium removal, these constituents are incorporated in the raffinates which were disposed of in Waste Pit 3. The practice of incineration residue processing was discontinued prior to the operation of Waste Pit 5; therefore, their presence is not expected in this waste pit. The treatability program is based on the knowledge that dioxins and furans are present in Waste Pit 3. Their presence or absence in Waste Pit 5 will not impact the treatability program. Dioxin and furans were identified as constituents of potential concern for the waste units and fate and transport modeling was performed for these constituents. Air modeling for release of material from Waste Pit 3 (following cover failure) and risk characterization to the on-property and off-property farmer concluded that dioxins and furans were extremely small contributors to risk for these individuals. Therefore, lack of data for Waste Pit 5 and the Clearwell are judged to have no significant impact to the risk assessment. Waste Pit 6 did not receive wastes identified as potential contributors of dioxins and furans.

TABLE 7-7
(continued)

Data Limitation	Significance to Alternatives Evaluation	Significance to Baseline Risk Assessment	Recommended Action/Justification
Sample preparation methods for samples collected by the CIS sampling program, resulted in high sample quantitation limits for chemical analyses.	Limited data sets available for determining treatability needs.	Increased uncertainty in the source term present for migration.	No additional sampling is warranted. An extensive treatability program is in progress to determine the applicability of various treatment alternatives. These studies are not impacted by the SQL of chemical analyses performed on the untreated wastes. The treated wastes will be analyzed at appropriate quantitation limits. The baseline risk assessment was conducted using one-half the SQL for all non-detects in accordance with EPA guidance for contaminants selected as constituents of potential concern. Based upon the chemical quantitation limits and detections of the 1991 RI/FS sampling program it is judged that this practice would tend to overestimate the projected risk to the receptors.

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TABLE 7-7
(continued)

Data Limitation	Significance to Alternatives Evaluation	Significance to Baseline Risk Assessment	Recommended Action/Justification
The waste pits are heterogeneous and due to the limited number of samples collected per pit, the characterization data may not be fully representative of the distribution of the waste constituents.	Increased uncertainty in the maximum concentration of any individual constituent present in a pit (waste unit) hampering the evaluation of the suitability of treatment options.	The source term defined by the mean of the sample distribution may not represent the "true" average concentration within the waste unit. Utilizing the calculated mean in fate and transport modeling could lead to underestimation of the exposure point concentration in a transfer medium, since limited sampling may not identify "hot spots" within the pits (waste units).	Collection of additional data is not warranted. The program for collection of samples from within the pits was biased toward collection and identification of those contaminants with the highest concentration constituting the major sources of risk. This was accomplished by the use of field screening techniques, specifically, beta-gamma detection equipment to select samples with high radiological concentrations and sampling to select material highest in organic chemicals. Samples for use in treatability analyses were bestowed over larger regions of the pit. In addition, the upper confidence level (95 %) of the mean (UCL) was utilized in calculating the quantity of a contaminant present within a waste unit which is likely to overestimate this value. These UCL values were also used in air contaminant transport modeling. For extremely small data sets the maximum detected concentration was used as the source concentration. Both of these techniques lead to the potential for a positive bias in risk results. Leachate from the waste unit is a natural mechanism for "averaging" the contents of a waste unit. Leachate concentrations were preferred for use as source terms in contaminant fate and transport via groundwater from the waste unit. In June/July 1993, twenty-two additional samples were collected from 1700-series monitoring wells within Waste Pits 1, 2, 3 and 4 and the Burn Pit. The samples were collected to supplement available data used to describe nature and extent of contamination in OU1, to reduce uncertainties in calculations and modeling supporting risk assessment, and to support preliminary remedial design. An analysis of the sample data shows no significant impact to numbers of CPCs or to the baseline risk assessment.

TABLE 7-7
(continued)

Data Limitation	Significance to Alternatives Evaluation	Significance to Baseline Risk Assessment	Recommended Action/Justification
Even with the large numbers of surface soil samples evaluated it remains uncertain that all localized areas with elevated constituent concentrations have been detected.	The uncertainty in the concentration of contaminants present in the surface soil yields uncertainty in the short term effectiveness for worker health and safety due to air transport of surface soil contaminants during the remedial action. Further, similar uncertainty would result in establishing residual risk in situ alternatives and in volume and cost estimates for ex situ alternatives.	The uncertainty in surface soil contaminant concentrations yields uncertainty in the exposure point concentrations used in risk characterization.	No additional sampling is warranted. Localized areas of elevated contaminant concentrations are anticipated in preparation of health and safety plans for workers. Further, localized areas of elevated contaminant concentrations are assumed in the evaluation of remedial action alternatives through the use of the UCL of the mean to represent contaminant concentration. Finally, any remedial actions undertaken in Operable Unit 1 will significantly disturb the surface soil over the entire unit area, necessitating systematic monitoring and/or sampling of surface soil during such activities. The baseline risk assessment follows U.S. EPA guidance by using the UCL of the mean as the exposure point concentration. This method is judged by U.S. EPA to "account" for any missed "hot spots" during the soils characterization program. Conservatism is also achieved by assuming that the receptor spends long periods of time in the Operable Unit 1 area. In June/July 1993, twenty-nine additional surface soil samples were collected from areas adjacent to the waste pits. The samples were collected to supplement available data used to describe nature and extent of contamination in OU1, to reduce uncertainties in calculations and modeling supporting risk assessment, and to support preliminary remedial design. An analysis of the sample data, presented in Section E.6, shows no significant impact to the baseline risk assessment.

TABLE 7-7
(continued)

Data Limitation	Significance to Alternatives Evaluation	Significance to Baseline Risk Assessment	Recommended Action/Justification
A number of Tentatively Identified Compounds (TICs) were found in pit material samples in the low ppm and ppb ranges. These constituents were removed from the quantitative analysis based on EPA risk assessment guidance and protocols. Qualifiers used to evaluate TICs indicate that the presence of the compounds and their concentions were unreliable for quantitative statistical evaluation and quantitive risk assessment.	TICs are of uncertain origin and are defined as those compounds that may result from chromatographic responses that exceed 10 percent of the nearest internal standard. Evaluation of TICs, therefore, may impact statistical evaluations of CPCs, total risk, and PRLs.	The potential for toxicity and risk of TICs is uncertain since their estimated levels and availability of expert and clinical information on dose response and toxicity is non-existent.	No further action is required. The TICs appear to be relatively non-toxic with a minimum potential for exposure, primarily from the pit material. Although there is risk of hazard from the exposure to the eyes and skin, this appears to be minimal because the source material has a very low level concentration in the pit material. The volume of pit material required for ingestion to produce an adverse effect from these levels of materials would be in excess of a few kilograms (2-3 lbs or more) and is highly unlikely. Any possible risk would likely be occupational considering its likely that a construction or remedial worker, digging in the soil, would be exposed to the pit material TICs. These materials may be present due to the residuals blown over from crop farms and/or present due to existing biological (plants, insects, microbes) products present naturally in the soils. This would tend to reduce the expectation that these materials would be toxic. There are few only at very small amounts and it would require the receptor to consume inordinately large volumes of pit material to reach toxic levels. Under chronic conditions of exposure, a positive impact on risk always exists. The primary potential of such materials is to irritate the mucous membranes of the eyes and the respiratory tract. Given their presence in the pit material, the impact is minimal, if at all.

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Appendix E

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average exposure scenario is known as the central tendency (CT) scenario throughout this report.

Justification: Specific guidance on the implementation and use of the CT scenario is not yet available from EPA's Office of Emergency and Remedial Response, so interim guidance from EPA Region V has been used in constructing this scenario and in presenting the risks to a hypothetical receptor resulting from the calculated average exposures.

- The methods used to calculate exposures from direct exposures to radiation, dermal contact, and inhalation while showering have been changed to reflect EPA guidance that became available after the Risk Assessment Work Plan Addendum was published. These are presented in more detail in the section on the exposure assessment (Section E.3.0).

  Justification: DOE and EPA have agreed that the Baseline Risk Assessment will use the most recently recommended and approved methods, models, and parameters.

- The removal processes considered to predict concentrations in food include the effects of leaching in addition to the radioactive and chemical decay presented in the Risk Assessment Work Plan Addendum. This is presented in more detail in the section on the exposure assessment (Section E.3.0 of this appendix).

  Justification: During irrigation and aerial deposition, contaminants are added to the soil. Simultaneously, radioactive decay, chemical degradation, and soil leaching deplete these contaminants. The methodology set forth in the Risk Assessment Work Plan Addendum effectively calculates radioactive decay and chemical degradation, but approximates the effect of leaching by calculating plant concentrations after 70 years of deposition/irrigation. This approach is appropriate for most chemical and radionuclides at the site. However, this approach overestimates the concentrations of very mobile contaminants such as Tc-99. An updated methodology, based on work published in National Council on Radiation Protection (NCRP) Report No. 76 (NCRP 1984) and Commentary No. 3 (NCRP 1989) has been adopted to more accurately represent the physical processes at the site.

466 *43-US* ~~• Toxicological screening was performed using risk-based screening criteria (EPA 1993b). Chemicals presenting a HQ less than 0.1 or ILCR lower than 10^{-7} [one order of magnitude less than the value presented in the risk-based screening tables (EPA 1993c)] were removed from the CPC list. Solid samples were compared to residential surface soil and liquid samples were compared to tap water.~~

~~Justification: This scheme provides a consistent, repeatable and regularly updated method for performing toxicological screening.}~~

310 36-US

- Risks and hazard quotients (HQs) are not quantified for chemicals for which toxicity data are not available in IRIS, HEAST, or from ECAO.}
  Some contaminant exposures (childhood exposures to lead, dermal exposure to PAH, etc.) might be better addressed using a qualitative approach.
  Justification: It is not possible to perform a quantitative risk assessment for chemicals for which toxicity data are not available. The large number of chemicals that are quantitatively assessed is adequate to provide estimates of risk for this operable unit.

Since publication of the Risk Assessment Work Plan Addendum, EPA has provided additional technical guidance concerning methods, models, and parameters that has been incorporated into this Baseline Risk Assessment to the fullest extent possible. Additional guidance documents are referenced where applicable.

2/24/94 Meeting

E.1.3.3 Recent Agency Guidance

On February 24, 1994 a meeting was held between USEPA Region V and DOE personnel. In this meeting, agreements were reached regarding use of a new receptor (the expanded trespasser), dermal exposure to polycyclic aromatic hydrocarbons (PAHs), child inhalation rates, and skin surface area used for dermal exposure. The approach used in this baseline risk assessment was modified for consistency with these agreements.

Expanded Trespasser

For the purpose of establishing preliminary remediation goals (PRGs) for the Future Land Use With Continued Federal Ownership, an on-property trespassing receptor was established. Under this exposure scenario, access to the site would be restricted and discouraged through the construction and maintenance of signs, fences, and locked gates around the perimeter of the restricted area. Despite these controls, it was assumed that trespassing would occur. The expanded trespassing scenario assumes a youth (ages 6 to 18) trespasses 110 days per year for two hours each day and the same person trespasses as an adult (ages 18 to 50) 40 days per year for one hour each day. This receptor and the associated exposure factors apply only to Operable Units 1, 2, 3, and 4. The risk assessment for the OU5 FS will include additional trespassing as well as recreational exposure scenarios, which are to be fully developed on a site-wide basis within the Operable Unit 5 RI/FS. A full array of trespassing and recreational exposure scenarios from no trespassing through full recreational use of the site will be developed.

Dermal Exposures to PAHs

Reliable cancer slope factors for dermal exposure to (PAHs) are currently unavailable. Current policy indicates it is inappropriate to extrapolate dermal slope factors from oral slope factors for PAHs. Also, extrapolation from other routes of exposure is inappropriate due to varied absorption, metabolic transformations and target organ end point responses. However, PAHs are potent skin carcinogens. Current information on the contribution to cancer risk from dermal exposure to PAHs indicates the toxicity from the dermal pathway may be as toxic as from the oral route of exposure. In order to provide an estimate of the risk contribution from PAHs via dermal exposure for all direct contact pathways, the risk posed for dermal exposure was assumed equal to the risk from oral exposure.

Child Inhalation Rates

DOE calculated a value of 0.5 m^3/hr. for use as the appropriate value for the child's inhalation rate to be used for residential exposure scenarios. This value was developed utilizing currently used physiological parameters by pediatric medical practitioners from the Children's Hospital at the University of Cincinnati Medical Center. The ventilation volumes and rates used approximate the normal active child, in a conservative manner. The value developed for risk assessments is an upward adjustment of the normal child, to the moderately active child whose ventilation rate and volume are on the high side of the normal range. Accordingly, the value of 0.5m^3/hour is used as the inhalation rate for children, 0-6 years of age, and accounts for an increased activity above the normal resting level of activity. This value, developed in consultation with the physicians, is based upon current medical parameters used to treat patients. A value of .83m^3/hour was used for trespassing scenarios to account for even higher ventilation volumes.

Body Surface Area for Dermal Exposure

The 95th percentile body surface area value of 2.3m^2, recommended by EPA was the physiological parameter used for the human body surface area during calculation of dermal exposures for all risk assessments. DOE disagrees with this guidance and has presented a dissenting opinion. The matter will be examined by EPA, but until such time that EPA acts upon this matter, the above value will be used. {Meeting Comment End}

E.1.4 OVERVIEW OF OPERABLE UNIT 1 CONCEPTUAL MODEL

Conceptual site models facilitate consistent and comprehensive evaluation of the risks to human health by creating a framework for identifying the paths by which human health may be impacted by contaminants found at Operable Unit 1. The conceptual models depict the relationships between five elements necessary to construct a complete exposure pathway:

- Sources of potential constituents of concern
- Release mechanisms
- Transport pathways
- Exposure mechanisms and exposure routes
- Receptors

Two conceptual site models were developed for Operable Unit 1 to provide the basis for identifying the potential risks to human health. One conceptual site model considers the potential risks to human health from the current configuration of Operable Unit 1 source terms and receptors (current conditions) and the second model considers potential risks from a hypothetical future configuration of Operable Unit 1 source terms and receptors (future conditions). Three land use configurations are also considered: (1) current land use with access controls; (2) current land use without access controls, and (3) future land use without access controls. The conceptual site models do not consider existing contamination in groundwater or any off-site media, which will be addressed in the Operable Unit 5 risk assessment. Only soil, surface water, and waste pit material from within the boundaries of Operable Unit 1 are considered, as are future groundwater, surface water, and sediment contamination that has as its source the media within the Operable Unit 1 boundaries.

Appendix E-1

Tables

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TABLE E.1-1

OPERABLE UNIT 1 UNIT DESCRIPTION

Unit	Period of Operation	Physical Inventory	Physical Description
Waste Pit 1 Waste Capacity: 48,500 cubic yards	1952-1959	Brick, magnesium fluoride slag, neutralized waste filter cake, scrap graphite, sump cakes from the production facility, sump liquor, and uranium.	Clay liner; silts and clays with varying grain size; solid, semisolid and grease-like materials; 0.5-foot cover soil; 70 percent vegetative cover.
Waste Pit 2 Waste Capacity: 24,200 cubic yards	1957-1964	Brick, magnesium fluoride slag, neutralized waste filter cake, scrap graphite, sump cakes from production plants, sump liquor, raffinates, thorium, and uranium.	Clay liner; coarse sand; clay and silt-material of semisolid consistency; fragments of concrete up to 1-inch size; 1-to 4-foot soil cover; 70 percent vegetative cover.
Waste Pit 3 Waste Capacity: 204,000 cubic yards	1959-1977	Liquid effluent and slurries, lime neutralized raffinates, slag leach residues, uranium, and thorium.	Clay liner; coarse-grained material underlain by very soft, moist to wet, semisolid material; wood fragments; soil/flyash cover up to 14 ft. deep; 70 percent vegetative cover.
Waste Pit 4 Waste Capacity: 55,100 cubic yards	1960-1986	Asbestos and paint, dust collector residues, process residues, trailer cake, uranium, thorium, neutralized raffinate, uranium tetrafluoride, uranium trioxide, black oxide, graphite, concrete, flyash, and pallets.	Clay liner; silt and sand with layers of clay below 10 feet; material was saturated below 9 feet; 6-foot layer of compacted clay with a PE. cover.
Waste Pit 5 Waste Capacity: 97,900 cubic yards	1968-1987	Neutralized raffinate, neutralized slag leach residue, sump sludge, wastewater from production area (through GS), steel and concrete rubble, uranium, and thorium.	Synthetic liner; standing water; 4 feet of watery material with sand-sized grains underlain by 25 feet of a 1,1,1-trichloroethane wet semisolid material with very little cohesion; covered with water.

TABLE E.1-1
(Continued)

Unit	Period of Operation	Physical Inventory	Physical Description
Waste Pit 6 Waste Capacity: 9,600 cubic yards	1979-1985	Asbestos, filter cake, process residues containing elevated levels of uranium, UF_4, and MgF_2	Synthetic liner; saturated, soft, coarse to fine sand and clay materials; covered with water.
Clearwell Waste Capacity: 3,700 cubic yards	1959-present	Arsenic, barium, mercury, aluminum, magnesium, calcium, cobalt, cyanide, calcium fluoride, iron, vanadium, PCBs, and trichloroethane	Clay liner; silt-sized, semi-solid material and sand; covered with water.
Burn Pit Waste Capacity: 30,300 cubic yards	1957-1969	Arsenic, mercury, aluminum, magnesium, calcium, iron, lead, silver, PCBs, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, pentachlorophenol(2), phenanthrene, 2-methylnaphthalene, tetrachlorethane, ethylbenzene, fluoranthene, phenol, xylenes, and pyrene	Silt-sized, semi-solid material; sand-sized material; and fill with glass, wood, and aluminum; not covered.

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$$x_1 \le x_2 \le \ldots \le x_i$$

$x_{j,\,(j=1\ to\ i)}$ = *sample concentrations*
i = *the number of background samples*

The 95th percentile concentration is then determined to be

$$C_{(.95)} = x_k \qquad \text{(E.2-3)}$$

such that

$$k \ge i \times 0.95 \ (i = \textit{number of samples})$$

where

$C_{(.95)}$ = *95th Percentile Concentration*

k = *The Identification Number of the Sample Selected*

E.2.2.2.2 Determination of Final Concentration Term

The final concentration term is determined by selecting the larger of the UCL/Max values from the two data sets. The final concentration term was used for modeling, risk assessment, and CPC screening.

E.2.3 IDENTIFICATION OF CONSTITUENTS OF POTENTIAL CONCERN (CPCS)

CPCs are selected based on the likelihood that they are anthropogenic, site-related, and their ability to produce carcinogenic or toxic effects. This section presents the systematic selection process used to compare constituent concentrations to background levels, and to assess the
33-US effectiveness of the constituent in inducing adverse health effects. ***A flow diagram describing the CPC selection procedure is presented in Figure E.2-1.***

E.2.3.1 Methodology

CPCs are determined using a two step procedure. The first is comparison to background levels (applicable to inorganic and radionuclide constituents only). Then, toxicological screening is performed. These steps are described separately below.

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317 E.2.3.1.1 Comparison to Background

The first step in selecting CPCs is to compare the site related data to background concentration levels. To conduct the comparison between the site-related measurements and the background data for a constituent, two tests were used in sequence: (1) a "location" test (Student's t-test or Wilcoxon Rank Sum test) and (2) followed by the "95th Percentile Test" (see below for details). If either of the test results rejects the null hypothesis (i.e., the distribution of measurements at the site appears to be shifted to the right (to higher measurements) of the background distribution), the constituent is considered to be a possible CPC and is submitted to toxicological screening. The constituent is not included as a possible CPC only if both test results indicate that there was not a "significant difference" between the two distributions. For cases where the location tests could not be performed due to small sample sizes or large portion of nondetects and the 95th Percentile Test suggests that the site-related data are not different from the background data, professional judgement by risk assessors was used to make the final determination.

The "location" test can be either the t-test, a parametric statistical method (assuming a normal distribution), or the Wilcoxon Rank Sum (WRS) test (or the Mann-Whitney U-test, a direct corollary to the WRS) which is the counterpart of the t-test in a nonparametric approach. The t-test was used to compare the mean of the site-related data with the mean of the background data. The WRS test compares two distributions of rank ordered data (equivalent distribution of ranks would indicate the data came from similar data sets). For instances in which the t-test cannot be applied to the data, the WRS test was conducted. Details of these procedures can be obtained from Gilbert,1987.

The 95th Percentile Test determines if any sample measurements for a given constituent exceed the upper 95th percentile for the background distribution. If so, the test indicates that the data contains at least one relatively high concentration and the constituent should be considered as a CPC. The 95th percentile for the background distribution can be computed as follows:

For background data with a normal distribution:

$$P_{95} = \bar{x} + z_{0.95} * s \qquad \text{(E.2-4)}$$

where:

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$\bar{x}$ = sample arithmetic mean
s = sample standard deviation
$z_{0.95}$ = 1.645

For background data with a lognormal distribution:

$$P_{95} = \exp(\bar{y} + z_{0.95} * s_y) \qquad \text{(E.2-5)}$$

where:

$\bar{y}$ = sample arithmetic mean of the log-transformed data ($y = \ln x$; $\bar{y} = \Sigma y/n$)
s_y = sample standard deviation of the log-transferred data
$z_{0.95}$ = 1.645

For background data with an undefined distribution:

If the distribution of the background data could not be adequately determined a non-
9-O parametric method was used to estimate the 95th percentile *(Maritz, J.S 1981)*. The initial step in determining the 95th percentile concentration is to order the data such that

$$x_1 \le x_2 \le \ldots \le x_i$$

where

$x_{j,\,(j=1\ to\ i)}$ = *sample concentrations*
i = *the number of background samples*

The 95th percentile concentration is then determined to be

$$C_{(.95)} = x_k \qquad \text{(E.2-6)}$$

such that

$$k \ge i \times 0.95 \ (i = \textit{number of samples})$$

where

$C_{(.95)}$ = *95th Percentile Concentration*

k = *The Identification Number of the Sample Selected*

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Because organic chemicals, some fission product radionuclides, and activation product radionuclides are not naturally occurring at measurable levels, background concentrations are assumed to be zero. Consequently, if these organic chemicals, fission products, or activation products are selected as CPCs, they are not based on comparison to background.

Inorganic and radiological constituents not significantly above background levels were excluded from the CPC list and assigned symbol "A" in Attachment E.II.}

E.2.3.1.2 Toxicological Screening

10-O After statistical comparisons to background were made, detected compounds which were shown to exceed background were subjected to toxicological screening to exclude constituents that are unlikely to have a human health risk at the levels detected. The following process was used:

- Essential macronutrients for which there are no known toxic effects at the concentrations defined were deleted. Examples of chemicals in this class include magnesium, calcium, potassium, and sodium. The deletion symbol "B" was assigned to chemicals deleted from the CPC list for this reason in Attachment E.II.
- Essential micronutrients for which there are no toxic effects at the concentrations found were deleted. Examples of chemicals in this class include iron and nitrate. Chemicals deleted for this reason were assigned the deletion symbol "C" in Attachment E.II.
- Ubiquitous elements in soil, not toxic except at high levels were deleted from the CPC list. Examples of chemicals in this class include Silicon, Aluminum, Chloride, Sulfide and Sulfate. Chemicals deleted for this reason were assigned the deletion symbol "D" in Attachment E.II.

44-US

- ~~Chemicals detected infrequently (less than 5%) at less than 5 times the method detection limit were deleted from the CPC list. Chemicals deleted for this reason were assigned the deletion symbol "E" in Attachment E.II.~~
- ~~Naturally occurring soil elements found in surface water at concentrations consistent with soil levels and that are non toxic at concentrations found were deleted from the surface water CPC list. These chemicals were assigned the deletion symbol "F" in Attachment E.II.~~

322

- Nonspecific chemical classes that are either too general to be useful for risk assessment (e.g., Total Organic Carbon) or for which chemical-specific results are presented in the same analysis (e.g., polynuclear aromatic hydrocarbons and chlorinated hydrocarbons) were excluded from the CPC list and assigned the deletion symbol "*E*" in Attachment E.II.}

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27-US

- *Chemicals with representative concentrations lower than screening values calculated from USEPA RAGs Part B, based on a HQ of 0.1 and a risk level of 10^{-7}, were removed from the CPC list and assigned the deletion symbol "F" in Attachment E.II.*

11-O ~~• Probable organic decomposition products occurring at less than 1 part per million were deleted from the CPC list and assigned the deletion symbol "H" in Attachment E.II.~~

~~• Volatile organic compounds with a vapor pressure less than 10 mm Hg at 20°C were excluded from the CPC list and assigned the deletion symbol "I" in Attachment E.II.~~

318, 319 ~~• Chemicals that present a HQ less than 0.1 or ILCR lower than 10^{-2} when~~
320, 321 ~~evaluated by Region III screening criteria (EPA, 1993c) were removed from the~~
323, 324 ~~CPC list and assigned the deletion symbol "J" in Attachment E.II. Solid samples~~
325, 326 ~~were compared to residential surface soil and liquid samples were compared to tap~~
27-US, 44-US ~~water.]~~

• Chemicals retained as CPCs but not quantitatively evaluated in the risk assessment were assigned the symbol "G" in Attachment E.II. Lead is an
44-US example of this type of chemical. ***These chemicals were discussed qualitatively or semi-qualitatively.***

• The list of chemicals removed was reviewed to identify those whose toxic effects were exerted upon a common target organ, or have synergistic or additive effects. Toxicity, concentration, and any additive/synergistic effects due to concomitant exposure were examined, as well as structure-activity relationships or other chemical similarities. The possible contribution to site risk was assessed to determine whether a compound should be returned to the CPC list.

44-US ~~• Radionuclides were only excluded from the CPC list if they were determined to not be significantly above background levels in the background screen discussed previously.~~ ***Methodology has established the 95th percentile background value as a decision making point; radionuclides exceeding this value are considered CPCs while radionuclides at less than that value are deleted.***

E.2.3.2 Results of Selecting CPCs

E.2.3.2.1 Surface Soil

Table E.2-2 lists the CPCs for surface soil. This table contains only those constituents which have been selected for quantitative evaluation in this assessment. A complete list of analytes and the rationale for their exclusion is presented in Attachment E.II of this Appendix.

E.2.3.2.2 Waste Pit 1

Table E.2-3 lists the CPCs and representative concentrations for waste pit material in Waste Pit 1. Only those constituents that have been selected for quantitative evaluation in this assessment are included. A complete list of analytes and the rationale for their exclusion is presented in Attachment E.II of this Appendix.

E.2.3.2.3 Waste Pit 2

Table E.2-4 lists the CPCs and representative concentrations for waste pit material in Waste Pit 2. These tables contain only those constituents that are evaluated quantitatively in the risk

Appendix E-2

Tables and Figures

TABLE E.2–2

CPC IN SURFACE SOIL (0–24 INCHES DEEP)

		CIS Data				RIFS Data				
Parameters	Units	Frequency of Detection	Maximum Value	Dist.[1]	Representative Concentration[2]	Frequency of Detection	Maximum Value	Dist.[1]	Representative Concentration[2]	Representative Concentration[3]
Antimony	mg/Kg					17 / 17	32.8	L	27.9	27.9
Beryllium	mg/Kg					17 / 17	1.0	L	0.8	0.8
Cadmium	mg/Kg					17 / 17	7.7	L	5.9	5.9
Aroclor–1254	ug/Kg					3 / 17	1400.0	U	1400.0	1400.0
Cesium–137	pCi/g	11 / 24	6	L	0.8					0.8
Neptunium–237	pCi/g	1 / 24	0.5	U	0.5					0.5
Plutonium–238	pCi/g	4 / 24	0.7	U	0.1					0.1
Plutonium–239/240	pCi/g	4 / 24	0.6	U	0.2					0.2
Radium–226	pCi/g					10 / 13	2.2	N	1.4	1.4
Radium–228	pCi/g					10 / 13	4.7	L	2.2	2.2
Strontium–90	pCi/g	1 / 24	1.5	U	1.5	3 / 11	0.9	U	0.9	1.5
Technetium–99	pCi/g	10 / 24	58	U	5.6	1 / 12	0.9	U	0.9	5.6
Thorium–228	pCi/g	20 / 24	48.0	U	7.8	11 / 11	4.1	L	2.2	7.8
Thorium–230	pCi/g	22 / 24	972.0	U	146.0	11 / 11	6.1	L	3.5	146.0
Thorium–232	pCi/g	19 / 24	31.0	U	5.5	11 / 11	1.6	L	1.2	5.5
Thorium–Total	mg/Kg					1 / 1	5.8	U	5.8	5.8
Uranium–234	pCi/g	24 / 24	241.0	L	117.5	13 / 13	28.5	L	17.5	117.5
Uranium–235/236	pCi/g	24 / 24	51.0	U	18.6	5 / 13	3.9	U	3.9	18.6
Uranium–238	pCi/g	24 / 24	1500.0	U	788.0	13 / 13	103.7	L	103.7	788.0
Uranium–Total	mg/Kg					9 / 9	413.5	U	413.5	413.5
Benzo(A)Anthracene	ug/Kg					1 / 16	98.0	U	98.0	98.0
Benzo(A)Pyrene	ug/Kg					1 / 16	42.0	U	42.0	42.0
Benzo(B)Fluoranthene	ug/Kg					1 / 16	59.0	U	59.0	59.0
Benzo(K)Fluoranthene	ug/Kg					1 / 16	46.0	U	46.0	46.0
Chrysene	ug/Kg					1 / 16	88.0	U	88.0	88.0

Notes:

1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).

2 – The representative concentration for the CIS or RIFS data sets is the either the maximum value or 95% UCL value. If the distribution could not be determined, but there were more than 7 detects, the non–parametric 95th percentile was used as the representative concentration.

3 – The representative concentration for surface soils is the maximum of the representative concentration from either the CIS or RIFS data.

TABLE E.2-3
CPCs IN PIT 1

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Antimony	mg/Kg	1 / 5	0.4	U	NA	6 / 6	125.0	U	NA	125.0
Arsenic	mg/Kg	5 / 5	15.0	U	NA	5 / 6	1.7	U	NA	15.0
Beryllium	mg/Kg	4 / 5	2.2	U	NA	6 / 6	12.5	U	NA	12.5
Cadmium	mg/Kg	4 / 5	5.0	U	NA	6 / 6	18.5	U	NA	18.5
Chromium	mg/Kg	5 / 5	46.0	U	NA	6 / 6	347.0	U	NA	347.0
Lead	mg/Kg	1 / 5	17.0	U	NA	5 / 5	53.4	U	NA	53.4
Silver	mg/Kg	4 / 5	33.0	U	NA	6 / 6	189.0	U	NA	189.0
4,4-DDT	ug/Kg	1 / 6	1600.0	U	NA		0.0			1600.0
Aroclor-1221	ug/Kg		0.0			1 / 6	4600.0	U	NA	4600.0
Aroclor 1248	ug/Kg	1 / 6	3500.0	U	NA	5 / 6	10000.0	U	NA	10000.0
Aroclor 1254	ug/Kg	6 / 6	11500.0	U	NA	5 / 5	13000.0	U	NA	13000.0
Aroclor 1260	ug/Kg	2 / 6	7800.0	U	NA		0.0			7800.0
Cesium-137	pCi/g	1 / 5	1.1	U	NA	1 / 6	0.3	U	NA	1.1
Plutonium-238	pCi/g					1 / 5	1.0	U	NA	1.0
Plutonium-239/240	pCi/g					1 / 6	1.0	U	NA	1.0
Radium-226	pCi/g					5 / 6	99.6	U	NA	99.6
Radium-228	pCi/g					5 / 6	41.0	U	NA	41.0
Ruthenium-106						1 / 6	2.4	U	NA	2.4
Strontium-90						5 / 6	7.7	U	NA	7.7
Technetium-99	pCi/g	1 / 5	15.0	U	NA	1 / 6	1.1	U	NA	15.0
Thorium-228	pCi/g	5 / 5	52.0	U	NA	2 / 4	790.0	U	NA	790.0
Thorium-230	pCi/g	5 / 5	3600.0	U	NA	4 / 4	5460.0	U	NA	5460.0
Thorium-232	pCi/g	5 / 5	55.0	U	NA	2 / 4	490.0	U	NA	490.0
Thorium-Total	mg/Kg					2 / 4	4400.0	U	NA	4400.0
Uranium-234	pCi/g	5 / 5	1180.0	U	NA	4 / 4	830.0	U	NA	1180.0
Uranium-235/236	pCi/g	5.0 / 5	151.0	U	NA	5 / 5	259.0	U	NA	259.0
Uranium-238	pCi/g	5 / 5	6980.0	U	NA	5 / 5	16160.0	U	NA	16160.0
Uranium-Total	mg/Kg					6 / 6	48480.0	U	NA	48480.0
2-Methylnaphthalene	ug/Kg	2 / 6	240.0	U	NA		0.0			240.0
Benzo(A)Anthracene	ug/Kg	2 / 6	100.0	U	NA		0.0			100.0
Benzo(A)Pyrene	ug/Kg	1 / 6	140.0	U	NA		0.0			140.0
Benzo(B)Fluoranthene	ug/Kg	5 / 6	330.0	U	NA		0.0			330.0
Benzo(K)Fluoranthene	ug/Kg	1 / 6	140.0	U	NA		0.0			140.0
Chrysene	ug/Kg	5 / 6	540.0	U	NA		0.0			540.0
Phenanthrene	ug/Kg	6 / 6	2400.0	U	NA		0.0			2400.0

TABLE E.2-3
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg					5 / 6	1.2	U	NA	1.2
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg					5 / 6	1.2	U	NA	1.2
1,2,3,4,7,8-HxCDF[4]	ug/Kg					3 / 6	0.8	U	NA	0.8
1,2,3,6,7,8-HxCDD[4]	ug/Kg					4 / 6	0.8	U	NA	0.8
1,2,3,6,7,8-HxCDF[4]	ug/Kg					3 / 6	0.3	U	NA	0.3
1,2,3,7,8,9-HxCDD[4]	ug/Kg					3 / 6	0.5	U	NA	0.5
1,2,3,7,8-PeCDF[4]	ug/Kg					5 / 6	1.2	U	NA	1.2
2,3,4,6,7,8-HxCDF[4]	ug/Kg					3 / 6	0.4	U	NA	0.4
2,3,4,7,8-PeCDF[4]	ug/Kg					4 / 6	1.2	U	NA	1.2
2,3,7,8-TCDF[4]	ug/Kg					5 / 6	14.0	U	NA	14.0
Heptachlorodibenzo-p-dioxin	ug/Kg					5 / 6	2.3	U	NA	2.3
Heptachlorodibenzofuran	ug/Kg					5 / 6	2.7	U	NA	2.7
Hexachlorodibenzo-p-dioxin	ug/Kg					5 / 6	4.9	U	NA	4.9
Hexachlorodibenzofuran	ug/Kg					4 / 6	2.9	U	NA	2.9
Octachlorodibenzo-p-dioxin	ug/Kg					5 / 6	0.7	U	NA	0.7
Octachlorodibenzofuran	ug/Kg					3 / 6	0.8	U	NA	0.8
Pentachlorodibenzofuran	ug/Kg					5 / 6	7.9	U	NA	7.9
Tetrachlorodibenzofuran	ug/Kg					6 / 6	35.0	U	NA	35.0

Notes:

1 – Distribution, N=Normal, L=Lognormal, U=Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).

2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.

3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.

4 – TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCCD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenz-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran

TABLE E.2-4
CPCs IN PIT 2

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Antimony	mg/Kg	2 / 5	1.2	U	NA	4 / 4	55.4	U	NA	55.4
Arsenic	mg/Kg	5 / 5	10.0	U	NA	4 / 4	423.0	U	NA	423.0
Barium	mg/Kg	5 / 5	208.0	U	NA	4 / 4	1920.0	U	NA	1920.0
Beryllium	mg/Kg	5 / 5	8.9	U	NA	4 / 4	26.9	U	NA	26.9
Cadmium	mg/Kg	5 / 5	9.6	U	NA	4 / 4	12.8	U	NA	12.8
Chromium	mg/Kg	5 / 5	91.0	U	NA	4 / 4	282.0	U	NA	282.0
Copper	mg/Kg	5 / 5	329.0	U	NA	4 / 4	1340.0	U	NA	1340.0
Lead	mg/Kg	5 / 5	190.0	U	NA	4 / 4	758.0	U	NA	758.0
Molybdenum	mg/Kg					4 / 4	215.0	U	NA	215.0
Nickel	mg/Kg	5 / 5	609.0	U	NA	4 / 4	1740.0	U	NA	1740.0
Thallium	mg/Kg					1 / 4	2.4	U	NA	2.4
Vanadium	mg/Kg	5 / 5	106.0	U	NA	4 / 4	594.0	U	NA	594.0
4,4-DDT	ug/Kg	2 / 5	1400.0	U	NA					1400.0
Aroclor 1248	ug/Kg	1 / 5	321.0	U	NA	2 / 4	4900.0	U	NA	4900.0
Aroclor 1254	ug/Kg	1 / 5	323.0	U	NA					323.0
Cesium-137	pCi/g	2 / 5	3.6	U	NA	1 / 4	0.5	U	NA	3.6
Plutonium-238	pCi/g	2 / 5	0.1	U	NA					0.1
Plutonium-239/240	pCi/g	2 / 5	0.6	U	NA					0.6
Radium-226	pCi/g					4 / 4	951.0	U	NA	951.0
Radium-228	pCi/g					4 / 4	437.0	U	NA	437.0
Ruthenium-106	pCi/g					1 / 4	4.0	U	NA	4.0
Strontium-90	pCi/g					3 / 4	4.0	U	NA	4.0
Technetium-99	pCi/g	3 / 5	618.0	U	NA	1 / 4	1.6	U	NA	618.0
Thorium-228	pCi/g	5 / 5	164.0	U	NA	2 / 2	697.0	U	NA	697.0
Thorium-230	pCi/g	5 / 5	3980.0	U	NA	2 / 2	18400.0	U	NA	18400.0
Thorium-232	pCi/g	5 / 5	88.0	U	NA	2 / 2	340.0	U	NA	340.0
Thorium-Total	mg/kg					2 / 2	2780.0	U	NA	2780.0
Uranium-234	pCi/g	5 / 5	18200.0	U	NA	2 / 2	1651.0	U	NA	18200.0
Uranium-235/236	pCi/g	5 / 5	8780.0	U	NA	2 / 2	130.0	U	NA	130.0
Uranium-238	pCi/g	5 / 5	17900.0	U	NA	2 / 2	1861.0	U	NA	17900.0
Uranium-Total	mg/kg					4 / 4	5803.0	U	NA	5803.0
2-Methylnaphthalene	ug/Kg	2 / 5	7000.0	U	NA	3 / 7	7800.0	U	NA	7800.0
4-Chloro-3-Methylphenol	ug/Kg					1 / 7	230.0	U	NA	230.0
Acenaphthylene	ug/Kg					1 / 7	110.0	U	NA	110.0
Benzo(A)Anthracene	ug/Kg	5 / 5	130000.0	U	NA	3 / 7	100000.0	U	NA	130000.0
Benzo(A)Pyrene	ug/Kg	4 / 5	120000.0	U	NA	3 / 7	68000.0	U	NA	120000.0
Benzo(B)Fluoranthene	ug/Kg	5 / 5	110000.0	U	NA	3 / 7	130000.0	U	NA	130000.0
Benzo(G,H,I)Perylene	ug/Kg	3 / 5	42000.0	U	NA	3 / 7	42000.0	U	NA	42000.0
Benzo(K)Fluoranthene	ug/Kg	4 / 5	75000.0	U	NA	3 / 7	44000.0	U	NA	75000.0
Chrysene	ug/Kg	4 / 5	4200.0	U	NA	2 / 7	86000.0	U	NA	86000.0
Dibenzo(A,H)Anthracene	ug/Kg	2 / 5	16000.0	U	NA	3 / 7	20000.0	U	NA	20000.0
Dibenzofuran	ug/Kg	3 / 5	36000.0	U	NA	3 / 7	21000.0	U	NA	36000.0
Fluoranthene	ug/Kg	5 / 5	490000.0	U	NA	5 / 7	280000.0	U	NA	490000.0

TABLE E.2-4
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Indeno(1,2,3-Cd)Pyrene	ug/Kg	3 / 5	46000.0	U	NA	3 / 7	37000.0	U	NA	46000.0
Pentachlorophenol	ug/Kg					2 / 7	1600.0	U	NA	1600.0
Phenanthrene	ug/Kg	5 / 5	370000.0	U	NA	5 / 7	280000.0	U	NA	370000.0
Pyrene	ug/Kg	5 / 5	250000.0	U	NA	5 / 7	230000.0	U	NA	250000.0
Tributyl Phosphate	ug/Kg					4 / 4	39000.0	U	NA	39000.0
1,1-Dichloroethene	ug/Kg					6 / 10	120.0	U	NA	120.0
Benzene	ug/Kg					1 / 10	4.0	U	NA	4.0
Vinyl Chloride	ug/Kg	1 / 4	670.0	U	NA	6 / 10	1900.0	U	NA	1900.0
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg					2 / 4	3.8	U	NA	3.8
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg					1 / 4	1.0	U	NA	1.0
1,2,3,4,7,8-HxCDF[4]	ug/Kg					1 / 4	0.3	U	NA	0.3
HpCDD[4]	ug/Kg					3 / 4	8.1	U	NA	8.1
HpCDF[4]	ug/Kg					3 / 4	5.9	U	NA	5.9
HxCDD[4]	ug/Kg					1 / 4	0.3	U	NA	0.3
HxCDF[4]	ug/Kg					2 / 4	2.7	U	NA	2.7
OCDD[4]	ug/Kg					4 / 4	45.9	U	NA	45.9
OCDF[4]	ug/Kg					3 / 4	4.9	U	NA	4.9
PeCDF[4]	ug/Kg					1 / 4	0.6	U	NA	0.6

Notes:
1 - Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 - NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 - The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 - TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCCD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenz-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran

TABLE E.2–5

CPCs IN PIT 3

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Antimony	mg/Kg	2 / 7	18	U	NA	4 / 6	63.5	U	NA	63.5
Arsenic	mg/Kg	7 / 7	3050	N	1970.1	6 / 6	37200.0	U	NA	37200.0
Barium	mg/Kg	7 / 7	14400	U	NA	6 / 6	3570.0	U	NA	14400.0
Beryllium	mg/Kg	7 / 7	24	L	42.8	6 / 6	10.7	U	NA	24.0
Cadmium	mg/Kg	7 / 7	13	L	13.4	6 / 6	38.6	U	NA	38.6
Chromium	mg/Kg	7 / 7								
				U	NA	6 / 6	2010.0	U	NA	2330.0
Lead	mg/Kg	5 / 7	613	U	NA	6 / 6	837.0	U	NA	837.0
Manganese	mg/Kg	7 / 7	10600	L	18063.6	6 / 6	20200.0	U	NA	20200.0
Molybdenum	mg/Kg		0		0.0	6 / 6	284.0	U	NA	284.0
Nickel	mg/Kg	7 / 7	504	L	1120.6	6 / 6	292.0	U	NA	504.0
Thallium	mg/Kg	3 / 7	12	U	NA	4 / 6	4.1	U	NA	12.0
Vanadium	mg/Kg	7 / 7	9700	N	5756.7	6 / 6	2200.0	U	NA	5756.7
Aroclor–1248	ug/Kg					4 / 6	4800.0	U	NA	4800.0
Aroclor–1254	ug/Kg	2 / 7	550.0	U	NA	5 / 6	3400.0	U	NA	3400.0
Cesium–137	pCi/g					1 / 6	0.5	U	NA	0.5
Neptunium–237	pCi/g	3 / 7	2.1	U	NA					2.1
Plutonium–238	pCi/g	3 / 7	1.0	U	NA	1 / 5	1.0	U	NA	1.0
Plutonium–239/240	pCi/g	3 / 7	14.0	U	NA	2 / 5	1.6	U	NA	14.0
Radium–226	pCi/g					6 / 6	451.0	U	NA	451.0
Radium–228	pCi/g					6 / 6	241.0	U	NA	241.0
Ruthenium–106	pCi/g					2 / 6	4.2	U	NA	4.2
Strontium–90	pCi/g	1 / 7	5.2	U	NA	3 / 6	4.9	U	NA	5.2
Technetium–99	pCi/g	6 / 7	1110.0	U	NA	6 / 6	33.0	U	NA	1110.0
Thorium–228	pCi/g	7 / 7	40.0	L	174.5	4 / 5	554.0	U	NA	554.0
Thorium–230	pCi/g	7 / 7	11680.0	N	9115.9	6 / 6	11370.0	U	NA	11370.0
Thorium–232	pCi/g	7 / 7	59.0	U	NA	4 / 5	396.0	U	NA	396.0
Thorium–Total	mg/Kg					4 / 5	3570.0	U	NA	3570.0
Uranium–234	pCi/g	7 / 7	475.0	L	986.8	4 / 4	991.0	U	NA	991.0
Uranium–235/236	pCi/g	7 / 7	21.0	N	17.6	5 / 5	89.2	U	NA	89.2
Uranium–238	pCi/g	7 / 7	1380.0	L	1260.7	6 / 6	1740.0	U	NA	1740.0
Uranium–Total	mg/Kg					6 / 6	5938.0	U	NA	5938.0
Acenaphthylene	ug/Kg					1 / 4	96.0	U	NA	96.0
Benzo(A)Anthracene	ug/Kg	1 / 7	60.0	U	NA	1 / 7	360.0	U	NA	360.0
Benzo(A)Pyrene	ug/Kg					1 / 7	280.0	U	NA	280.0
Benzo(B)Fluoranthene	ug/Kg	1 / 7	110.0	U	NA	1 / 7	560.0	U	NA	560.0
Benzo(G,H,I)Perylene	ug/Kg					1 / 7	160.0	U	NA	160.0
Chrysene	ug/Kg	1 / 7	75.0	U	NA	1 / 7	370.0	U	NA	370.0

TABLE E.2–5
(Continued)

Parameter	Units	CIS Data: Frequency of Detection	CIS Data: Maximum Value	CIS Data: Dist.[1]	CIS Data: 95% UCL[2]	RIFS Data: Frequency of Detection	RIFS Data: Max Hit	RIFS Data: Dist.[1]	RIFS Data: 95% UCL[2]	Representative Concentration[3]
Indeno(1,2,3–Cd)Pyrene	ug/Kg					1 / 7	130.0	U	NA	130.0
N–Nitroso–Di–N–Propylamine	ug/Kg					2 / 4	460.0	U	NA	460.0
Pentachlorophenol	ug/Kg	2 / 6	1300.0	U	NA	5 / 5	1000.0	U	NA	1300.0
Phenanthrene	ug/Kg	1 / 7	120.0	U	NA	2 / 7	580.0	U	NA	580.0
2–Hexanone	ug/Kg					4 / 10	17.0	U	NA	17.0
1,2,3,4,6,7,8–HpCDD[4]	ug/Kg					5 / 6	1.7	U	NA	1.7
1,2,3,4,6,7,8–HpCDF[4]	ug/Kg					3 / 6	0.2	U	NA	0.2
1,2,3,6,7,8–HxCDD[4]	ug/Kg					1 / 6	0.0	U	NA	0.0
HpCDD[4]	ug/Kg					5 / 6	3.2	U	NA	3.2
HpCDF[4]	ug/Kg					5 / 6	1.0	U	NA	1.0
HxCDD[4]	ug/Kg					1 / 6	0.3	U	NA	0.3
HxCDF[4]	ug/Kg					4 / 6	0.4	U	NA	0.4
OCDD[4]	ug/Kg					6 / 6	19.4	U	NA	19.4
OCDF[4]	ug/Kg					5 / 6	1.1	U	NA	1.1
Tetrachlorodibenzofuran	ug/Kg					1 / 6	0.2	U	NA	0.2
Fluoride	ug/Kg					2 / 5	2350000.0	U	NA	2350000.0

Notes:
1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 – TCDD = Tetrachlorodibenzo–p–dioxin
PeCDD = Pentachlorodibenzo–p–dioxin
HxCDD = Hexachlorodibenzo–p–dioxin
HpCCD = Heptachlorodibenzo–p–dioxin
OCDD = Octachlorodibenz–p–dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran

TABLE E.2-6
CPCs IN PIT 4

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Antimony	mg/Kg	1 / 4	0.5	U	NA	4 / 5	317.0	U	NA	317.0
Beryllium	mg/Kg	4 / 4	13.0	U	NA	3 / 5	50.6	U	NA	50.6
Cadmium	mg/Kg	3 / 4	29.0	U	NA	5 / 5	34.8	U	NA	34.8
Chromium	mg/Kg	4 / 4	94.0	U	NA	5 / 5	1500.0	U	NA	1500.0
Lead	mg/Kg	4 / 4	63.0	U	NA	5 / 5	63.2	U	NA	63.2
Manganese	mg/Kg	4 / 4	3600.0	U	NA	5 / 5	5620.0	U	NA	5620.0
Nickel	mg/Kg	4 / 4	50.0	U	NA	5 / 5	223.0	U	NA	223.0
Silver	mg/Kg	3 / 4	444.0	U	NA	5 / 5	755.0	U	NA	755.0
Vanadium	mg/Kg	4 / 4	235.0	U	NA	5 / 5	558.0	U	NA	558.0
Aroclor 1242	ug/Kg	2 / 5	1034.0	U	NA					1034.0
Aroclor 1248	ug/Kg	3 / 5	854.0	U	NA	4 / 6	7500.0	U	NA	7500.0
Aroclor 1254	ug/Kg	5 / 5	1008.0	U	NA	3 / 6	6800.0	U	NA	6800.0
Neptunium-237	pCi/g	1 / 4	0.4	U	NA					0.4
Plutonium-238	pCi/g	2 / 4	0.5	U	NA					0.5
Plutonium-239/240	pCi/g	1 / 4	0.4	U	NA					0.4
Radium-226	pCi/g					5 / 6	50.1	U	NA	50.1
Radium-228	pCi/g					6 / 6	141.0	U	NA	141.0
Ruthenium-106	pCi/g					1 / 6	1.1	U	NA	1.1
Strontium-90	pCi/g					5 / 6	144.0	U	NA	144.0
Technetium-99	pCi/g	4 / 4	225.0	U	NA	5 / 6	9.4	U	NA	225.0
Thorium-228	pCi/g	4 / 4	395.0	U	NA	4 / 4	2469.0	U	NA	2469.0
Thorium-230	pCi/g	4 / 4	566.0	U	NA	6 / 6	1815.0	U	NA	1815.0
Thorium-232	pCi/g	4 / 4	92.0	U	NA	4 / 4	838.0	U	NA	838.0
Thorium-Total	mg/Kg					4 / 4	7565.0	U	NA	7565.0
Uranium-234	pCi/g	4 / 4	2320.0	U	NA	3 /3	4100.0	U	NA	4100.0
Uranium-235/236	pCi/g	4 / 4	426.0	U	NA	4 / 4	934.0	U	NA	934.0
Uranium-238	pCi/g	4 / 4	15800.0	U	NA	4 / 4	41900.0	U	NA	41900.0
Uranium-Total	mg/Kg					6 / 6	0.1	U	NA	0.1
2-Methylnaphthalene	ug/Kg	2 / 5	1100.0	U	NA	2 / 9	480.0	U	NA	1100.0
4-Chloro-3-Methylphenol	ug/Kg					2 / 9	77.0	U	NA	77.0
Benzo(A)Anthracene	ug/Kg	5 / 5	4100.0	U	NA	2 / 9	4700.0	U	NA	4700.0
Benzo(A)Pyrene	ug/Kg	4 / 5	4800.0	U	NA	2 / 9	2900.0	U	NA	4800.0
Benzo(B)Fluoranthene	ug/Kg	4 / 5	5800.0	U	NA	2 / 9	5200.0	U	NA	5800.0
Benzo(G,H,I)Perylene	ug/Kg	3 / 5	1300.0	U	NA	1 / 9	990.0	U	NA	1300.0
Benzo(K)Fluoranthene	ug/Kg	4 / 5	3700.0	U	NA					3700.0
Chrysene	ug/Kg	5 / 5	4500.0	U	NA	2 / 9	3300.0	U	NA	4500.0
Dibenzo(A,H)Anthracene	ug/Kg	2 / 5	560.0	U	NA					560.0
Dibenzofuran	ug/Kg	4 / 5	1700.0	U	NA	2 / 9	1200.0	U	NA	1700.0
Indeno(1,2,3-Cd)Pyrene	ug/Kg	4 / 5	1400.0	U	NA	1 / 9	990.0	U	NA	1400.0

TABLE E.2-6
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Phenanthrene	ug/Kg	5 / 5	16000.0	U	NA	2 / 9	12000.0	U	NA	16000.0
Tributyl Phosphate	ug/Kg					2 / 2	72000.0	U	NA	72000.0
2-Hexanone	ug/Kg					4 / 9	29.0	U	NA	29.0
3-Chloropropene	ug/Kg					1 / 2	3.0	U	NA	3.0
Benzene	ug/Kg					1 / 9	14.0	U	NA	14.0
Vinyl Chloride	ug/Kg					2 / 9	14.0	U	NA	14.0
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg					4 / 6	2.6	U	NA	2.6
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg					5 / 6	3.2	U	NA	3.2
1,2,3,4,7,8,9-HpCDD[4]	ug/Kg					3 / 6	2.4	U	NA	2.4
1,2,3,4,7,8-HxCDD[4]	ug/Kg					1 / 6	0.1	U	NA	0.1
1,2,3,4,7,8-HxCDF[4]	ug/Kg					5 / 6	2.9	U	NA	2.9
1,2,3,6,7,8-HxCDD[4]	ug/Kg					2 / 6	0.2	U	NA	0.2
1,2,3,6,7,8-HxCDF[4]	ug/Kg					5 / 6	1.1	U	NA	1.1
1,2,3,7,8,9-HxCDD[4]	ug/Kg					2 / 6	0.2	U	NA	0.2
1,2,3,7,8,9-HxCDF[4]	ug/Kg					3 / 6	0.8	U	NA	0.8
1,2,3,7,8-PeCDF[4]	ug/Kg					5 / 6	2.1	U	NA	2.1
2,3,4,6,7,8-HxCDF[4]	ug/Kg					4 / 6	1.2	U	NA	1.2
2,3,4,7,8-PeCDF[4]	ug/Kg					5 / 6	2.7	U	NA	2.7
2,3,7,8-TCDF[4]	ug/Kg					5 / 6	9.9	U	NA	9.9
HpCDD[4]	ug/Kg					5 / 6	4.0	U	NA	4.0
HpCDF[4]	ug/Kg					5 / 6	4.4	U	NA	4.4
HxCDD[4]	ug/Kg					4 / 6	2.7	U	NA	2.7
HxCDF[4]	ug/Kg					5 / 6	8.5	U	NA	8.5
OCDD[4]	ug/Kg					5 / 6	9.0	U	NA	9.0
OCDF[4]	ug/Kg					4 / 6	4.9	U	NA	4.9
PeCDF[4]	ug/Kg					5 / 6	15.3	U	NA	15.3
TCDD[4]	ug/Kg					2 / 6	0.5	U	NA	0.5
TCDF[4]	ug/Kg					6 / 6	34.1	U	NA	34.1
Fluoride	ug/Kg					1 / 2	3793000.0	U	NA	3793000.0

Notes:
1 - Distribution, N = Normal, L = Lognormal, U=Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 - NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 - The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 - TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCCD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenz-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran

TABLE E.2–7
CPCs IN PIT 5

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Antimony	mg/Kg	5 / 6	64.0	U	NA	10 / 10	88.1	L	96.2	88.1
Arsenic	mg/Kg	6 / 6	2800.0	U	NA	8 / 10	715.0	N	561.3	2800.0
Barium	mg/Kg	6 / 6	36900.0	U	NA	10 / 10	18100.0	L	12941.7	36900.0
Beryllium	mg/Kg	6 / 6	18.0	U	NA	10 / 10	22.4	N	14.4	18.0
Cadmium	mg/Kg	4 / 6	17.0	U	NA	10 / 10	4.7	L	3.5	17.0
Chromium	mg/Kg	6 / 6	223.0	U	NA	10 / 10	108.0	L	92.5	223.0
Cobalt	mg/Kg	4 / 6	44.0	U	NA	10 / 10	17.1	L	12.0	44.0
Copper	mg/Kg	5 / 6	18200.0	U	NA	10 / 10	8680.0	N	5300.9	18200.0
Lead	mg/Kg	5 / 6	236.0	U	NA	10 / 10	134.0	L	109.8	236.0
Manganese	mg/Kg	6 / 6	4740.0	U	NA	10 / 10	599.0	N	501.6	4740.0
Molybdenum	mg/Kg					10 / 10	1350.0	L	1931.9	1350.0
Nickel	mg/Kg	6 / 6	247.0	U	NA	10 / 10	189.0	N	138.6	247.0
Thallium	mg/Kg	4 / 6	11.0	U	NA	4 / 10	52.0	U	NA	52.0
Vanadium	mg/Kg	6 / 6	5380.0	U	NA	10 / 10	4530.0	N	2794.5	5380.0
Aroclor 1248	ug/Kg	2 / 6	550.0	U	NA					550.0
Aroclor 1254	ug/Kg	2 / 6	750.0	U	NA					750.0
Cesium–137	pCi/g	2 / 6	76.0	U	NA	10 / 10	106.0	L	223.5	106.0
Neptunium–237	pCi/g	5 / 6	19.0	U	NA	3 / 3	83.0	U	NA	83.0
Plutonium–238	pCi/g	5 / 6	4.4	U	NA	3 / 10	0.3	U	NA	4.4
Plutonium–239/240	pCi/g	5 / 6	13.0	U	NA	5 / 10	3.7	U	NA	13.0
Radium–226	pCi/g					10 / 10	180.0	L	159.9	159.9
Radium–228	pCi/g					9 / 10	49.0	N	32.6	32.6
Ruthenium–106	pCi/g					2 / 10	1.6	U	NA	1.6
Strontium–90	pCi/g	6 / 6	31.0	U	NA	9 / 10	18.0	N	9.7	31.0
Technetium–99	pCi/g	6 / 6	2990.0	U	NA	10 / 10	3020.0	L	2247.5	2990.0
Thorium–228	pCi/g	6 / 6	44.0	U	NA	10 / 10	38.0	U	NA	44.0
Thorium–230	pCi/g	6 / 6	8480.0	U	NA	10 / 10	2600.0	U	NA	8480.0
Thorium–232	pCi/g	6 / 6	55.0	U	NA	7 / 10	10.0	U	NA	55.0
Thorium–Total	mg/Kg					8 / 10	92.0	U	92.0	92.0
Uranium–234	pCi/g	6 / 6	1250.0	U	NA	10 / 10	1400.0	N	892.9	1250.0
Uranium–235/236	pCi/g	6 / 6	79.0	U	NA	5 / 10	58.0	U	NA	58.0
Uranium–238	pCi/g	6 / 6	1230.0	U	NA	10 / 10	2800.0	L	1473.4	1473.4
Uranium–Total	mg/Kg					10 / 10	3700.0	N	2770.0	2770.0

Notes:
1 – Distribution, N=Normal, L=Lognormal, U=Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or WMC data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.

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TABLE E.2-8

CPCs IN SURFACE WATER OF PIT 5

Parameter	Units	CIS Data Frequency Detection	Maximum Value	Filtered/ Unfiltered	Representative Concentration[1]
Cyanide	ug/L	2 / 2	87.0	Unfiltered	87.0
Antimony	ug/L	2 / 2	4.5	Unfiltered	4.5
Arsenic	ug/L	2 / 2	2.1	Unfiltered	2.1
Barium	ug/L	2 / 2	108.0	Unfiltered	108.0
Copper	ug/L	2 / 2	21.0	Unfiltered	21.0
Lead	ug/L	2 / 2	2.9	Unfiltered	2.9
Nickel	ug/L	2 / 2	21.0	Unfiltered	21.0
Selenium	ug/L	2 / 2	2.1	Unfiltered	2.1
Vanadium	ug/L	2 / 2	47.0	Unfiltered	47.0
Cesium-137	pCi/L	2 / 2	90.0	Unfiltered	90.0
Strontium-90	pCi/L	2 / 2	41.0	Unfiltered	41.0
Technetium-99	pCi/L	2 / 2	320.0	Unfiltered	320.0
Thorium-230	pCi/L	2 / 2	0.1	Unfiltered	0.1
Uranium-234	pCi/L	2 / 2	420.0	Unfiltered	420.0
Uranium-235	pCi/L	2 / 2	19.0	Unfiltered	19.0
Uranium-238	pCi/L	2 / 2	400.0	Unfiltered	400.0
Benzene	ug/L	2 / 2	11.0	Unfiltered	11.0
Methylene Chloride	ug/L	2 / 2	2.0	Unfiltered	2.0
Toluene	ug/L	2 / 2	1.0	Unfiltered	1.0

Notes:
1 – Representative concentration is assumed to equal the maximum concentration detected.

TABLE E.2–9

CPCs IN PIT 6

		CIS Data				RIFS Data				
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]
Arsenic	mg/kg	1 / 1	7.6	U	NA	9 / 9	76.7	L	65.3	65.3
Beryllium	mg/kg	1 / 1	5.7	U	NA	9 / 9	2.1	N	1.5	5.7
Cadmium	mg/kg	1 / 1	5.7	U	NA	1 / 9	1.3	U	NA	5.7
Lead	mg/kg	1 / 1	60.0	U	NA	9 / 9	113.0	L	90.4	90.4
Silver	mg/kg	1 / 1	158.0	U	NA	7 / 9	9.2	L	12.7	158.0
Aroclor 1254	ug/Kg	1 / 4	81.0	U	NA					81.0
Cesium–137	pCi/g	3 / 4	31.0	U	NA	9 / 9	14.0	N	10.6	31.0
Neptunium–237	pCi/g	4 / 4	3.6	U	NA					3.6
Plutonium–238	pCi/g	4 / 4	1.4	U	NA	6 / 9	1.0	U	NA	1.4
Plutonium–239/240	pCi/g	4 / 4	15.0	U	NA	9 / 9	14.0	N	11.1	15.0
Radium–226	pCi/g					9 / 9	4.9	L	4.3	4.3
Radium–228	pCi/g					9 / 9	191.0	L	257.5	191.0
Strontium–90	pCi/g	4 / 4	5.1	U	NA	6 / 9	4.8	U	NA	5.1
Technetium–99	pCi/g	4 / 4	164.0	U	NA	5 / 9	45.0	U	NA	164.0
Thorium–228	pCi/g	4 / 4	1.2	U	NA	9 / 9	1.7	N	1.5	1.5
Thorium–230	pCi/g	4 / 4	44.0	U	NA	9 / 9	62.0	N	45.2	45.2
Thorium–232	pCi/g	4 / 4	1.2	U	NA	9 / 9	1.0	N	0.7	1.2
Uranium–234	pCi/g	4 / 4	5330.0	U	NA	9 / 9	4064.0	L	3455.2	5330.0
Uranium–235/236	pCi/g	4 / 4	1750.0	U	NA	9 / 9	337.0	L	286.4	1750.0
Uranium–238	pCi/g	4 / 4	18700.0	U	NA	9 / 9	28746.0	L	22721.3	22721.3
Uranium–Total	mg/kg					9 / 9	27733.0	L	45960.0	27733.0
Tetrachloroethene	ug/Kg	4 / 4	29000.0	U	NA					29000.0

Notes:

1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).

2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.

3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RI/FS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.

4 – Laboratory contaminant, not considered a CPC.

TABLE E.2–10

CPCs IN SURFACE WATER OF PIT 6

Parameter	Units	CIS Data: Frequency of Detection	CIS Data: Maximum Value	CIS Data: Filtered/ Unfiltered	Representative Concentration[1]
Antimony	ug/L	1 / 5	1.7	Unfiltered	1.7
Lead	ug/L	1 / 5	2.9	Unfiltered	2.9
Radium–228	pCi/L	5 / 5	31.3	Unfiltered	31.3
Technetium–99	pCi/L	5 / 5	3500.0	Unfiltered	3500.0
Thorium–230	pCi/L	2 / 5	0.3	Unfiltered	0.3
Uranium–234	pCi/L	5 / 5	77.0	Unfiltered	77.0
Uranium–235	pCi/L	5 / 5	9.3	Unfiltered	9.3
Uranium–238	pCi/L	5 / 5	460.0	Unfiltered	460.0
Chloroform	ug/L	4 / 5	3.0	Unfiltered	3.0
Tetrachloroethene	ug/L	5 / 5	2.0	Unfiltered	2.0
Toluene	ug/L	4 / 5	6.0	Unfiltered	6.0

Notes:
1 – Representative concentration is assumed to equal the maximum concentration detected.

TABLE E.2–11

CPCs IN BURN PIT – SOLID CONTENTS

		CIS Data				RIFS Data				
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]
Antimony	mg/Kg	1 / 7	0.6	U	NA	2 / 4	17.8	U	NA	17.8
Arsenic	mg/Kg	5 / 7	21.0	U	NA	4 / 4	39.2	U	NA	39.2
Beryllium	mg/Kg	5 / 7	16.0	U	NA	4 / 4	1.9	U	NA	1.9
Cadmium	mg/Kg	7 / 7	35.0	U	NA	4 / 4	5.4	U	NA	5.4
Chromium	mg/Kg	7 / 7	88.0	U	NA	4 / 4	91.2	U	NA	91.2
Lead	mg/Kg	5 / 7	53.0	U	NA	4 / 4	279.0	U	NA	279.0
Silver	mg/Kg	2 / 6	506.0	U	NA	4 / 4	21.6	U	NA	21.6
Vanadium	mg/Kg	3 / 6	290.0	U	NA	4 / 4	43.3	U	NA	43.3
Aroclor 1242	ug/Kg	1 / 7	290.0	U	NA					290.0
Aroclor 1248	ug/Kg	1 / 7	200.0	U	NA					200.0
Aroclor 1254	ug/Kg	5 / 7	2700.0	U	NA	3 / 4	7700.0	U	NA	7700.0
Neptunium–237	pCi/g	2 / 6	0.6	U	NA					0.6
Plutonium–238	pCi/g	1 / 6	0.5	U	NA					0.5
Plutonium–239/240	pCi/g	1 / 6	0.4	U	NA					0.4
Radium–226	pCi/g				0.0	4 / 4	39.2	U	NA	39.2
Radium–228	pCi/g				0.0	4 / 4	10.4	U	NA	10.4
Ruthenium–106	pCi/g				0.0	2 / 4	1.5	U	NA	1.5
Technetium–99	pCi/g	4 / 6	64.0	U	NA	4 / 4	3.3	U	NA	64.0
Thorium–228	pCi/g	6 / 6	19.0	U	NA	4 / 4	900.0	U	NA	900.0
Thorium–230	pCi/g	6 / 6	218.0	U	NA	4 / 4	4530.0	U	NA	4530.0
Thorium–232	pCi/g	6 / 6	21.0	U	NA	4 / 4	410.0	U	NA	410.0
Thorium–Total	mg/Kg				0.0	4 / 4	3700.0	U	NA	3.7
Uranium–234	pCi/g	6 / 6	415.0	U	NA	4 / 4	1711.0	U	NA	1711.0
Uranium–235/236	pCi/g	6 / 6	27.0	U	0.0	4 / 4	102.0	U	NA	102.0
Uranium–238	pCi/g	6 / 6	454.0	U	NA	4 / 4	1996.0	U	NA	1996.0
Uranium–Total	mg/Kg				0.0	4 / 4	4458.0	U	NA	4.5

TABLE E.2–11
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
2–Methylnaphthalene	ug/Kg	1 / 7	50.0	U	NA	2 / 5	820.0	U	NA	820.0
Benzo(A)Anthracene	ug/Kg	4 / 7	170.0	U	NA	2 / 5	6300.0	U	NA	6300.0
Benzo(A)Pyrene	ug/Kg	1 / 7	160.0	U	NA	2 / 5	3900.0	U	NA	3900.0
Benzo(B)Fluoranthene	ug/Kg	4 / 7	170.0	U	NA	1 / 5	9600.0	U	NA	9600.0
Benzo(G,H,I)Perylene	ug/Kg	1 / 7	85.0	U	NA	2 / 5	2900.0	U	NA	2900.0
Benzo(K)Fluoranthene	ug/Kg	1 / 7	200.0	U	NA	1 / 5	340.0	U	NA	340.0
Bis(2–Ethylhexyl) Phthalate	ug/Kg	5 / 7	2000.0	U	NA	3 / 5	9700.0	U	NA	9700.0
Chrysene	ug/Kg	3 / 7	83.0	U	NA	2 / 5	7000.0	U	NA	7000.0
Dibenzofuran	ug/Kg				0.0	1 / 5	900.0	U	NA	900.0
Indeno(1,2,3–Cd)Pyrene	ug/Kg	1 / 7	78.0	U	NA	2 / 5	2200.0	U	NA	2200.0
Pentachlorophenol	ug/Kg	2 / 7	2600.0	U	NA					2600.0
Phenanthrene	ug/Kg	4 / 7	190.0	U	NA	3 / 5	15000.0	U	NA	15000.0
2–Hexanone	ug/Kg				0.0	1 / 4	2.0	U	NA	2.0
Vinyl Chloride	ug/Kg				0.0	1 / 4	3.0	U	NA	3.0
1,2,3,4,6,7,8–HpCDD[4]	ug/Kg				0.0	2 / 4	0.5	U	NA	0.5
1,2,3,4,6,7,8–HpCDF[4]	ug/Kg				0.0	2 / 4	0.3	U	NA	0.3
1,2,3,4,7,8,9–HpCDD[4]	ug/Kg				0.0	1 / 4	0.3	U	NA	0.3
HpCDD[4]	ug/Kg				0.0	2 / 4	1.0	U	NA	1.0
HpCDF[4]	ug/Kg				0.0	1 / 4	0.3	U	NA	0.3
OCDD[4]	ug/Kg				0.0	2 / 4	4.0	U	NA	4.0
OCDF[4]	ug/Kg				0.0	2 / 4	0.3	U	NA	0.3

Notes:

1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).

2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.

3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.

4 – TCDD = Tetrachlorodibenzo–p–dioxin
PeCDD = Pentachlorodibenzo–p–dioxin
HxCDD = Hexachlorodibenzo–p–dioxin
HpCCD = Heptachlorodibenzo–p–dioxin
OCDD = Octachlorodibenzo–p–dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran

TABLE E.2-12

CPCs IN THE CLEARWELL – SOLID CONTENTS

		CIS Data				RIFS Data				
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]
Antimony	mg/Kg	2 / 4	32.0	U	NA	5 / 7	10.9	U	NA	32.0
Arsenic	mg/Kg	4 / 4	18.0	U	NA	6 / 7	59.1	U	NA	59.1
Barium	mg/Kg	4 / 4	6910.0	U	NA	7 / 7	1790.0	N	1569.9	6910.0
Beryllium	mg/Kg	4 / 4	9.1	U	NA	7 / 7	2.9	L	3.2	9.1
Cadmium	mg/Kg	2 / 4	7.2	U	NA	7 / 7	2.9	L	7.0	7.2
Chromium	mg/Kg	4 / 4	76.0	U	NA	7 / 7	196.0	N	148.4	148.4
Copper	mg/Kg	4 / 4	1120.0	U	NA	7 / 7	3320.0	L	18483.3	3320.0
Lead	mg/Kg	4 / 4	83.0	U	NA	7 / 7	588.0	N	417.1	417.1
Manganese	mg/Kg	4 / 4	1660.0	U	NA	7 / 7	19800.0	N	12661.4	12661.4
Thallium	mg/Kg	1 / 4	2.1	U	NA	4 / 7	1.6	U	NA	2.1
Vanadium	mg/Kg	4 / 4	2600.0	U	NA	7 / 7	285.0	L	351.5	2600.0
Aroclor 1242	ug/Kg	1 / 4	121.0	U	NA					121.0
Aroclor 1248	ug/Kg	1 / 4	308.0	U	NA					308.0
Aroclor 1254	ug/Kg	4 / 4	737.0	U	NA					737.0
Cesium-137						/ 6	71.4	U	NA	450.0
Neptunium-237	pCi/g	3 / 4	2.2	U	NA	4 / 6	1.8	U	NA	2.2
Plutonium-238	pCi/g					5 / 6	0.5	U	NA	0.5
Plutonium-239/240	pCi/g					5 / 6	0.5	U	NA	0.5
Radium-226	pCi/g					6 / 6	170.0	U	NA	170.0
Radium-228	pCi/g					6 / 6	26.4	U	NA	26.4
Strontium-90	pCi/g	4 / 4	26.0	U	NA	2 / 6	12.8	U	NA	26.0
Technetium-99	pCi/g	2 / 4	278.0	U	NA	6 / 6	695.0	U	NA	695.0
Thorium-228	pCi/g	4 / 4	56.0	U	NA	6 / 6	28.1	U	NA	56.0
Thorium-230	pCi/g	4 / 4	5600.0	U	NA	6 / 6	314.0	U	NA	5600.0
Thorium-232	pCi/g	4 / 4	39.0	U	NA	6 / 6	9.7	U	NA	39.0
Thorium-Total	mg/Kg					6 / 6	88.9	U	NA	0.1
Uranium-234	pCi/g	4 / 4	376.0	U	NA	6 / 6	1050.0	U	NA	1050.0
Uranium-235/236	pCi/g	4 / 4	49.0	U	NA	6 / 6	373.0	U	NA	373.0
Uranium-238	pCi/g	4 / 4	670.0	U	NA	6 / 6	1640.0	U	NA	1640.0
Uranium-Total	mg/Kg					6 / 6	2780.0	U	NA	2780.0

TABLE E.2–12
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]
Benzo(A)Anthracene	ug/Kg	2 / 4	890.0	U	NA					890.0
Benzo(A)Pyrene	ug/Kg	1 / 4	670.0	U	NA					670.0
Benzo(B)Fluoranthene	ug/Kg	1 / 4	710.0	U	NA					710.0
Benzo(G,H,I)Perylene	ug/Kg	1 / 4	230.0	U	NA					230.0
Benzo(K)Fluoranthene	ug/Kg	1 / 4	750.0	U	NA					750.0
Chrysene	ug/Kg	3 / 4	1000.0	U	NA					1000.0
Indeno(1,2,3–Cd)Pyrene	ug/Kg	1 / 4	270.0	U	NA					270.0
Phenanthrene	ug/Kg	4 / 4	2100.0	U	NA					2100.0

Notes:
1 – Distribution, N=Normal, L=Lognormal, U=Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% non
2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data se is the lower of the maximum detected value or the 95% upper confidence limit.
4 – The 95th percentile background concentrations for subsurface soil are compared with maximum values.

TABLE E.2-13

CPCs IN THE SURFACE WATER OF THE CLEARWELL

Parameter	Units	CIS Data: Frequency of Detection	CIS Data: Maximum Value	CIS Data: Filtered/ Unfiltered	Representative Concentration[1]
Cyanide	ug/L	1 / 2	87.0	Unfiltered	87.0
Arsenic	ug/L	2 / 2	4.2	Unfiltered	4.2
Copper	ug/L	2 / 2	19.0	Unfiltered	19.0
Manganese	ug/L	2 / 2	20.0	Unfiltered	20.0
Selenium	ug/L	1 / 2	3.0	Unfiltered	3.0
Silver	ug/L	2 / 2	14.0	Unfiltered	14.0
Vanadium	ug/L	2 / 2	513.0	Unfiltered	513.0
Radium-226	pCi/L	2 / 2	1.1	Unfiltered	1.1
Technetium-99	pCi/L	2 / 2	4030.0	Unfiltered	4030.0
Thorium-230	pCi/L	1 / 2	0.4	Unfiltered	0.4
Uranium-234	pCi/L	2 / 2	1900.0	Unfiltered	1900.0
Uranium-235	pCi/L	2 / 2	120.0	Unfiltered	120.0
Uranium-238	pCi/L	2 / 2	6200.0	Unfiltered	6200.0
2-Nitrophenol	ug/L	1 / 2	4.0	Unfiltered	4.0
Acetone	ug/L	1 / 2	520.0	Unfiltered	520.0

Notes:
1 - Representative concentration is assumed to equal the maximum concentration detected.

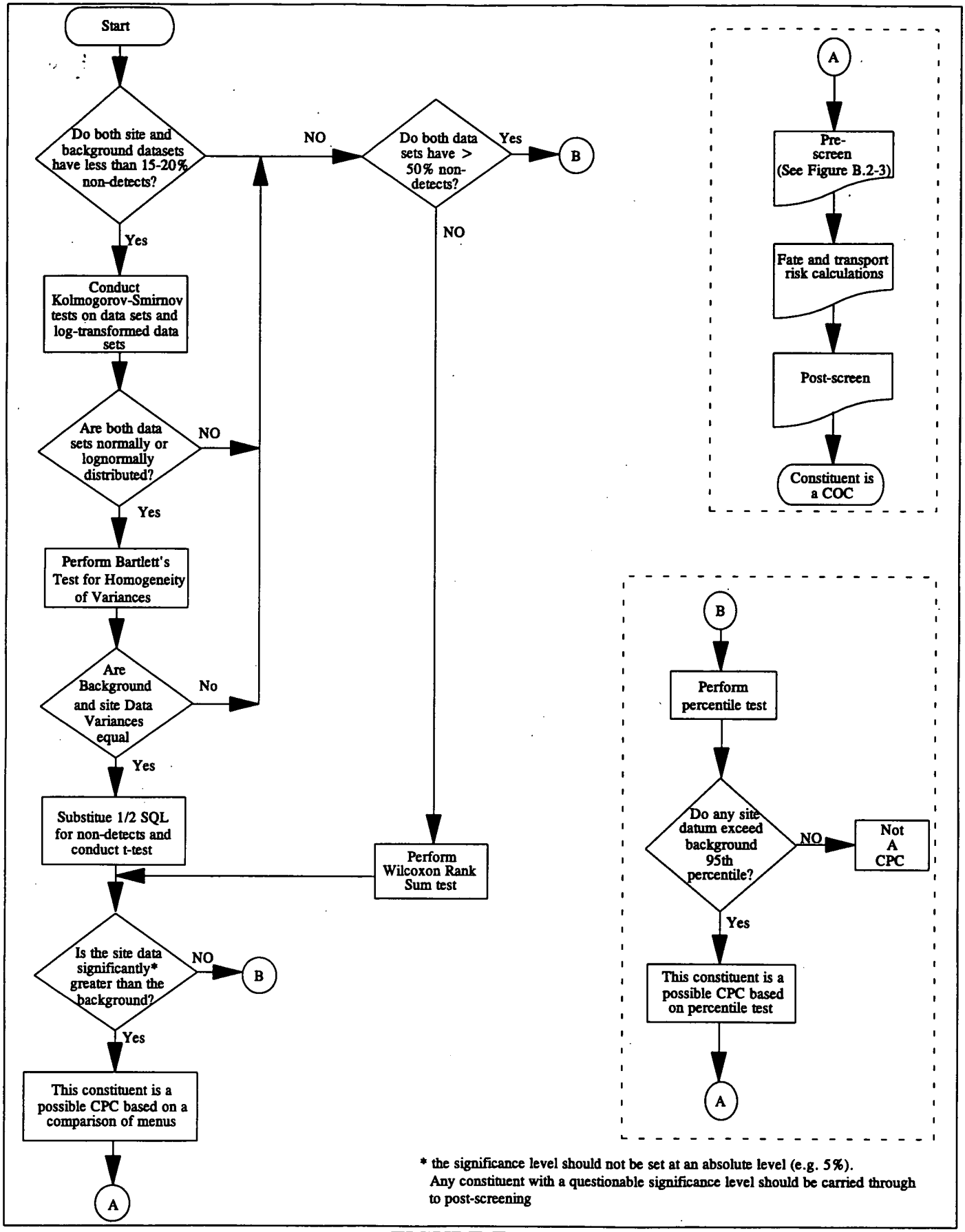

FIGURE E.2-1
CONSTITUENT OF POTENTIAL CONCERN (CPC) SELECTION PROCESS

an area-weighted average concentration was developed using the full area of Waste Pit 3 and other soils, and one-half the area of Waste Pits 5 and 6 (assuming half the waste pit material is exposed).

E.3.4.3 Waste Pit 4 Material

The future land use scenario considers the possibility that a home could be constructed on Pit 4, which is physically the most stable area of Operable Unit 1. It is assumed that once construction is complete, that topsoil would be emplaced for lawns. The pit is currently covered with a RCRA cap and synthetic cover, which are unsuitable for vegetative growth.

20-O ***The future exposure point concentrations for Pit 4 are listed in Table E.3-6.***

E.3.4.3.1 Radioactive Contaminants

Fourteen radionuclides were detected in the contents of Pit 4. As discussed in Section E.3.4.1.1, several of these are naturally occurring radionuclides. As with the other future scenarios, only nuclides with half-lives greater than 25 years are evaluated.

E.3.4.3.2 Chemical Contaminants

The chemicals selected as CPCs for quantitative evaluation include 12 metals and 44 organics. The organics include numerous PAHs, dioxins, furans, PCBs,semivolatiles and volatiles.

E.3.4.4 Buried Pit Materials

Several of the defined exposure scenarios require the evaluation of penetrating radiation risks from buried waste pit contents. The buried contents of the waste pits produce radiation which can expose humans on the ground surface. To assess the magnitudes of these exposures, a computer code called Microshield (Grove Engineering, 1987) is used, as required by the WPA (DOE 1992a).

Microshield is capable of calculating the radiation dose rate for a variety of source and shield geometries, source materials, shield materials, and shield thicknesses. A limited amount of input information is required. Required input for Microshield includes information on the source, the types and concentrations of radionuclides present in the source being modeled, the shape and physical dimensions of the source and its cover (if any), and the density and physical makeup of the source and cover, and the distance form the source to the receptor.

pathways are cumulative. Thus, all the receptors evaluated are subject to more than one exposure pathway and have been evaluated accordingly.

E.3.5.7 Scenario-Specific Assumptions and Exposure Parameters

Exposure parameters are dependent on receptor-specific behavior patterns, and vary from receptor scenario to receptor scenario. The following sections begin with a brief description of each set of parameters used to evaluate exposures to hypothetical receptors during this assessment. This synopsis is followed by descriptions of any site-specific parameter values and their derivation. Tables E.3-16 and E.3-17 contain a summary of these parameters.

E.3.5.7.1 Exposure Duration (ED)

The exposure duration is the period of time a receptor is exposed in a lifetime. Tables E.3-16 and E.3-17 list the values and sources of the exposure durations used to calculate exposures to the hypothetical receptors evaluated in this assessment.

Because of the agricultural history of the area, the RME adult may be exposed over an entire 70-year lifetime. Therefore, the exposure duration selected for this receptor is 70 years. This value is over twice as long as the standard 30-year exposure presented in EPA 1991b. The 70-year value was determined in consultation with EPA Region V and applies to the off-property RME resident adult farmer, the on-property RME resident adult farmer, the Great Miami River user, and the off-property user of beef and dairy products.

The RME child and the CT adult are assumed to receive exposures over 6 years and 9 years, respectively, as suggested by supplemental guidance (EPA 1991b). The trespassing youth is assumed to receive exposures while roaming randomly about the property between the ages of
337,372 six and 18. U.S. EPA suggests this activity to be evaluated over a period of 12
373 years (DOE 1992d)}. The home builder is evaluated to assess the health impacts of exposures incurred while building a home on the property. This activity is assumed to be completed within one year of groundbreaking (NRC 1984), so the exposure duration for the home builder is set at one year.

The Great Miami River user is also assumed to swim in the river. It is assumed that this receptor only swims during a 30-year period of the individual's life. Therefore, the exposure
38-US duration for this scenario is 30 years. ***Although there are no areas designated for swimming in the Great Miami River, it is assumed that a youth, 12 years of age, would use the Great Miami River for swimming, fishing and diving, through age 42. This age range was***

selected because the Great Miami River current makes the river unsafe for very young children to swim in and because there are no designated swimming areas to attract visitors. It is very unlike that anyone would use the river for recreational purposes over an entire lifetime. Therefore, the exposure duration assumed for this scenario is 30 years.

The extended trespasser is assumed to visit the site for 12 years as a youth (ages 6 to 18) and for 32 years as an adult (until age 50). The combined exposure duration for this receptor is 44 years.

E.3.5.7.2 Exposure Frequency

The exposure frequency is the number of days a receptor is exposed each year. Tables E.3-16 and E.3-17 list the values and sources of the exposure frequencies used to calculate exposures to the hypothetical receptors evaluated in this assessment.

The exposure frequency selected for scenarios involving a RME adult farmer or a RME child is the standard RME value of 350 days per year listed in EPA 1989a. The 350 days per year value applies to the off-property RME resident adult, the on-property RME resident adult, the on-property RME resident child, the off-property user of beef and dairy products, and the Great Miami River user. The Great Miami River user is also assumed to swim in the river. The exposure frequency selected for this activity is five days per year as suggested by guidance (EPA 1989a).

The exposure frequency selected for scenarios involving a CT adult farmer is 275 days per year, as suggested by supplemental guidance (EPA 1991b). EPA Region V suggests the exposure frequency of the trespassing child to be set at 52 days per year (DOE 1992). The extended trespasser is assumed to spend 110 days per year on site.

375 *39-US* ~~The home builder is evaluated to assess the health impacts of exposures incurring while building a home on the property. For this activity, the total time spent building the house is assumed to be 500 hours. This is equivalent to a construction period of 3 months, which is believed to be reasonably conservative for typical construction. It is believed to be very conservative for activities involving the use of heavy construction equipment (NRC 1984b). Therefore, assuming a worker spends 10 hours per day during construction, the exposure frequency for the home builder is 50 days per year.}~~

The home builder is evaluated to assess the health impacts of exposures incurred while building a home on the property. For this activity, it is assumed that a worker spends approximately 175 eight-hour days constructing a home.

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E.3.5.7.3 Exposure Time

The exposure time is the amount of time a receptor is exposed each day. Tables E.3-16 and E.3-17 list the values and sources of the exposure times used to calculate exposures to the hypothetical receptors evaluated in this assessment.

The RME adult farmer scenarios constructed for this assessment assume the receptor works outside of the residence for 2000 hours per year. Spreading this time over the 350 days per year of on-site exposure yields an average outdoor exposure time of 5.7 hours per day. This leaves an indoor exposure time of 18.3 hours per day for this receptor. Thus, about 25 percent of the receptor's time on-site is spent outside of the residence. These values apply to the off-property RME resident adult farmer and the on-property RME resident adult farmer. The on-property RME resident child is assumed to spend only 2 hours per day outdoors, for a total of 700 hours per year.

376 ~~It is assumed that the CT resident adult farmer is exposed outdoors for 1,152 hours (equal to 48 days of continuous exposure) out of the 275 days spent within the boundaries of the operable unit each year (EPA, 1993h). This is equivalent to an exposure time of 4.2 hours per day of exposure.~~ 40-US ***It is assumed that the CT resident adult farmer is exposed outdoors approximately 4.2 hours per day for 275 days per year, which is equivalent to 1155 hours of outdoor exposure in a year.*** This leaves an indoor exposure time of 19.8 hours per day for this receptor. Thus, about 20 percent of the receptor's time on-site is spent outside of the residence. These values apply only to the CT receptor.

The trespassing youth and the extended trespasser are assumed to spend time on the site. Current trespassing activities are minimal because Operable Unit 1 is currently surrounded by two fences and patrolled on a regular basis by a security force. If these patrols are relaxed, trespassing may occur, but the time spent on the property is unknown. EPA Region V suggests that the exposure time of the trespassing youth to be set at 4 hours per day if site-specific information is not available (DOE 1993d). The extended trespasser is assumed to spend 2 hours per day outdoors on the site.

The home builder is evaluated to assess the health impacts of exposures incurring while building a home on the property. This activity is assumed to be completed after 500 hours (NRC 1984). Assuming a worker constructs a house in 50 days, the total exposure time for the home builder is 10 hours per day. This time is divided equally into 5 hours per day outside of the structure and 5 hours per day inside of the structure.

The RME adult farmer and child receptors are assumed to receive skin exposures via bathing or showering once a day. Since no site-specific information on this activity is available, the adult exposure time selected for this activity is 0.25 hours per day, as suggested by guidance

(EPA 1989a). The exposure time selected for the RME child performing this activity is 0.25 hour per day, as suggested by guidance (EPA 1992e).

The Great Miami River user is assumed to use the river for recreational swimming. Since no site-specific information on this activity is available, the exposure time selected for this activity is 0.2 hour per day, 5 days per year, as suggested by guidance (EPA 1992e).

E.3.5.7.4 Inhalation Rates

The inhalation rate is the volume of air inhaled daily by a receptor. Tables E.3-17 and E.3-18 list the values and sources of the inhalation rates used to calculate exposures to the hypothetical receptors evaluated in this assessment.

EPA suggests using a value of 20 cubic meters per day (0.83 m^3/h) as the inhalation rate for an RME adult (EPA 1989b). Due to a lack of information, this inhalation rate is used for the trespassing youth and all adult exposures, except those involving inhalation of volatiles and radon within the home and the visitor exposures. Inhalation of volatiles from water and radon in the home is evaluated using 15 cubic meters per day for the 18.3 h/d the receptor is inside the home (0.82 m^3/h) (EPA 1991f). The home builder is assumed to be more active than the
29-US average adult, so an inhalation rate of ***2.5*** m^3/h is used for the time this receptor is on site. The inhalation rate for the on-property RME child was set at 0.5 m^3/h, given the child's smaller lung capacity and time spent at rest.

E.3.5.7.5 Soil Ingestion Rates

The soil ingestion rate is the mass of soil ingested daily by a receptor. Tables E.3-17 and E.3-18 list the values and sources of the soil ingestion rates used to calculate exposures to the hypothetical receptors evaluated in this assessment.

40-US ~~The soil ingestion rate of the RME adult farmer estimated for this risk assessment is a site-specific time weighted average ingestion rate. It is based on ingestion rates for specific activities performed during the course of the receptor's lifetime, and the relative length of time spent engaged in those activities.~~

~~The first six years of the RME adult's life are spent as a young child whose ingestion rate is 0.2 grams per day. Using EPA's suggested exposure frequency of 350 days per year, this period contributes a total of 420 grams of soil to the lifetime total.~~

~~Between the ages of 18 and 70, the RME adult farmer is assumed to spend about 50 years working a farm. The 1987 Census of Agriculture (DOC, 1987) indicates that 1,284 of the~~

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~~1,364 farms in Hamilton and Butler Counties (95 percent) are under 500 acres. Assuming a farmer follows recommended agricultural practices and rotates his crops, a typical farm may have 35 percent of its available acreage in corn, 35 percent in soybeans, 20 percent in wheat, and 10 percent in hay. The U.S. Soil Conservation Service Field Office Technical Guide indicates that farmers spend 1.24 hour per acre farming corn, 1 hour per acre farming soybeans, 1.28 hours per acre farming wheat, and 2.73 hours an acre farming hay. From this information, it is calculated that 95 percent of the farmers in Hamilton County spend less than 660 hours per year actually farming the land. An additional 20 percent is added to the 660 hours to account for breakdowns, walkover surveys, and miscellaneous activities, raising the total time to just under 800 hours per year. Assuming the farmer works for eight hours per day, 95 percent of the farmers in these two counties spend less than 100 days per year actually farming. EPA suggests using an incidental soil ingestion rate during farming activities of 0.48 grams per day, so the amount of soil ingested over the 50 year occupational lifetime of a farmer would be 2,400 grams. In the remaining 250 days a year spent on the property during these 50 years, the resident ingests soil at a rate of 0.1 grams per day — adding another 1,259 grams of soil to the farmer's diet. The remaining fourteen years of the receptor's life are spent as an older child (12 years) and an adult (2 years) whose ingestion rates are 0.1 grams per day, contributing another of 490 grams of soil to the lifetime total. The combined intake from all periods in the RME adult resident's life is 4,560 grams of soil or about 0.18 grams per day. The 0.18 grams per day value is used to quantify the exposures due to incidental ingestion of soil by the RME adult in this assessment, which differs from the value presented in the Work Plan Addendum (DOE 1992a).~~

40-US ***A soil ingestion rate of 0.18 grams per day (DOE, 1993f) was used to approximate lifetime exposure to the RME farmer. This value is based on ingestion rates for activities performed throughout the receptor's lifetime including childhood, youth and adult lifestages over a 70 year period. For the sake of this risk assessment, it is assumed that all soil ingested is from OU1.***

The soil ingestion rates for the trespassing youth and extended trespasser (0.1g/day) and the on-property resident child (0.2g/day) are specified by EPA 1991j. It was assumed that all on-property receptors received 100 percent of their soil intake from the site. This includes the on-property RME child and adult, the on-property CT adult, and the home builder. The trespassing child was assumed to only receive 25 percent of his daily soil intake from the site, as only 4 of 16 waking hours are spent on property.

E.3.5.7.6 Water Ingestion Rates

The water ingestion rate is the volume of water drunk daily by a receptor. Generally this intake is from drinking water, but may be from incidental ingestion during swimming. Tables E.3-17 and E.3-18 list the values and sources of the water ingestion rates used to calculate exposures to the hypothetical receptors evaluated in this assessment.

Appendix E-3

Tables

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TABLE E.3-4

EXPOSURE POINT CONCENTRATIONS FOR SURFACE SOIL AND PIT COVERS CURRENT SOURCE TERM[a]

Radionuclides (pCi/g)	
Cesium-137	8.00E-01
Neptunium-237	5.00E-01
Plutonium-238	1.00E-01
Plutonium-239/240	2.00E-01
Radium-226	1.40E+00
Radium-228	2.20E+00
Strontium-90	1.50E+00
Technetium-99	5.60E+00
Thorium-228	7.80E+00
Thorium-230	1.50E+02
Thorium-232	5.50E+00
Uranium-234	1.20E+02
Uranium-235/236	1.90E+01
Uranium-238	7.90E+02
Inorganics (mg/Kg)	
Antimony	2.79E+01
Arsenic	8.20E+00
Beryllium	7.71E-01
Cadmium	5.86E+00
Thallium	7.00E-01
Thorium-Total	5.80E+00
Uranium-Total	4.13E+02
Organics (mg/Kg)	
PCBs	1.40E+00
Benzo(A)Anthracene	9.80E-02
Benzo(A)Pyrene	4.20E-02
Benzo(B)Fluoranthene	5.90E-02
Benzo(K)Fluoranthene	4.60E-02
Chrysene	8.80E-02

Notes:
[a] Concentration is the larger of the UCL/Max value calculated from CIS and RIFS (or WMC) databases.

5511

TABLE E.3-5

EXPOSURE POINT CONCENTRATIONS FOR EXPOSED PIT MATERIAL AND SURFACE SOIL FUTURE SOURCE TERM[a,b]

	Surface Soils	Pit 3[a]	Pit 5	Pit 6	Weighted Average
Area:	129,000	6,720	7,500	1,500	144,720
Radionuclides (pCi/g)					
Cesium-137	8.00E-01	5.00E-01	1.06E+02	3.10E+01	6.55E+00
Neptunium-237	5.00E-01	2.10E+00	8.30E+01	3.60E+00	4.88E+00
Plutonium-238	1.00E-01	1.00E+00	4.40E+00	1.40E+00	3.78E-01
Plutonium-239/240	2.00E-01	1.40E+01	1.30E+01	1.50E+01	1.66E+00
Radium-226	1.40E+00	4.51E+02	1.60E+02	4.34E+00	3.05E+01
Ruthenium-106	5.00E+00 [e]	4.20E+00	1.60E+00	5.00E+00 [e]	4.79E+00
Strontium-90	1.50E+00	5.20E+00	3.10E+01	5.10E+00	3.24E+00
Technetium-99	5.60E+00	1.11E+03	2.99E+03	1.64E+02	2.13E+02
Thorium-230	1.50E+00	1.14E+04	8.48E+03	4.52E+01	9.69E+02
Thorium-232[c]	5.50E+00	5.50E+02	5.50E+01	1.91E+02	3.53E+01
Uranium-234	1.20E+02	9.91E+02	1.25E+03	5.33E+03	2.73E+02
Uranium-235/236	1.90E+01	8.92E+01	7.90E+01	1.75E+03	4.33E+01
Uranium-238	7.90E+02	1.74E+03	1.47E+03	2.27E+04	1.10E+03
Inorganics (mg/Kg)					
Antimony	2.79E+01	6.35E+01	8.81E+01	3.00E-01 [e]	3.23E+01
Arsenic	5.60E+00	3.72E+04	2.80E+03	6.53E+01	1.88E+03
Barium	6.61E+01	1.44E+04	3.69E+04	9.50E+01	2.64E+03
Beryllium	7.71E-01	2.40E+01	1.80E+01	5.70E+00	2.79E+00
Cadmium	5.86E+00	3.86E+01	1.70E+01	5.70E+00	7.96E+00
Chromium	1.57E+01	2.34E+02	2.23E+02	3.00E+01	3.67E+01
Cobalt	1.09E+01	5.07E+01	4.40E+01	2.60E+01	1.46E+01
Copper	1.81E+01	2.33E+03	1.82E+04	2.22E+02	1.07E+03
Lead	1.61E+01	8.37E+02	2.36E+02	9.04E+01	6.64E+01
Manganese	6.12E+02	2.02E+04	4.74E+03	2.59E+02	1.73E+03
Mercury	2.00E-02 [e]	5.10E+00	1.80E+00	2.00E-02 [e]	3.48E-01
Molybdenum	4.50E+00	2.84E+02	1.35E+03	1.00E+01 [e]	8.73E+01
Nickel	3.01E+01	5.04E+02	2.47E+02	5.10E+01	6.36E+01
Selenium	6.00E-01	9.00E+01	1.80E+01	2.00E-01 [e]	5.65E+00
Silver	9.00E+00	4.18E+01	2.22E+01	1.58E+02	1.28E+01
Thallium	6.00E-01	1.20E+01	5.20E+01	1.08E+02	4.91E+00
Vanadium	2.14E+01	5.76E+03	5.38E+03	1.00E+02	5.66E+02
Thorium-Total	5.80E+00	3.57E+03	9.20E+01	NA	1.78E+02
Uranium-Total	4.14E+02	5.94E-03	2.75E+03	2.77E+04	7.98E+02
Fluoride	NA	2.35E+03	NA	NA	2.35E+03

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TABLE E.3-5

(Continued)

	Surface Soils[a]	Pit 3	Pit 5	Pit 6	Weighted Average
Area:	129,000	6,720	7,500	1,500	144,720
Organics (mg/Kg)					
PCBs	1.40E+00	8.20E+00	1.30E+00	8.10E-02	1.70E+00
Acenaphthylene	ND	9.60E-02	ND	ND	4.46E-03
Benzo(A)Anthracene	9.80E-02	3.60E-01	ND	ND	1.04E-01
Benzo(A)Pyrene	4.20E-02	2.80E-01	ND	ND	5.04E-02
Benzo(B)Fluoranthene	5.90E-02	5.60E-01	ND	ND	7.86E-02
Benzo(G,H,I)Perylene	ND	1.60E-01	ND	ND	7.43E-03
Benzo(K)Fluoranthene	4.60E-02	ND	ND	ND	4.10E-02
Chrysene	8.80E-02	3.70E-01	ND	ND	9.56E-02
Indeno(1,2,3-Cd)Pyrene	ND	1.30E-01	ND	ND	6.04E-03
N-Nitroso-Di-N-Propylamine	ND	4.60E-01	ND	ND	2.14E-02
Pentachlorophenol	ND	1.30E+00	ND	ND	6.04E-02
Phenanthrene	ND	5.80E-01	ND	ND	2.69E-02
2-Hexanone	ND	1.70E-02	ND	ND	7.89E-04
Tetrachlorodibenzofuran[d]	NA	2.00E-04	ND	ND	8.55E-05
Hexachlorodibenzo-p-dioxin[d]	NA	4.80E-05	ND	ND	2.05E-05
Hexachlorodibenzofuran[d]	NA	3.50E-04	ND	ND	1.50E-04
Heptachlorodibenzo-p-dioxin[d]	NA	1.70E-03	ND	ND	7.27E-04
Heptachlorodibenzofuran[d]	NA	2.10E-04	ND	ND	8.98E-05
Octachlorodibenzo-p-dioxin	NA	1.94E-02	ND	ND	8.29E-03
Octachlorodibenzofuran	NA	1.10E-03	ND	ND	4.70E-04
Tetrachloroethene	ND	2.20E-02	ND	2.90E+01	3.02E-01

Notes:
[a] Concentration is the larger of the UCL/Max value calculated from CIS and RIFS (or WMC) databases.
[b] A blank infers that the chemical is not a CPC for this area. Concentration is assumed to be zero.
[c] Exposure concentration for Thorium 232 in surface soil is based on the current concentration.
[d] Exposure concentration for dioxins and furans include all detected 2,3,7,8 congeners.
[e] Value reported is half the Sampling Reporting Limit.
NA = Constituent not analyzed for this source area. The area was removed from the averaging.
ND = Constituent was analyzed for, but not detected.

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TABLE E.3-17

EXPOSURE INPUT PARAMETERS
CURRENT LAND USE RECEPTORS

Pathway Parameters (units)	Trespassing Youth Age 7-18	Off-Property RME Resident Adult Farmer Age 1-70	Off-Property RME Resident Child Ages 0-6	User of Meat & Milk Grown Within Operable Unit 1 Age 1-70	On-Property Groundskeeper
All Pathways					
EF (day/yr)	52[a]	350[b]	350[b]	350[b]	35[e]
ED (yr)	12[a]	70[b]	6[b]	70[b]	25[d]
AT-Noncancer (day)	4380[b]	25550[b]	2190[b]	25550[b]	9125[b]
AT-Cancer (day)	25550[b]	25550[b]	25550[b]	25550[b]	25550[b]
BW (kg)	43[b]	70[b]	15[b]	70[b]	70[b]
Inhalation of dust, volatiles, and radon					
IR (m^3/hr)	0.83[b]	0.83[b]	0.5[k,l]	NA[c]	2.5[d]
IR indoor (m^3/d)	NA	15[m]	15[m]	NA	NA
ET indoors (hr/day)	NA	18.3[f]	22.0[f]	NA	NA
ET outdoors (hr/day)	4[a]	5.7[f]	2.0[f]	NA	8.0[d]
Incidental ingestion of soil					
IR (g/day)	0.1[b]	NA	NA	NA	0.1[b]
FI (unitless)	0.25[g]	NA	NA	NA	1.0
Dermal contact with soil					
SA (m^2)	0.42[h]	NA	NA	NA	.575[h]
AF (mg/cm^2)	1.0[h]	NA	NA	NA	1.0[h]
ABS (unitless)	csv	NA	NA	NA	csv[i]
External radiation exposure					
DR (mrem/hr)	csv[i]	NA	NA	NA	csv[i]
ET indoors (hr/day)	NA	NA	NA	NA	NA
ET outdoors (hr/day)	4[a]	NA	NA	NA	8.0[d]
SH indoors (unitless)	NA	NA	NA	NA	NA
SH outdoors (unitless)	0[b]	NA	NA	NA	0[b]

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TABLE E.3-17
(Continued)

Pathway Parameters (units)	Trespassing Youth Age 7-18	Off-Property RME Resident Adult Farmer Age 1-70	Off-Property RME Resident Child Ages 0-6	User of Meat & Milk Grown Within Operable Unit 1 Age 1-70	On-Property Groundskeeper
Ingestion of vegetables, fruit, milk products, meat and fish					
$IR_{vegetables}$ (g/day)	NA	200[b,c]	100[j]	NA	NA
$FI_{vegetables}$ (unitless)	NA	0.40[c]	0.40[c]	NA	NA
IR_{fruits} (g/day)	NA	140[b,c]	204[j]	NA	NA
FI_{fruits} (unitless)	NA	0.30[c]	0.30[c]	NA	NA
IR_{Meat} (g/day)	NA	101[b]	39[b]	101[b]	NA
FI_{meat} (unitless)	NA	0.75[c]	0.75[c]	0.75[c]	NA
$IR_{milk\ products}$ (L/day)	NA	0.4[b]	0.9[b]	0.4[b]	NA
$FI_{milk\ products}$ (unitless)	NA	0.75[c]	0.75[c]	0.75[c]	NA
IR_{fish}	NA	NA	NA	NA	NA
Ingestion of drinking water					
IR (L/day)	NA	2.0[b]	1.0[b]	NA	NA
FI (unitless)	NA	1.0	1.0	NA	NA

[a] DOE 1993d Comment Responses - Site Wide Characterization Report, Assumes a youth trespasses on site 3 days/week for the months of June, July and August (36 days while the youth is not in school) plus 1 day/week for the months of April, May, September and October (16 days) for a total of 52 days, 4 hrs/day.
[b] DOE 1992a
[c] EPA 1990d
[d] EPA 1991j Standard Default Exposure Factors (OSWER Directive 9285.6-03).
[e] Assumes a groundskeeper spends 1 day/week, 35 weeks/yr on the grounds of OU2.
[f] Assumes the RME farmer works outdoors 2000 hours/year, and a resident child spends 700 hrs/yr outdoors.
[g] DOE 1993e, Response to Comment 265 of the OU4 RI, Adjusted based on 4 out of 16 (or 25%) waking hours spent on property.
[h] EPA 1992e
[i] csv - Chemical Specific Value.
[j] USDA 1986 NFCS, CSF II Report No. 85-1
[k] EPA 1993c
[l] EPA 1988c Derived from an algorithm relating respiratory route to body weight, corrected by a factor of 2.11.
[m] EPA 1991f
NA - Not applicable.

TABLE E.3-18

EXPOSURE INPUT PARAMETERS
FUTURE LAND USE RECEPTORS

Pathway Parameters (units)	Trespassing Youth Age 7-18	Off-Property RME Resident Adult Farmer Age 1-70	Off-Property RME Resident Child Age 0-6	User of Meat & Milk Grown Within OU1 Age 1-70	User of Great Miami River Water Age 1-70	On-Property CT Resident Adult Farmer Age 1-70	On-Property RME Resident Adult Farmer Age 1-70	On-Property RME Resident Child Age 0-6	Expanded Trespasser Age 7-18	Expanded Trespasser Age 19-50	On-Property Groundskeeper	On-Property Home Building Age 19+
All pathways except where noted												
EF (day/yr)	52[a]	350[b]	350[b]	NA	350[b]	275[i]	350[b]	350[b]	110[m]	40[m]	35[p]	175[d]
ED (yr)	12[a]	70[b]	6[b]	NA	70[b]	9	70[b]	6[b]	12[m]	32[m]	25[s]	1[d]
BW (kg)	43[b]	70[b]	15[b]	NA	70[b]	70[b]	70[b]	15[b]	43[b]	70[b]	70[b]	70[b]
AT-Noncancer (day)	4380[b]	25550[b]	2190[b]	NA	25550[b]	3285[b]	25550[b]	2190[b]	4380[b]	11680[b]	9125[b]	175[b]
AT-Cancer (day)	25550[b]	25550[b]	25550[b]	NA	25550[b]	25550[b]	25550[b]	25550[b]	25550[b]	25550[b]	25550[b]	25550[b]
Inhalation of dusts, volatiles, and radon												
IR (m^3/hr)	0.83[b]	0.83[b]	0.5[c,e]	NA	NA	0.83[b]	0.83[b]	0.5[e]	0.83[b]	0.83[b]	2.5[s]	0.83[b]
IR indoor (m^3/d)	NA	15[f]	15[f]	NA	NA	15[f]	15[f]	15[f]	NA	NA	NA	NA
ET outdoors (hr/day)	4[a]	5.7[h]	2[j]	NA	NA	4.2[i]	5.7[h]	2[j]	2.0[m]	1.0[m]	8.0[s]	8[d]
Drinking water												
IR (L/day)	NA	2.0[b]	1.0[b]	NA	2.0[b]	1.4	2[b]	1.0[b]	NA	NA	NA	NA
FI (L/day)	NA	1.0[b]	1.0[b]	NA	1.0[b]	1.0[b]	1.0[b]	1.0[b]	NA	NA	NA	NA
Dermal contact while bathing												
SA (m^2)	NA	2.3[k]	0.8[k]	NA	2.3[k]	2.0[k]	2.3[k]	0.8[k]	NA	NA	NA	NA
DA_e (mg/cm_2-event)	NA	csv[l]	csv[l]	NA	csv	csv	csv	csv	NA	NA	NA	NA
ET (hr/day)	NA	0.25[k]	0.25[k]	NA	0.25[k]	0.17[k]	0.25[k]	0.25[k]	NA	NA	NA	NA
Incidental ingestion of surface water while swimming or wading												
IR (L/hr)	0.035[g]	NA	NA	NA	0.05[k]	NA	NA	NA	0.035[g]	NA	NA	NA
ET (hr/day)	1.0[a]	NA	NA	NA	2.6[k]	NA	NA	NA	1.0	NA	NA	NA
EF_{wading} (day/yr)	52[a]	NA	NA	NA	NA	NA	NA	NA	52[a]	NA	NA	NA
EF_{swim} (day/yr)	NA	NA	NA	NA	7[k]	NA	NA	NA	na	NA	NA	NA
ED (yrs)	12[a]	NA	NA	NA	30	NA	NA	NA	12[a]	NA	NA	NA

TABLE E.3-18
(Continued)

Pathway Parameters (units)	Trespassing Youth Age 7-18	Off-Property RME Resident Adult Farmer Age 1-70	Off-Property RME Resident Child Age 0-6	User of Meat & Milk Grown Within OU1 Age 1-70	User of Great Miami River Water Age 1-70	On-Property CT Resident Adult Farmer Age 1-70	On-Property RME Resident Adult Farmer Age 1-70	On-Property RME Resident Child Age 0-6	Expanded Trespasser Age 7-18	Expanded Trespasser Age 19-50	On-Property Groundskeeper	On-Property Home Building Age 19+
Dermal contact with surface water while swimming or wading												
SA (m^2)	5130[g]	NA	NA	NA	2.3[k]	NA	NA	NA	5130[g]	NA	NA	NA
DA_e (mg/cm^2-event)	csv[l]	NA	NA	NA	csv[l]	NA	NA	NA	csv[l]	NA	NA	NA
ET (hr/day)	1.0	NA	NA	NA	2.6[k]	NA	NA	NA	1.0	NA	NA	NA
EF_{swim} (day/yr)	NA	NA	NA	NA	7[k]	NA	NA	NA	NA	NA	NA	NA
EF_{wading} (day/yr)	52[a]	NA	NA	NA	NA	NA	NA	NA	52[a]	NA	NA	NA
ED (yrs)	12[a]	NA	NA	NA	30	NA	NA	NA	12[a]	NA	NA	NA
Incidental ingestion of soil/sediment												
IR (g/day)	0.1[b]	NA	NA	NA	NA	0.122[a]	0.18[r]	0.2[b]	0.1[b]	0.1[b]	0.1[b]	0.48[a]
$FI_{sed.}$ (unitless)	0.06[t]	NA	NA	NA	NA	NA	NA	NA	0.1[t]	NA	NA	NA
FI_{soil} (unitless)	0.19[t]	NA	NA	NA	NA	1.0[b]	1.0[b]	1.0[b]	0.1[t]	.05[t]	1.0[b]	1.0[d]
Dermal contact with soil/sediment												
SA (m^2)	0.42[k]	NA	NA	NA	NA	0.5[k]	0.575[k]	0.2[k]	.42[k]	.575[k]	.575[k]	0.575[k]
AF (mg/cm^2)	1.00[k]	NA	NA	NA	NA	0.2[k]	1.0[k]	1.0[k]	1.0[k]	1.0[k]	1.0[k]	1.0[k]
ABS (unitless)	csv	NA	NA	NA	NA	csv	csv	csv	csv	csv[l]	csv	csv
External radiation exposure												
DR (mrem/hr)	csv	NA	NA	NA	NA	csv	csv	csv	csv	csv	csv	csv
ET indoors (hr/day)	NA	NA	NA	NA	NA	19.8[i]	18.3[h]	22[j]	NA	NA	NA	4[d]
ET $outdoor_{sediment}$ (hr/day)	1[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ET $outdoors_{soil}$ (hr/day)	3_a	NA	NA	NA	NA	4.2[i]	5.7[h]	2[j]	2.0[m]	1.0[m]	8.0[s]	4[d]
SH indoors (unitless)	NA	NA	NA	NA	NA	0.5[b]	0.5[b]	0.5[b]	NA	NA	NA	0.5[b]
SH outdoors (unitless)	0[b]	NA	NA	NA	NA	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]	0[b]

TABLE E.3-18
(Continued)

Pathway Parameters (units)	Trespassing Youth Age 7-18	Off-Property RME Resident Adult Farmer Age 1-70	Off-Property RME Resident Child Age 0-6	User of Meat & Milk Grown Within OU1 Age 1-70	User of Great Miami River Water Age 1-70	On-Property CT Resident Adult Farmer Age 1-70	On-Property RME Resident Adult Farmer Age 1-70	On-Property RME Resident Child Age 0-6	Expanded Trespasser Age 7-18	Expanded Trespasser Age 19-50	On-Property Groundskeeper	On-Property Home Building Age 19+
Ingestion of vegetables, fruit, meat, milk products and fish												
IR_{fruit} (g/day)	NA	140[b,n]	204[o,b]	NA	140[b]	140[n,b]	140[n,b]	204[o,b]	NA	NA	NA	NA
FI (unitless)	NA	0.3[n,b]	0.3[n,b]	NA	0.3[n,b]	0.2	0.3[n,b]	0.3[n,b]	NA	NA	NA	NA
$IR_{vegetables}$ (g/day)	NA	200[b,n]	100[o,b]	NA	200[b,n]	200[b]	200[n,b]	100[o,b]	NA	NA	NA	NA
FI (unitless)	NA	0.4[n,b]	0.4[n,b]	NA	0.4[n,b]	0.25	0.4[n,b]	0.4[n,b]	NA	NA	NA	NA
IR_{meat}(g/day)	NA	100[b]	39[o,b]	100[b]	100[b]	100[b]	100[b]	39[o,b]	NA	NA	NA	NA
FI (unitless)	NA	.75[b]	0.75[b]	.75[b]	0.75[b]	0.44	0.75[b]	0.75[b]	NA	NA	NA	NA
IR_{milk} (L/day)	NA	0.4[b]	0.9[b]	0.4[b]	0.4[b]	0.16	0.3[b]	0.9[b]	NA	NA	NA	NA
FI (unitless)	NA	.75[b]	0.75[b]	0.75[b]	0.75[b]	0.75[b]	0.75[b]	0.75[b]	NA	NA	NA	NA
IR(fish)	NA	NA	NA	NA	54[b]	NA	NA	NA	NA	NA	NA	NA

[a] DOE 1993d, Comment Responses - Site Wide Characterization Report. Assumes a youth trespasses on site 3 days/wk from June through August, plus 1 day/wk in April, May, September, and October, for a total of 52 days/yr, 4hr/day (of which one hour is spent playing in Paddys Run).
[b] DOE 1992a
[c] EPA 1993c
[d] Assumes a home builder spends 175 8-hour days building a home, spending 50% of his time working in/on the house, and 50% of the time working in/on the soil/waste.
[e] EPA 1988c,Derived from an algorithym relating respiratory rate to body rate, corrected by a factor of 2.11
[f] EPA, 1991f
[g] Assumes a youth swallows 0.035 L/hr while wading. Also assumes approximately 30% body surface area exposure for a wading scenario.
[h] Assumes the RME farmer spends 2000 hours outdoors during the 350 days of exposure a year (5.7 h/d = 2000 h/y / 350 d/y). Indoor duration is the remaining time in a day.
[i] EPA 1992j Assumes the CT farmer spends the equivalent of 48 days during a 275 day exposure period outdoors each year. (4.2 h/d = 24 h/d x 48 d/275 d/y). Indoor duration is the remaining time in a day.
[j] Assumes a resident small child spends 700 hours/year outdoors.
[k] EPA 1992e, EPA/600/8-91/011b.
[l] csv - Chemical Specific Value.
[m] Assumes the expanded trespasser visits the site 110 days/yr (2 hr/day) as a youth, and 40 days/yr (1hr/day) as an adult for a total of 44 years. Only the youth plays in Paddys Run.
[n] EPA 1990d, EPA/600/8-89/043
[o] USDA 1986, NFCS, CSFII Report No. 85-1.
[p] Assumes the groundskeeper works in the on the grounds of OU1, 35 days/yr.
[q] NA - Not applicable.
[s] EPA 1991j
[t] DOE 1993e Response to Comment 265 of the OU4 RI (FI for soil and sediment are based on the number of hours exposed out of 16 waking hours).
[u] Parameters represent values used for exposure to both media, sediment, and soil which apply to that receptor.

bone, and several excretory pathways. In humans, lead concentrations in bone increase with age (Tsuchiya, 1986). About 90 percent of the body burden of lead is located in the skeleton. Neonatal blood concentrations are about 85 percent of maternal concentrations (EPA 1990c). Excretion of absorbed lead is principally through the urine, although GI secretion, biliary excretion, and loss through hair, nails, and sweat are also significant.

E.4.2.47.2 Noncancer Toxicity

The noncancer toxicity of lead to humans has been well characterized through decades of medical observation and scientific research (EPA 1993a). The principal effects of acute oral exposure are colic with diffuse paroxysmal abdominal pain (probably due to vagal irritation), anemia, and, in severe cases, acute encephalopathy, particularly in children (Tsuchiya 1986). The primary effects of long-term exposure are neurological and hematological. Limited occupational data indicate that long-term exposure to lead may induce kidney damage. The principal target organs of lead toxicity are the erythrocyte and the nervous system. Some of the effects on the blood, particularly changes in levels of certain blood enzymes, and subtle neurobehavioral changes in children, appear to occur at levels so low as to be considered nonthreshold effects.

386

387 ~~HEAST (EPA 1993g) presents no inhalation RfC for lead, but refers to the National~~

41-US ~~Ambient Air Quality Standard (NAAQS) for lead, which could be used in lieu of an inhalation RfC. However, this NAAQS standard was not used in the Operable Unit 1 baseline risk assessment.~~ . ***However, this NAAQS standard is not useful in determining the impact of lead on children under the age of seven and; therefore, was not used in the Operable Unit 1 baseline risk assessment.*** The NAAQS for lead is 1.5 $\mu g/m^3$, averaged quarterly (EPA 1992b). The NAAQS is equivalent to 0.00043 mg/kg/day, assuming a body weight of 70 kg and an inhalation rate of 20 m^3/day.

The EPA (1990c, 1993a) determined that it is inappropriate to derive an RfD for oral exposure to lead for several reasons. First, the use of an RfD assumes that a threshold for toxicity exists, below which adverse effects are not expected to occur; however, the most sensitive effects of lead exposure, impaired neurobehavioral development in children and altered blood enzyme levels associated with anemia, may occur at blood lead concentrations so low as to be considered practically nonthreshold in nature. Second, RfD values are specific for the route of exposure for which they are derived. Lead, however, is ubiquitous,

exposure. Finally, the dose-response relationships common to many toxicants, and upon which derivation of an RfD is based, do not hold true for lead. This is because the fate of lead within the body depends, in part, on the amount and rate of previous exposures, the age of the recipient, and the rate of exposure. There is, however, a reasonably good correlation between blood lead concentration and effect. Therefore, blood lead concentration is the appropriate parameter on which to base the regulation of lead.

The EPA UBK lead model is an iterated set of equations that estimate blood lead concentration in children aged 0 to 7 years (EPA 1990c; 1991c). The biokinetic part of the model describes the movement of lead between the plasma and several body compartments and estimates the resultant blood lead concentration. The rate of the movement of lead between the plasma and each compartment is a function of the transition or residence time (i.e., the mean time for lead to leave the plasma and enter a given compartment, or the mean residence time for lead in that compartment). Compartments modeled include the erythrocytes, liver, kidneys, all the other soft tissue of the body, cortical bone, and trabecular bone. Excretory pathways and their rates are also modeled. These include the mean time for excretion from the plasma to the urine, from the liver to the bile, and from the other soft tissues to the hair, skin, sweat, etc. The model permits the user to adjust the transition and residence times.

41-US ~~At the time the Operable Unit 1 baseline risk assessment was completed, a final version of the EPA UBK model and guidance for its use in Superfund risk assessment was not available. Considering the current limitations of the EPA UBK model, it was not applied in the assessment of health effects of lead for Operable Unit 1.~~

EPA guidance (EPA, 1989k) establishes an interim soil cleanup level for lead of 500 to 1000 parts per million (ppm) to be applied at Superfund sites. This range is considered by EPA to be protective for direct contact with lead-contaminated soils in residential settings. The guidance adopts recommendations of the Centers for Disease Control and is to be followed
41-US when current or predicted land use is residential. ***Version 0.99 of the 1UBK model has undergone Science Advisory Board review and is currently being distributed.***

~~In more recent guidance (EPA 1991i) EPA states that they are seeking resolution of specific technical concerns before issuing a directive recommending the UBK model as the preferred~~

Appendix E-4

Tables

TABLE E.4-5

TOXICITY EQUIVALENCY FACTORS (TEFs)[a] AND CORRESPONDING ORAL AND INHALATION SLOPE FACTORS FOR THE GROUP B2 PAHs

PAH	Relative Potency	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$
Benzo(a)pyrene	1.0	7	6
Benzo(a)anthracene	0.1	0.7	0.6
Benzo(b)fluoranthene	0.1	0.7	0.6
Benzo(k)fluoranthene	0.01	0.07	0.06
Chrysene	0.01	0.07	0.06
Dibenzo(a,h)anthracene	1.0	7	6
Indeno(1,2,3-cd)pyrene	0.1	0.7	0.6

[a]EPA, 1993f

control, and source term configuration are based on the predicted air concentrations at that point, for whatever time frame is specified for a particular scenario/receptor.

E.5.2.2 Risks to the Groundskeeper

The hypothetical groundskeeper is an adult who is expected to be occupationally exposed on a routine basis over a period of 25 years. This receptor is assumed to receive exposures from incidental ingestion of soil, dermal contact with soil, inhalation of fugitive dust, and from external gamma radiation from both buried waste pit material and surface soil. The exposure input parameters used in evaluating this receptor were presented in Table E.3-17. Detailed chemical-specific risk estimates and hazard quotients are presented in Tables E.IV-1 and E.IV-2, and are also summarized in Tables E.5-1 and E.5-2. Note that cancer risks for chemicals in Table E.5-1 are presented two ways. The first method was based on the toxicity equivalency factor (TEF) approach for assessing risk to potentially carcinogenic polynuclear aromatic hydrocarbons (PAHs). The second method was based on the assumption that all carcinogenic PAHs have the same cancer slope factor as benzo(a)pyrene. Both approaches are presented to allow a comparison of results.

Radionuclides

Inhalation of fugitive dust, and penetrating radiation from both soil and buried waste pit materials are the primary exposure routes of concern for this receptor. Uranium and thorium isotopes are the primary contributors to the inhalation risk; and uranium, thorium, and radium isotopes produce the most significant external gamma exposures. The total risk from

TBL radionuclides for this receptor are ~~8×10^{-5}~~ 1×10^{-4}.

Chemical Carcinogens

Dermal contact exposures under the defined exposure scenario produce calculated risks of 1×10^{-5}. This risk is due to the presence of beryllium and PCBs at concentrations ~~0.771~~ *0.8* mg/Kg and 1.4 mg/kg in on-property surface soils.

Chemical Toxicants

Most of the metals found in the soil are not toxic via inhalation. Direct contact exposures

DOE produce a ~~Health~~ *Hazard* Index of 0.3 for this receptor; therefore, the potential for systemic effects are low. Dermal absorption of uranium (~~414.5~~ *413.5* mg/Kg) in surface soil is the primary driver of the Hazard Index. The estimated Hazard Index for soil ingestion is 0.03.

These Hazard Indices are well below unity, and therefore the onset of toxic effects is unlikely for this receptor.

E.5.2.3 Risks to the Off-Property Resident Farmer

At the current time, no homes are located at the point of maximum risk via the air exposure pathways. However, a hypothetical receptor was developed based on the assumption that he would be subject to indirect (air) exposures from the property for a period of 70 years. A more detailed description of this receptor and the parameter values used in calculating risks are presented in Section E.3.5 of this report. For the current scenarios, this receptor's risks are also summarized on Tables E.5-1 and E.5-2. Detailed, chemical-specific risks and hazard quotients are presented in Tables E.IV-3 and E.IV-4.

Radionuclides

The hypothetical off-property resident exposed to the predicted concentrations of radionuclides in air incurs a total calculated risk of 3×10^{-6}, as shown in Table E.5-1. Table E.IV-3 indicates that these risks are primarily associated with inhalation of thorium and uranium isotopes. Risks from inhalation constitute almost 100 percent of the total air pathway risks.

Chemical Carcinogens

Exposure of the off-property resident adult is also considered for the predicted air concentrations of chemicals originating in the surface soil at the FEMP. Multiple exposure routes are considered, such as inhalation of dust and ingestion of foodstuffs affected by dust. The risk from any one of the food pathways exceed the risk incurred via inhalation. A hypothetical receptor is expected to experience a total chemical carcinogenic risk of

TBL ~~1×10^{-7}~~ 2×10^{-7}, which is more than an order of magnitude below the risks attributable to the radionuclides.

There are two major contributors to the total chemical carcinogenic risk. The first is total PCBs, which present the primary component of the food pathways risk. The metals cadmium and beryllium produce the highest risk via inhalation of fugitive dust.

Chemical Toxicants

A number of metals were found in the surface soils, and are subject to off-property transport via fugitive dust emissions. While many of these metals are not toxic via inhalation, aerial

deposition on foodstuffs can contribute to the total Hazard Index. As shown in Table E.5-2,
TBL the total Hazard Index for this receptor is ~~0.0002~~ *0.00027*.

E.5.2.4 Risks to the Off-Property Resident Child

A hypothetical child receptor was developed to compliment the off-property resident adult and permit evaluation of health risks to a critical potential subpopulation. This receptor is based on the assumption that the individual would be subject to indirect (air) exposures from the property for a period of 6 years. A more detailed description of this receptor and the parameter values used in calculating risks are presented in Section E.3.5 of this report. For the current scenarios, this receptor's risks are also summarized on Tables E.5-1 and E.5-2. Detailed, chemical-specific risks and hazard quotients are presented in Tables E.IV-5 and E.IV-6.

Radionuclides

The hypothetical off-property child who is exposed to the predicted concentrations of radionuclides from air incurs a total calculated risk of 2×10^{-7}, as shown in Table E.5-1. Table E.IV-5 indicates that these risks are primarily associated with the presence of thorium and uranium isotopes. Risks from inhalation constitute almost 100 percent of the total air pathway risks.

Chemical Carcinogens

Exposure of the off-property resident child is also considered for the predicted air concentrations of chemicals originating in the surface soil at the FEMP. Risks from any one food pathway exceed the risks incurred via inhalation. This hypothetical receptor is expected
TBL to experience total chemical carcinogenic risks of ~~7×10^{-8}~~ 8×10^{-8} ~~which is more than an order of magnitude below the risks attributable to the radionuclides~~.

There are two major contributors to the total chemical carcinogenic risks. The first is total PCBs, which present the primary component of the food pathways risks. The metals cadmium and beryllium produce the highest risks via inhalation of fugitive dust.

Chemical Toxicants

A number of metals were found in the surface soils, and are subject to off-property transport via fugitive dust emissions. While many of these metals are not toxic via inhalation, the

fallout on foodstuffs can contribute to the total Hazard Index. As shown in Table E.5-2, the total Hazard Index for this receptor is ~~0.0001~~ ***0.0013***.

E.5.3 CURRENT LAND USE WITHOUT ACCESS CONTROLS

This scenario assumes industrial use of the site continues and that access controls and engineering controls on the property are relaxed or discontinued. Over time, uncontrolled erosion and subsidence could expose waste. Therefore, both the current and future source term configurations were considered when evaluating this land use scenario.

Air modeling was used to identify the points of maximum on-property and off-property risk for both source term configurations. Once the transport criteria were fixed and the source (soil) concentrations were input, the resulting air concentrations were combined with the composite radiological and chemical intake and dose-response factors to determine the grid location of maximum risk (Figure E.3-4). In the case of on-site exposures, this point was the 0,0 coordinate, which is located in the center of the Burn Pit. The point of maximum off-property risk is identified as a point at the fenceline approximately 450 meters west and 150 meters south of the center of the Burn Pit. All risks discussed for the on-site and off-site air concentrations for these land uses, access control and source term configurations are based on the predicted air concentrations at that point, for whatever time frame is specified for a particular scenario/receptor.

The groundwater modeling exercise for the future source term determined the location of the maximum carcinogenic risk in much the same manner as that described for the air modeling. A grid was established, and once the contaminant plume migration was predicted for each grid node, the composite intakes and risks were applied to the predicted concentrations of each modeled constituent at each node. Once the point of maximum risk was determined, the concentrations of all contaminants at that point were evaluated. The point of maximum
31-US off-property risk via groundwater exposure is located east of the fenceline ***(Figures E.5-1 and E.5-2)***. Modeled constituents are estimated to reach a maximum total risk at that location in approximately 680 years. The point of maximum on-property risk is located just
31-US down-gradient of Waste Pit 4, ***(Figures E.5-1 and E.5-2)*** and the maximum concentrations leaching from the waste pits is expected in 630 years. These receptor locations were shown in Figure E.3-4.

E.5.3.1 Current Source Term Configuration

Risks to five hypothetical receptors and one composite receptor were assessed under this current land use scenario using the current source term:

- A groundskeeper
- An off-property resident farmer
- An off-property resident child
- A trespassing youth
- A person ingesting meat and milk products from animals grazed and watered on the operable unit
- A composite off-property receptor combining some of the behaviors of the trespassing youth, off-property resident farmer, and the off-property user of meat and milk products

Risks to the groundskeeper, the off-property resident farmer, and the off-property resident child are the same as those presented under current land use with access controls (Section 5.2.1). Risks to the trespassing youth and the off-property user of meat and milk products are presented below.

E.5.3.1.1 Risks to the Trespassing Youth

The hypothetical trespassing youth is postulated to receive exposures while wandering randomly through the study area, and is evaluated to explore potential risks to a subpopulation of potential concern. This receptor is assumed to be an older child, aged 6 to 18 years old. A more detailed description of this receptor and the parameter values used in calculating risks are presented in Section E.3.5 of this report. Chemical-specific risk estimates and hazard quotients are presented in Tables E.IV-7 and E.IV-8, and are summarized by pathway and media in Tables E.5-1 and E.5-2.

Radionuclides

The measured and modeled concentrations of radionuclides in surface soil and air produce a
TBL total calculated risk of ~~3×10^{-5}~~ 5×10^{-5}, as shown in Table E.5-1. Penetrating radiation from buried waste pit material, and external gamma exposure to uranium isotopes in surface soil contribute over 95% of the total risk. Uranium and thorium isotopes (in equilibrium with their short-lived daughters) are the primary radionuclides of concern in the air and account for almost 100 percent of the risk from inhalation.

Chemical Carcinogens

If exposed to the concentrations of contaminants currently found in surface soil or modeled to exist in air, the trespassing child would incur total calculated risks of ~~1×10^{-5}~~ 9×10^{-6}. These total risks include risks of about 9×10^{-6} from dermal contact and incidental ingestion of soil containing total PCBs and beryllium. Dermal contact with soil produces over 95 percent of the total incremental cancer risks from chemicals.

Chemical Toxicants

Dermal contact with current measured concentrations of noncarcinogenic chemicals found in the surface soil produce over 97% of the calculated Hazard Index of about 0.5 from all pathways (Table E.5-2). Uranium, cadmium, and antimony are the primary contributors to the total Hazard Index for this receptor. The results indicate exposures to noncarcinogenic compounds by a trespassing child would be unlikely to result in any adverse (toxic) health effects.

E.5.3.1.2 Risks to the Off-Property User of Meat and Milk Products

The final receptor considered under the current land use/current source configuration is an off-property adult who routinely (over a period of 70 years) ingests meat and milk products from cows grazed and watered in the Operable Unit 1 area. This scenario is based on the current surface soil and surface water concentrations, and uses the exposure input parameters presented in Table E.3-17. This receptor could only be exposed should land use controls be discontinued. The risks are summarized in Tables E.5-1 (carcinogenic risks) and E.5-2 (Hazard Indices). Tables E.IV-9 and E.IV-10 present the detailed risks and hazard quotients for each chemical, exposure route, and medium.

Radionuclides

The total incremental lifetime cancer risk incurred by the off-property user of meat and milk products produced on site is ~~4×10^{-4}~~ 7×10^{-4} for the radionuclides. Ingestion of milk products is the route that produces the maximum risks. This exposure scenario's risks are driven by the uranium isotopes, Tc-99, Sr-90, and Cs-137. With the exception of the uranium isotopes, which were found at high activities, Tc-99, Sr-90, and Cs-137 are highly mobile in the environment and readily transfer from soil to the food chain.

Chemical Carcinogens

For this scenario and receptor, biotransfer from soil to plant material and hence to meat or milk controls the total carcinogenic risks from chemicals. Total risks to the off-property

TBL resident exposed in this manner are about ~~8×10^{-4}~~ 9×10^{-4}, and is almost solely attributable to soil biotransfer of PCBs and benzo(a)pyrene to meat and milk.

Chemical Toxicants

TBL This off-property receptor adult incurs a Hazard Index of ~~2~~ *2.9* via all routes of exposure. Ingestion of meat from cows grazed on the property produces a Hazard Index greater than 1.0. Antimony, cadmium, and uranium are the primary contributors to the Hazard Index for food pathways originating in soil, while silver is most significant for the water pathways. These Hazard Indices are summarized in Table E.5-2.

E.5.3.1.3 Risks to a Composite Off-Property Receptor

It is conceivable that a local resident could not only live downwind of the waste pits, but could also ingest locally produced meat or milk products and have trespassed on the site as a child. In this unlikely case, the total risks incurred by this receptor would be the total risks for three of the receptors presented above. When exposures overlap, the more conservative value is considered. For example, both the off-property resident adult and the off-property user of meat and milk products consume animal products at the same rate, only the activity giving the higher exposure (consumption of meat and milk products grown on-site) is counted toward the total exposure to the composite off-property resident.

TBL The total radiological risk would be about ~~5×10^{-4}~~ 6×10^{-4}. This accounts for direct radiation

DOE, TBL exposures and soil ingestion/dermal contact as a trespassing ~~child~~ *youth* (~~3×10^{-5}~~ 5×10^{-5}), inhalation of dust and ingestion of vegetables and fruits affected by aerial deposition

TBL (3×10^{-6}), and ingestion of meat and milk products produced on property (~~4×10^{-4}~~ 5×10^{-4}).

TBL The total chemical carcinogenic risk for this composite receptor would be ~~1×10^{-3}~~ 5×10^{-4} for the same routes of exposure. Of the radionuclides, Sr-90 and uranium in the soil are most significant, and total PCBs are the most significant risk drivers for the chemical carcinogens.

TBL The composite HI for this receptor is ~~2~~ *3* for all pathways. Again, it is the biotransfer from soil to vegetation and into the food chain that drives this risk. Cadmium, antimony, and uranium are the primary noncarcinogenic analytes in this exposure scenario.

E.5.3.2 Future Source Term Configuration

Risks to five hypothetical receptors and one composite receptor were assessed for the future source term under this land use scenario:

- An off-property resident farmer
- An off-property resident child
- A trespassing youth
- A person using meat and milk products from animals grazed and water on the operable unit
- A person using the Great Miami River for domestic, agricultural, and recreational use
- A composite off-property receptor combining some of the behaviors of the trespassing youth, off-property resident farmer, and the off-property user of meat and milk products

Risks to the off-property resident farmer, and the off-property resident child are the same as those presented under current land use with access controls (Section 5.2.2.1). Risks to the off-property user of meat and milk products are the same as those under future land use without access controls presented in Section 5.5 below. Risks to the trespassing youth, the Great Miami River User, and composite receptors are presented below.

E.5.3.2.1 Risks to the Trespassing Youth

Under the current land use, future source term configuration, it is possible that an older child could trespass on the property over a period of 12 years. This receptor could be exposed to site-related contaminants via inhalation of fugitive dust and radon, via penetrating gamma radiation from buried waste pit material, and via direct contact with surface soil, exposed waste pit material, surface water, and sediment in Paddys Run that originated as soil within the Operable Unit 1 boundaries. ILCRs and hazard quotients for this receptor are summarized in Table E.5-3 and E.5-4, and the detailed calculations are contained in Tables E.IV-11 and E.IV-12.

Radionuclides

Exposures to fugitive dust emissions and external exposure from exposed waste pit material and surface soil result in roughly equal risks (8×10^{-5} and 1×10^{-4}), and account for almost 100 percent of the total radiocarcinogenic risk (2×10^{-4}) for this receptor. The primary

contributors to this risk are Th-230 and Ra-226 found in the exposed waste pit materials from Waste Pits 3, 5, and 6. Other routes of exposure such as sediment or soil ingestion and external exposure to sediment result in risks one or more orders of magnitude lower.

Chemical Carcinogens

The total chemical carcinogenic risk for the trespassing youth is 1×10^{-4}. Inhalation of fugitive dust, incidental ingestion of soil, and dermal contact with soil result in the greatest individual pathway risks (4×10^{-5}, 4×10^{-5}, and 4×10^{-5}, respectively) for this receptor. These risks are driven by the presence of arsenic and beryllium in the soil. Organic compounds such as PCBs and dioxins result in risks one or more orders of magnitude lower than the metals. For example, total risks for all PCBs via soil ingestion and dermal contact are 3×10^{-6} and all chlorinated dioxins and furans result in total soil pathway risks of 5×10^{-8}.

Chemical Toxicants

Inhalation of resuspended soil produces a Hazard Quotient of 1.9 for this receptor. No one constituent produces a Hazard Index exceeding 1. Dermal contact with soil containing uranium and ingestion of soil containing arsenic contribute almost 60 percent of the Hazard Index for this receptor.

E.5.3.2.2 Great Miami River User

This hypothetical adult receptor is assumed to live adjacent to the Great Miami River and use untreated river water for all domestic uses, as well as for swimming and as a source of fish, over a period of 70 years. The Great Miami River user is evaluated to explore the risks to an off-property subpopulation of concern. A more detailed description of this receptor and the input parameters used to calculate risks is contained in Section E.3. Risks and HIs for this receptor are contained in Tables E.IV-13 and E.IV-14, and are summarized in Tables E.5-3 and E.5-4.

Radionuclides

The total incremental cancer risk from radionuclides incurred by this hypothetical receptor is

TBL ~~2×10^{-7}~~ 3×10^{-7}, which is within the range generally considered to be acceptable (EPA 1990e). Of all the pathways evaluated, routine ingestion of the river water as a potable water source produces over 70 percent of the risk. U-238, which is predicted to reach the river at a

concentration of ~~0.103~~ *0.1* pCi/L, contributes about 80 percent of the risks from drinking water. U-234 and Sr-90 make up essentially all of the remaining risk from radionuclides.

Chemical Carcinogens

The total incremental cancer risk from chemical carcinogens in river water is about 3 x 10^{-8}. Ingestion of fish dominates this pathway, contributing 60% of to the total. Total PCB's in fish are calculated to produce risks of ~~1.5 x 10^{-8}~~ *2 x 10^{-8}*.

TBL

Chemical Toxicants

The Hazard Quotient for this receptor is 0.004. The predicted level of uranium in the river water is the major contributor to this HI.

E.5.3.2.3 Risks to a Composite Off-Property Receptor

A composite off-property receptor is also considered in this risk assessment. It is considered possible that a local resident could trespass on the site, live downwind or down-gradient of the site as an adult, and regularly ingest meat or milk products grown on property.

Radionuclides

The total radiological risks associated with these multiple exposures are 1 x 10^{-3}. Uranium and thorium isotopes (for the direct contact and inhalation scenarios) and U-238 (for the food ingestion pathways) are the most significant contributors to the risk.

Chemical Carcinogens

Arsenic, beryllium, and benzo(a)anthracene found in the soil drive the carcinogenic risks for this hypothetical composite receptor. The food pathways (ingestion of fruits and vegetables affected by dust from the site, ingestion of meat and milk products from cows grazed on the site) and dermal contact cause the major portion of the risk. The total pathway risk for this receptor from carcinogenic chemicals is about 1 x 10^{-3}.

Chemical Toxicants

There are several metals that contribute to the Hazard Index of 20 for the composite off-property receptor. Uranium in groundwater contributes over half of this Hazard Index.

E.5.4 FUTURE LAND USE WITH ACCESS CONTROLS (GOVERNMENT RESERVE)

This scenario postulates the government retains ownership of the operable unit and continues to restrict access to the site, but does not maintain the engineering controls of the pits, allowing erosion and subsidence to expose waste. The receptors associated with this scenario include:

- An adult trespasser who also trespassed as a youth (an "expanded trespasser")
- A groundskeeper
- An off-property resident farmer
- An off-property resident child
- A person using meat and milk products from animals grazed and water on the operable unit
- A person using the Great Miami River for domestic, agricultural, and recreational use
- A composite off-property receptor combining some of the behaviors of the adult trespasser, the off-property resident farmer, and the off-property user of meat and milk products

Risks to the off-property resident farmer, off-property resident child, and off-property user of meat and milk products are the same as those presented under future land use with the future source term. The Great Miami River user is the same as those listed under current land use with the future source term (Section 5.3). Risks to the remaining receptors are presented below.

E.5.4.1 Expanded Trespasser

The hypothetical trespassing adult is assumed to receive exposures while wandering randomly through the study area, and is evaluated to explore potential risks to a subpopulation of potential concern. A more detailed description of this receptor and the parameter values used in calculating risks are presented in Section E.3.5 of this report. Chemical-specific risk estimates and hazard quotients are presented in Tables E.IV-15 and E.IV-16, and are summarized by pathway and media in Tables E.5-5 and E.5-6.

Radionuclides

The measured and modeled concentrations of radionuclides in surface soil and air produce a total calculated risk of 4×10^{-4}, as shown in Table E.5-5. Air (inhalation exposures only), penetrating radiation from buried waste pit material, and external gamma exposure to

radionuclides in surface soil contribute most of the total radiological risks from the air. Uranium and thorium isotopes (in equilibrium with their short-lived daughters) are the primary radionuclides of concern in the air and account for almost 100 percent of the total radiological risks from the air. Uranium, thorium, and radium isotopes are the primary components of the external exposure risk.

Chemical Carcinogens

If exposed to the concentrations of contaminants currently found in surface soil or predicted to exist in air, the expanded trespasser would incur a total risk of 3×10^{-4}. This total risk includes 6×10^{-5} from the inhalation of fugitive dust containing arsenic and chromium VI, and
TBL a risk of about ~~1×10^{-4}~~ 2×10^{-4} from dermal contact with total PCBs, arsenic, and beryllium.

Chemical Toxicants

The current measured concentrations of noncarcinogenic chemicals found in the surface soil and predicted concentrations of these contaminants in air produce calculated Hazard Indices of about 0.3 from inhalation of fugitive dust, 0.5 from incidental ingestion, and 3 from dermal contact with soil, for a total Hazard Index of 4 from all pathways. Hazard Indices are summarized in Table E.5-6. Dermal contact with soil containing uranium is the primary contributor to the total Hazard Index for this receptor (Hazard Index = 2). The results indicate that exposure to uranium in soil by the expanded trespasser suggests that adverse health (toxic) effects are possible under the proposed conditions.

E.5.4.2 Groundskeeper

The proposed groundskeeper scenario evaluates exposures and health impacts of an adult who receives occupational exposures during landscaping and routine maintenance activities within the operable unit boundaries. As stated in Section E.3, this receptor is expected to come into direct contact with the soil, and be exposed via inhalation of fugitive dust and external gamma radiation from both buried waste pit material and surface soil. The exposure input parameters used in evaluating this receptor were presented in Table E.3-17. Detailed chemical-specific risk estimates and hazard quotients are presented in Tables E.IV-17 and E.IV-18, and are also summarized in Tables E.5-5 and E.5-6.

Radionuclides

Inhalation of fugitive dust, and external exposure to radionuclides in soil, are the primary exposure routes of concern for this receptor. Uranium and thorium isotopes are the primary contributors to the inhalation risk, while thorium and radium isotopes produce the most significant external gamma exposures. The total risks from radionuclides for this receptor are

TBL ~~approach~~ 1×10^{-3}.

Chemical Carcinogens

The total incidental risk from chemical carcinogens for the groundskeeper is 4×10^{-4}. The inhalation risk under the defined exposure scenario is 2×10^{-4}, while incidental ingestion of soil contributes an additional 40% of the total risks. These risks are due primarily to the presence of arsenic and beryllium in surface soil and resuspended dust.

Chemical Toxicants

As with the expanded trespasser, cobalt (Hazard Quotient = 0.2), barium (Hazard Quotient = 0.2), and manganese (Hazard Quotient = 0.2) in fugitive dust are the primary drivers of the Hazard Index for inhalation. Arsenic in ingested soil (Hazard Quotient = 0.9) and dermal absorption of uranium from soil (Hazard Quotient = 0.4) contribute most of the remaining

TBL Hazard Index. The estimated HI is ~~2~~ *2.2* for all routes of exposure.

E.5.5 FUTURE LAND USE WITHOUT ACCESS CONTROLS

This scenario assume the government relinquishes ownership of the site. Access controls are discontinued, allowing neighboring land uses to encroach on the site. Maintenance of engineering controls cease, allowing erosion and subsidence to expose waste. Since maximum exposures to the remaining receptors occur in the future when waste pit material is exposed and runoff control does not exist, the probability of adverse human health effects is greater than with the current source term configuration. Risks to five hypothetical on-site and four hypothetical off-site receptors were evaluated for the future source term under this land use scenario:

- An on-property RME farmer
- An on-property child
- An on-property CT farmer
- An on-property farmer using water from pockets of perched water

- A person building a home
- An off-property resident farmer
- An off-property resident child
- A person using meat and milk products from animals grazed and water on the operable unit
- A person using the Great Miami River for domestic, agricultural, and recreational use

Risks to the Great Miami River User are the same as those discussed under current land use with the future source term (Section 5.3). Risks to these remaining receptors are presented below.

E.5.5.1 On-Property RME Farmer

This receptor is defined as an on-property resident farmer who spends his entire lifetime living and working on the Operable Unit 1 area. He receives direct exposures from a number of media by virtue of spending his life on property. The point of maximum exposure for this individual is considered to be in the vicinity of Waste Pit 4 and the Burn Pit (Figure E.3-4). The total risks for this receptor are summarized in Table E.5-7 (carcinogenic risks) and E.5-8 (Hazard Indices), and chemical-specific risks and hazard quotients are contained in Tables E.IV-19 and E.IV-20.

Radionuclides

External exposure to radionuclides in surface soil and waste pit materials contribute about 60 percent to the total risk of 5×10^{-2}. Uranium, radium and thorium isotopes in the soil/waste pit material are the major contributors to the risk (45%). Ingestion of groundwater and crops irrigated with groundwater at the predicted time of maximum risk (after 500 years) would result in calculated risks of 2×10^{-2} and 5×10^{-3}, respectively. Isotopes of uranium and thorium are the major contributors to the ingestion risk. Inhalation of fugitive dust contributes another 5×10^{-3}.

Other pathways and exposures are much smaller than these calculated risks. For example, risks associated with exposures to radon entering a home from the soil beneath it are about 1×10^{-7}.

Chemical Carcinogens

The total risk associated with exposure to chemical carcinogens (5×10^{-2}) is due primarily to various exposures to groundwater containing carcinogenic metals such as arsenic, and the incidental ingestion soil. Soil pathway risks are driven by the presence of arsenic in the soil.

Chemical Toxicants

The total Hazard Index for the on-property RME resident is 540. While the numbers should not be interpreted as a probability, it can be said that groundwater represents the most significant portion of this total (Hazard Index = 360). Ingestion of crops irrigated with groundwater (HI = 120), and incidental ingestion of soil (HI = 17) are also likely to result in adverse (toxic) health effects. Uranium, antimony, and arsenic contribute over 90 percent to the total Hazard Index for groundwater exposures.

E.5.5.2 On-Property Child

This hypothetical child receptor is assumed to reside within the Operable Unit 1 study area for a period of 6 years. A more detailed description of this receptor and the parameter values used in calculating risks are presented in Section E.3.5 of this report. This receptor is evaluated to assess the impacts of chemicals on the critical subpopulation of children assumed to reside within the operable unit.

The carcinogenic risks for this receptor are summarized in Table E.5-7, and the Hazard Indices are summarized in Table E.5-8. Detailed results are contained in Tables E.IV-21 and E.IV-22.

Radionuclides

The total radiocarcinogenic risk for the RME child receptor is estimated at 3×10^{-3}, which is an order of magnitude less than that predicted for the RME resident adult receptor. External exposure to exposed waste pit material and ingestion of contaminated groundwater together present almost 80 percent of the total risk. Uranium, thorium, and radium isotopes are the primary constituents of this risk.

Chemical Carcinogens

Table E.5-7 indicates that the total chemical carcinogenic risks from all evaluated pathways is 2×10^{-2}. Ingestion of drinking water from the Great Miami aquifer and ingestion of fruits

and vegetables irrigated with groundwater contribute about half of the total risk. Metals are the primary carcinogenic constituents.

Another 25 percent of the total risk is caused by direct exposures to surface soil and exposed waste pit material. Arsenic, beryllium, and total PCBs contribute most of the total risk.

Chemical Toxicants

The total Hazard Index for the RME child is 1600, as shown on Table E.5-8. The results of the risk assessment indicate that ingestion of groundwater contributes over 50 percent of the total Hazard Index. Food pathways also play a major role in the risk, both via air pathways and groundwater pathways. Uranium in soil and exposed waste pit material and groundwater is one of the major toxicants acting on potential child receptors at this facility.

Concentrations of lead in soil at Operable Unit 1 were compared to interim soil cleanup levels of 500 to 1000 ppm, which is recommended for use at Superfund sites where current or predicted land use is residential (EPA 1989k). The area-weighted average lead concentration of 52 ppm for Operable Unit 1 soils is well below this recommended range, indicating that lead levels are not expected to pose a significant health hazard to sensitive receptors, including children.

E.5.5.3 On-Property CT Farmer

This hypothetical receptor is defined as residing on the Operable Unit 1 study area for a period of 9 years, with all exposure routes considered using the parameters presented in Table E.3-18. Although this receptor is similar to the RME resident adult discussed in the preceding section, parameter values have been selected to evaluate risks that are closer to the expected average values.

As suggested by EPA guidance (EPA 1992d), the resident CT adult is included in this assessment because calculated risks to this receptor provide a useful perspective on the uncertainty involved with exposure parameters used in calculating risks to the RME adult.
415 While the central tendency evaluation calculates an incidence of health effects that is closer to the expected average of median incidence rate, it is important to note that many of the parameter values used exceed the median or average values.} For example, the CT adult scenario in this analysis uses the upper 95 percent confidence interval on the mean as the

exposure concentration. Thus the results presented for this receptor are not true average or median risks.

The risks for this receptor are also presented in Tables E.5-7 and E.5-8. Chemical-specific information on risks and individual pathways is contained in Tables E.IV-23 and E.IV-24.

Radionuclides

The overall risk from radionuclides for the CT receptor (4×10^{-3}) is about 10 percent of that calculated for the RME receptor (5×10^{-2}). The primary sources of risk (i.e., pathways, media, and contaminants) follow approximately the same distribution.

Chemical Carcinogens

Calculated incremental lifetime cancer risks from chemical exposure for the CT resident adult total 4×10^{-3}, without consideration of ingestion of water from the perched aquifer. Again, the carcinogenic metals like arsenic drive the risks, especially via ingestion of drinking water and ingestion of fruits and vegetables. Ingestion of surface soil while working outdoors is also a notable component of the total risk.

Chemical Toxicants

The toxic effects due to on-property exposures via food ingestion pathways followed closely by groundwater ingestion dominate the total Hazard Index (290) for this receptor. Ingestion of drinking water and ingestion of food crops affected by aerial deposition are the primary components of this HI. Again, the toxic metals drive this risk, particularly arsenic and uranium.

E.5.5.4 On-Property RME Farmer Using Perched Water for Domestic Purposes

This receptor is defined as an on-property resident farmer who spends his entire lifetime living and working on the Operable Unit 1 area. The single distinguishing difference between this receptor and the resident farmer discussed in Section E.5.5.1 is the source of the individual's domestic water. This receptor uses water from the pockets of perched water within the operable unit. Because the perched water is unlikely to provide a consistent water supply for routine agricultural uses, only ingestion and domestic water use are considered for this medium. As in the previous case, this resident farmer also receives direct exposures from a number of media by virtue of spending his life on property. The point of maximum

exposure for this individual is considered to be in the vicinity of Waste Pit 4 and the Burn Pit. The total risks for this receptor are summarized in Table E.5-7 (carcinogenic risks) and E.5-8 (Hazard Indices), and chemical-specific risks and hazard quotients are contained in Tables E.IV-25 and E.IV-26.

Radionuclides

The total radionuclide risk for this receptor is calculated to be 6 x 10^{-1}, using the one-hit risk model. Calculated risks from ingestion of perched groundwater containing 429,000 Pci/L of uranium (~~4 x 10^{-1}~~ *6 x 10^{-1}*, using the one hit risk model) dominate the risks from all other pathways combined.

TBL

Chemical Carcinogens

The total risk associated with exposure to chemical carcinogens (9 x 10^{-1}, using the one hit model). Risks associated with bathing in water from the perched aquifer are calculated to be about 80 percent of the risk. This risk is mainly attributable to the presence of total PCBs and total tetrachlorodibenzofuran. Other dioxins and furans also contribute significant additions to the risks from dermal contact exposures. Ingestion of groundwater contributes most of the remaining risks.

Chemical Toxicants

The total Hazard Index for the on-property RME resident is 6100. While the numbers should not be interpreted as a probability, it can be said that ingestion of uranium, molybdenum, and thallium in water contribute over 90 percent of the total Hazard Index.

E.5.5.5 Off-Property Resident Adult Farmer

This receptor has the same characteristics as the off-property resident evaluated under the current source term. The only difference is that this person could now experience additional exposures related to changes in the site configuration, such as erosion of soil caps over the waste pit material and increased leaching. The cancer risks and hazard quotients for this receptor are summarized in Tables E.5-7 and E.5-8, and the detailed chemical-specific information is contained in Tables E.IV-27 and E.IV-28. Total carcinogenic risks for all groundwater routes of exposure are shown in Figures E.5-1.

Radionuclides

The total radiocarcinogenic risks calculated for this hypothetical receptor are 2 x 10^{-3}. The most significant routes of exposure for the off-property resident are the inhalation of fugitive dust (2 x 10^{-4}), ingestion of fruits and vegetables irrigated with groundwater (4 x 10^{-4}) and ingestion of drinking water (1 x 10^{-3}). The risks associated with uranium and thorium isotopes is about 98 percent of the total risk from inhalation. U-238 contributes more than 80 percent of the drinking water ingestion risks and about 85% of the total radiological risks for all groundwater pathways (including food ingestion).

Chemical Carcinogens

None of the modeled groundwater chemical constituents reaching the fenceline are carcinogenic via ingestion and therefore carcinogenic risks via the groundwater pathway are zero. Arsenic and nickel are carcinogenic via inhalation but metals do not volatilize during showering. The total chemical carcinogenic risk for the off-property RME resident is 3 x 10^{-4}, ingestion of fruit and vegetables contaminated by air transport accounts for over 50 percent of the total. Predicted levels of arsenic in fugitive dust emissions contribute over 95% percent of the total calculated risk for all pathways.

Chemical Toxicants

As shown in Table E.5-8, the total Hazard Index for all exposure routes for the off-property RME resident is 32. Uranium is the only constituent producing a calculated Hazard Index greater than 1 (HI = 30) Ingestion of uranium in groundwater produces about 70 percent of the total Hazard Index. Uranium in vegetables irrigated with ground water contributes another 20 percent to the total.

E.5.5.6 Off-property Resident Child

This receptor has the same characteristics as the off-property resident adult farmer evaluated under the future source term (Section E.5.5.7). This child (ages 0 to 6) could now experience additional exposures related to changes in the site configuration, such as erosion of soil caps over the waste pit material and increased leaching. The cancer risks and hazard quotients for this receptor are summarized in Tables E.5-7 and E.5-8, and the detailed chemical-specific information is contained in Tables E.IV-29 and E.IV-30.

Radionuclides

The total radiocarcinogenic risk calculated for this hypothetical receptor is ~~4×10^{-5}~~ 1×10^{-4}. The most significant routes of exposure for the off-property child are ingestion of groundwater (~~2×10^{-5}~~ 6×10^{-5}), and ingestion of fruits and vegetables irrigated with groundwater (~~1×10^{-5}~~ 3×10^{-5}). U-238 contributes more than 80 percent of the drinking water ingestion risk and about 85% of the total radiological risk for all groundwater pathways.

Chemical Carcinogens

None of the modeled groundwater chemical constituents reaching the fenceline are carcinogenic via ingestion and therefore carcinogenic risks via the groundwater pathway are zero. Arsenic and nickel are carcinogenic via inhalation but metals do not volatilize during showering. The total chemical carcinogenic risk for the off-property RME resident child is 7×10^{-5}, ingestion of fruit and vegetables contaminated by aerial deposition accounts for over 70 percent of the total. Predicted levels of arsenic in fugitive dust emissions contribute over 95% percent of the total calculated risk for all pathways.

Chemical Toxicants

As shown in Table E.5-8, the total Hazard Index for all exposure routes for the off-property RME resident child is 90. Uranium is the only constituent producing a calculated Hazard Index greater than 1 (HI = 87) Ingestion of uranium in groundwater produces about 70 percent of the total Hazard Index. Uranium in vegetables irrigated with ground water contributes another 20 percent to the total.

E.5.5.7 Home Builder

39-US The home builder spends ~~50~~ *175* days in one year on the property while building a house. A more detailed description of this receptor and the parameter values used in calculating risks are presented in Section 3.3 of this report. This receptor is evaluated to assess the impacts of chemicals on anyone building a home within the operable unit. Health impacts from this activity may be considered by themselves or in combination with other RME receptor activities such as the on- or off-property RME adult or the trespassing child. However, given the fact that these total risks are one or more orders of magnitude lower than the risks presented for the future residents, they would have little impact on the overall risk.

This receptor is assumed to be exposed to surface soils and exposed waste pit materials. Ingestion and dermal contact with the soil, inhalation of fugitive dust, and external radiation exposures were considered for this receptor. The risks are summarized in Tables E.5-7 and E.5-8, and details are presented in Tables E.IV-31 and E.IV-32.

Radionuclides

TBL The total radiocarcinogenic risks experienced by this hypothetical receptor is ~~8×10^{-5}~~ 2×10^{-4}. This risk is largely due to inhalation of Th-230 and U-238 in dust. A second significant exposure is attributable to external radiation from Ra-226 and Th-232 in soils. These two exposures routes provide about 94 percent of the total radiological risk to the homebuilder.

Chemical Carcinogens

TBL Chemical carcinogenic risks (~~6×10^{-5}~~ 2×10^{-4}) for this receptor are comparable to the radiocarcinogenic risk. Inhalation of fugitive dust and incidental ingestion of soil containing arsenic contributes about 95 percent of the total risks.

Chemical Toxicants

The Hazard Index resulting from ingestion of soil while building a home (6) is primarily caused by the presence of arsenic in surface soil. The total Hazard Index from all pathways

TBL for this receptor is ~~8~~ *60*.

E.5.5.8 Off-Property User of Meat and Milk Products

This receptor was described in detail in Sections E.5.2.2.2 and E.3 of this report. The total carcinogenic risks and Hazard Indices experienced by this receptor are contained in Tables E.5-7 and E.5-8, and chemical-specific risks for each pathway/medium combination are contained in Tables E.IV-33 and E.IV-34.

Radionuclides

The total incremental lifetime cancer risk from radionuclides associated with the production of

TBL food on the Operable Unit 1 area approaches ~~5×10^{-4}~~ 8×10^{-4}. Ingestion of dairy products over a period of 70 years by this hypothetical off-property receptor contributes over 80% of the risks, due primarily to U-238, Cs-137, and Tc-99 in water; and to U-238 and Sr-90 in surface soil.

Chemical Carcinogens

As with the current land use/source term configuration, it is the ingestion of food products from cows grazed on property (versus livestock watering on property) that drive the risks. Ingestion of meat results in a total risk of ~~1×10^{-3}~~ 2×10^{-3}, and ingestion of milk has an associated risk of 6×10^{-4}. Total PCBs and arsenic are the major components of the total risk for these pathways. Total risks associated with cows drinking surface water from the pits are lower (6×10^{-6}) than from the soil pathways (8×10^{-4}) or air pathways (8×10^{-4}) and are the result of the presence of arsenic in the on-site water-filled waste pits at weighted average concentration of 0.002 mg/L.

Chemical Toxicants

The total Hazard Index from the food pathways originating in soil, surface water, and air deposition on soil is 4 *4.9*. ~~Only arsenic deposited on fruit and vegetables produces an HQ exceeding 1 (HQ = 1.2).~~ Grazing of cows in areas containing arsenic, antimony, cadmium, silver, or uranium can result in an unacceptable Hazard Index to the defined receptor.

E.5.6 SUMMARY OF HEALTH RISK CHARACTERIZATION

The selection of CPCs for evaluation in this baseline risk assessment was a key step in the risk assessment process. Contaminants were selected on the basis of the history of site operations and an evaluation of characterization data with respect to the distribution and concentration of contaminants in the various media at the site and the potential contribution of individual contaminants to overall health effects. Confidence is high that the significant contaminants were identified because considerable information is available from the site characterization effort and few contaminants were eliminated as CPCs. The CPCs include 15 long-lived radionuclides and numerous chemicals consisting of metals and organic compounds such as PAHs, PCBs, and dioxins and furans. Most of the radionuclides have short-lived daughters that are evaluated concurrently with the parent radionuclides, unless specifically included. Low levels of radionuclides are spread throughout the soils of Operable Unit 1. Eight waste pits contain large inventories of waste with high concentrations of a number of chemicals and radionuclides.

Cancer induction is the only health effect considered for the radionuclides detected in Operable Unit 1 with the exception of total uranium. Many of the chemicals are classified as carcinogenic and were evaluated are potential carcinogens. This assessment indicates that

metals (particularly arsenic) and radionuclides (particularly U-238, Th-232, and their short-lived progeny) are the contaminants contributing most significantly to risks.

Toxic effects other than carcinogenesis are considered for many of the metals and chemicals detected in Operable Unit 1. Several of the metals evaluated are present in concentrations which exceed the levels thought to produce toxic effects. Uranium, arsenic, and antimony are most notable.

Health effects associated with exposures to lead could not be quantitatively assessed because of the unavailability of toxicity values. However, when the UCL concentration of lead in the soil is compared to the EPA's recommended values, the results indicated that lead in soil is not a major concern for the identified exposure routes and site configurations.

Receptors and exposure pathways were identified in this baseline risk assessment on the basis of site-specific considerations of current land use and reasonable projections of future land use that considered the time frame of this analysis. Confidence is high that the main exposure pathways and potential receptors have been identified and evaluated. Although additional receptors and activities could be identified, exposures would be similar to or less than those estimated for the specific receptors and pathways considered in this analysis. Standard (conservative) intake parameters were used for the assessment of the inhalation and ingestion pathways, and, although some uncertainty exists with respect to these values, this uncertainty is not expected to significantly affect the analysis.

The potential for health effects from exposure to site-related contaminants was estimated for on-property receptors and in adjacent off-property areas impacted by site releases. The on-property exposure points evaluated in this baseline risk assessment were operable unit soil, outdoor air and the waste pits. To focus the discussion, the magnitude of the total estimated carcinogenic risks and HIs are discussed relative to remedial action goals for an NPL site, as defined by the EPA (1989a, 1990e). These goals are an ILCR of 10^{-6} to 10^{-4} and an HI not to exceed 1 for toxic effects other than cancer.

E.5.6.1 Summary of Health Effects Under Current Land Use

This section summarizes the calculated health risks for the current land use scenarios. Only the maximally exposed individuals (MEI) are addressed.

Under continuing access controls, a groundskeeper and an off-property farm family are evaluated. The MEI under this land use is the groundskeeper (Tables 5-9 and E.5-10). The total calculated risks to this receptor approach 1 x 10^{-4}, while the total HI for this receptor is less than unity. External radiation from surface soil and buried pit materials dominates exposures to this receptor (9 x 10^{-5}). Uranium in surface soils and uranium and radium in buried pit materials contribute the largest portion of this radiation exposure. Absorption of beryllium from direct contact with surface soil contributes the largest portion of the chemical risk (about 10 percent of the total risks from both chemical and radiological constituents). In general, the risk assessment has shown that organic chemicals are not a major concern at this site under current land use/source term conditions. For example, the largest single source of carcinogenic risk from an organic chemical to the MEI is dermal contact with PCBs in soil, which produce a calculated risk of about 2 x 10^{-6}.

When access controls are discontinued, it is assumed that maintenance of site engineering controls will also cease. This may eventually expose buried pit material through erosion and subsidence. Therefore, this land use was evaluated using both the current and a potential future source term to explore the impacts of a weathered source term potential receptors. Five receptors were evaluated under this land use. They are the off-property farmer, the off-property child, the Great Miami River User, the off-property user of meat and milk products, and the groundskeeper. The individual exhibiting the highest risks under this land use if the source remains in it current configuration is the off-property user of meat and milk products (Table E.5-11). The risks under the current source term are about 1 x 10^{-3} and are dominated by PCBs taken up by grazing cows. In the future, the off-property farmer is the individual receiving the highest calculated risks (2 x 10^{-3}). Uranium in drinking water contributes more than 50 percent of this risk, and uranium uptake by crops irrigated with uranium add an additional 15 percent. Arsenic on resuspended particulates increases in importance, in future, producing just over 13 percent of the total calculated future risk. Table E.5-12 presents the hazard indices for the maximally exposed individuals. Under the current source term, the MEI for toxic effects is the off-property user of meat and milk products (the same as the MEI for risks). The HI for this individual is just over 2, and is dominated by the uptake of uranium, antimony and cadmium by grazing cows. In the future, the MEI becomes the off-property child, whose HI of about 90 is dominated by uranium in drinking water (70%).

E.5.6.2 Summary of Health Effects Under Future Land Use

This section summarizes the calculated health effects for the future land use scenarios evaluated by chemical, by pathway, and by media. Emphasis is given to the constituents which clearly dominate the assessment, and the discussion focuses on the maximally exposed individuals.

If government use of the site changes or ceases, additional use of the land are possible. To investigate the human health impacts of this possibility, a variety of scenarios were examined. One such land use, government reserve, postulates that ownership of the site is retained by the government, but that site maintenance and strict access controls are relaxed. Six receptors were evaluated under this scenario. They are the off-property farmer, the off-property child, the groundskeeper, the extended trespasser, the off-property user of meat and milk, and the Great Miami River user. The off-property farmer is the individual receiving the highest calculated risks under the government reserve scenario (Table 5-13). The risks to this receptor (2×10^{-3}) are dominated by uranium in groundwater (75 percent), followed by arsenic in air (13 percent). The off-property child receives the highest HI (90, on Table E.5-14). Uranium in drinking water contributes 90 percent of this value.

Unrestricted use of the site was examined by removing the groundskeeper from the list of receptors evaluated for the government reserve, adding a home builder, and placing a farm family within the operable unit boundaries. In this case, the on-property farmer (Table E.5-13) receives the highest calculated risks (1×10^{-1} using the one hit model). Over a third of these risks are attributable to arsenic in groundwater beneath the pits, and over 25 percent of the total risks are from ingestion of arsenic in drinking water. Another twenty percent of the risks are attributable to uranium in groundwater. External radiation from surface soil contributes an additional 20 percent of the risks (2×10^{-2}). The on-property child would be assigned the highest HI. The results presented in Table E.5-14 indicate that 70 percent of the HI for this receptor (HI = 1600) is attributable to uranium in groundwater (70 percent). Another 12 percent is due to arsenic in groundwater. In addition, several of the metals produce exposures that generate HIs exceeding 1 (Table E.IV-22).

Appendix E-5

Tables

TABLE E.5-1

TOTAL CARCINOGENIC RISKS
CURRENT LAND USE, CURRENT SOURCE TERM

		RECEPTORS WITH ACCESS CONTROLS									ADDITIONAL RECEPTORS WITHOUT ACCESS CONTROLS					
		On-property Groundskeeper			Off-property Farmer			Off-property Young Child			Trespassing Youth			Off-property User of Meat and Milk Products		
			Chemical[a]			Chemical			Chemical			Chemical			Chemical	
Source Medium	Exposure Route	Radiological	(TEF for PAHs)	(BaP for PAHs)	Radiological	(TEF for PAHs)	(BaP for PAHs)	Radiological	(TEF for PAHs)	(BaP for PAHs)	Radiological	(TEF for PAHs)	(BaP for PAHs)	Radiological	(TEF for PAHs)	(BaP for PAHs)
Air																
	Inhalation	6E-06	1E-08	1E-08	3E-06	6E-09	6E-09	2E-07	1E-09	1E-09	7E-07	2E-09	2E-09	NA	NA	NA
	Ingestion of Fruits and Vegetables	NA	NA	NA	2E-08	3E-08	3E-08	2E-09	9E-09	9E-09	NA	NA	NA	NA	NA	NA
	Ingestion of Meat	NA	NA	NA	3E-10	5E-08	5E-08	1E-11	8E-09	8E-09	NA	NA	NA	NA	NA	NA
	Ingestion of Milk Products	NA	NA	NA	3E-09	6E-08	7E-08	6E-10	6E-08	6E-08	NA	NA	NA	NA	NA	NA
Surface Soil																
	Incidental Ingestion	2E-06	1E-06	1E-06	NA	NA	NA	NA	NA	NA	4E-07	4E-07	4E-07	NA	NA	NA
	Dermal Contact	NA	1E-05	1E-05	NA	NA	NA	NA	NA	NA	NA	9E-06	9E-06	NA	NA	NA
	External Exposure	7E-05	NA	NA	NA	NA	NA	NA	NA	NA	3E-05	NA	NA	NA	NA	NA
	Ingestion of Meat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7E-05	4E-04	5E-04
	Ingestion of Milk Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4E-04	5E-04	5E-04
Buried Pit Material																
	External Exposure	5E-05	NA	NA	NA	NA	NA	NA	NA	NA	2E-05	NA	NA	NA	NA	NA
On-property Surface Water																
	Ingestion of Meat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5E-05	5E-06	5E-06
	Ingestion of Milk Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2E-04	6E-07	6E-07
Subtotal:		1E-04	1E-05	1E-05	3E-06	2E-07	2E-07	2E-07	8E-08	8E-08	5E-05	9E-06	9E-06	7E-04	9E-04	1E-03
Total Carcinogenic Risk:			1E-04	1E-04		3E-06	3E-06		2E-07	2E-07		5E-05	5E-05		2E-03	2E-03

NA - Not Applicable. Exposure route not evaluated for this receptor.
[a] Seperate carcinogenic risk values were calculated assuming the toxicity equivalency factors (TEF approach) for PAHs and assuming all PAHs as carcinogenic as benzo(a)pyrene (BaP approach).

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TABLE E.5-2

TOTAL HAZARD INDICES
CURRENT LAND USE, CURRENT SOURCE TERM

		WITH ACCESS CONTROLS			ADDITIONAL RECEPTORS WITHOUT ACCESS CONTROLS	
Source Medium	Exposure Route	Groundskeeper	Off-property Farmer	Off-property Young Child	Trespassing Youth	Off-property User of Meat and Milk Products
Air						
	Inhalation	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA
	Ingestion of Fruits and Vegetables	NA	1.7E-04	6.8E-04	NA	NA
	Ingestion of Meat	NA	5.7E-05	1.0E-04	NA	NA
	Ingestion of Milk Products	NA	4.9E-05	5.2E-04	NA	NA
Surface Soil						
	Incidental Ingestion	3.4E-02	NA	NA	2.1E-02	NA
	Dermal Contact	2.7E-01	NA	NA	4.7E-01	NA
	External Exposure	NA	NA	NA	NA	NA
	Ingestion of Meat	NA	NA	NA	NA	1.3E+00
	Ingestion of Milk Products	NA	NA	NA	NA	1.4E+00
On-property Surface Water						
	Ingestion of Meat	NA	NA	NA	NA	8.4E-02
	Ingestion of Milk Products	NA	NA	NA	NA	1.5E-01
Total Hazard Index:		3.0E-01	2.7E-04	1.3E-03	4.9E-01	2.9E+00

NA – Not Applicable. Exposure route not evaluated for this receptor.

000245

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TABLE E.5-3

TOTAL CARCINOGENIC RISKS
CURRENT LAND USE, FUTURE SOURCE TERM

Medium	Exposure Route	Trespassing Youth			Great Miami River User		
		Radiological	Chemical[a] (TEF for PAHs)	Chemical[a] (BaP for PAHs)	Radiological	Chemical (TEF for PAHs)	Chemical (BaP for PAHs)
Air							
	Inhalation	8E-05	4E-05	4E-05	NA	NA	NA
Surface Soil							
	Incidental Ingestion	1E-06	4E-05	4E-05	NA	NA	NA
	Dermal Contact	NA	4E-05	4E-05	NA	NA	NA
	External Exposure	1E-04	NA	NA	NA	NA	NA
Buried Pit Material							
	External Exposure	7E-06	NA	NA	NA	NA	NA
Paddys Run Surface Water							
	Incidental Ingestion	7E-08	4E-09	4E-09	NA	NA	NA
	Dermal Contact	NA	5E-08	5E-08	NA	NA	NA
Paddys Run Sediment							
	Incidental Ingestion	4E-08	8E-08	8E-08	NA	NA	NA
	Dermal Contact	NA	9E-06	9E-06	NA	NA	NA
	External Exposure	3E-06	NA	NA	NA	NA	NA
Great Miami River Surface Water							
	Ingestion	NA	NA	NA	2E-07	5E-09	5E-09
	Ingestion of Fruits and Vegetables	NA	NA	NA	5E-08	2E-09	2E-09
	Ingestion of Meat	NA	NA	NA	2E-09	3E-10	3E-10
	Ingestion of Milk Products	NA	NA	NA	1E-08	1E-10	1E-10
	Inhalation of VOCs	NA	NA	NA	NA	0E+00	0E+00
	Dermal Contact while Bathing	NA	NA	NA	NA	3E-09	3E-09
	Dermal Contact while Swimming	NA	NA	NA	NA	2E-10	2E-10
	Incidental Ingestion while Swimming	NA	NA	NA	1E-10	3E-12	3E-12
	Ingestion of Fish	NA	NA	NA	7E-09	2E-08	2E-08
Subtotal:		2E-04	1E-04	1E-04	3E-07	3E-08	3E-08
Total Carcinogenic Risk:			3E-04	3E-04		3E-07	3E-07

NA – Not Applicable. Exposure route not evaluated for this receptor.

[a] Seperate carcinogenic risk values were calculated assuming the toxicity equivalency factors (TEF approach) for PAHs and and assuming all PAHs as carcinogenic as benzo(a)pyrene (BaP approach).

000246

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TABLE E.5-4

TOTAL HAZARD INDEX
CURRENT LAND USE, FUTURE SOURCE TERM

Source Medium	Exposure Route	Trespassing Youth	Great Miami River User
Air			
	Inhalation	2.5E-01	NA
Surface Soil			
	Incidental Ingestion	4.4E-01	NA
	Dermal Contact	1.1E+00	NA
Paddys Run Surface Water			
	Incidental Ingestion	1.0E-02	NA
	Dermal Contact	2.9E-02	NA
Paddys Run Sediment			
	Incidental Ingestion	2.3E-03	NA
	Dermal Contact	1.1E-01	NA
Great Miami River Surface Water			
	Ingestion	NA	2.9E-03
	Ingestion of Fruits and Vegetables	NA	9.0E-04
	Ingestion of Meat	NA	1.4E-05
	Ingestion of Milk Products	NA	9.9E-05
	Inhalation of VOCs	NA	0.0E+00
	Dermal Contact while Bathing	NA	1.6E-04
	Dermal Contact while Swimming	NA	3.5E-05
	Incidental Ingestion while Swimming	NA	1.6E-06
	Ingestion of Fish	NA	5.7E-05
Total Hazard Index:		1.9E+00	4.2E-03

NA – Not Applicable. Exposure route not evaluated for this receptor.

000247

TABLE E.5–5

TOTAL CARCINOGENIC RISKS
FUTURE LAND USE (GOVERNMENT RESERVE), FUTURE SOURCE TERM

Source Medium	Exposure Route	On–property Groundskeeper			Expanded Trespasser		
			Chemical[a]			Chemical	
		Radiological	(TEF for PAHs)	(BaP for PAHs)	Radiological	(TEF for PAHs)	(BaP for PAHs)
Air							
	Inhalation	7E–04	2E–04	2E–04	1E–04	6E–05	6E–05
Surface Soil and Exposed Waste Pit Contents							
	Incidental Ingestion	7E–06	2E–04	2E–04	2E–06	5E–05	5E–05
	Dermal Contact	NA	5E–05	5E–05	NA	2E–04	2E–04
	External Exposure	4E–04	NA	NA	3E–04	NA	NA
Buried Pit Material							
	External Exposure	5E–05	NA	NA	3E–05	NA	NA
Paddys Run Surface Water							
	Incidental Ingestion	NA	NA	NA	7E–08	4E–09	4E–09
	Dermal Contact	NA	NA	NA	NA	5E–08	5E–08
Paddys Run Sediment							
	Incidental Ingestion	NA	NA	NA	4E–08	8E–08	8E–08
	Dermal Contact	NA	NA	NA	NA	9E–06	9E–06
	External Exposure	NA	NA	NA	3E–06	NA	NA
Subtotal:		1E–03	4E–04	4E–04	4E–04	3E–04	3E–04
Total Carcinogenic Risk:			2E–03	2E–03		7E–04	7E–04

NA – Not Applicable. Exposure route not evaluated for this receptor.

[a] Seperate carcinogenic risk values were calculated assuming the toxicity equivalency factors (TEF approach) for PAHs and assuming all PAHs as carcinogenic as benzo(a)pyrene (BaP approach).

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TABLE E.5-6

TOTAL HAZARD INDEX
FUTURE LAND USE (GOVERNMENT RESERVE)
FUTURE SOURCE TERM

Source Medium	Exposure Route	Groundskeeper	Expanded Trespasser
Air			
	Inhalation	6.2E-01	2.9E-01
Surface Soil and Exposed Waste Pit Contents			
	Incidental Ingestion	9.5E-01	5.4E-01
	Dermal Contact	6.1E-01	3.0E+00
Paddys Run Surface Water			
	Incidental Ingestion	NA	1.0E-02
	Dermal Contact	NA	2.9E-02
Paddys Run Sediment			
	Incidental Ingestion	NA	2.3E-03
	Dermal Contact	NA	1.1E-01
Total Hazard Index:		2.2E+00	4.0E+00

NA – Not Applicable. Exposure route not evaluated for this receptor.

000249

TABLE E.5-7

TOTAL CARCINOGENIC RISKS
FUTURE LAND USE (AGRICULTURAL USE)
FUTURE SOURCE TERM

Source Medium	Exposure Route	On-property RME Farmer[a] Radiological	On-property RME Farmer[a] Chemical[b] (TEF for PAHs)	On-property RME Farmer[a] Chemical[b] (BaP for PAHs)	On-property RME Farmer Use of Perched Groundwater[a] Radiological	On-property RME Farmer Use of Perched Groundwater[a] Chemical (TEF for PAHs)	On-property RME Farmer Use of Perched Groundwater[a] Chemical (BaP for PAHs)	On-property CT Farmer Radiological	On-property CT Farmer Chemical (TEF for PAHs)	On-property CT Farmer Chemical (BaP for PAHs)	On-property Young Child Radiological	On-property Young Child Chemical (TEF for PAHs)	On-property Young Child Chemical (BaP for PAHs)
Air													
	Inhalation	5E-03	1E-03	1E-03	5E-03	1E-03	1E-03	4E-04	1E-04	1E-04	9E-05	1E-04	1E-04
	Ingestion of Fruits and Vegetables	6E-05	2E-03	2E-03	6E-05	2E-03	2E-03	4E-06	2E-04	2E-04	4E-06	9E-04	9E-04
	Ingestion of Meat	2E-06	7E-04	7E-04	2E-06	7E-04	7E-04	1E-07	4E-05	4E-05	5E-08	1E-04	1E-04
	Ingestion of Milk Products	1E-05	1E-04	1E-04	1E-05	1E-04	1E-04	6E-07	6E-06	6E-06	2E-06	1E-04	1E-04
Exposed Waste Pit Materials													
	Incidental Ingestion	4E-04	8E-03	8E-03	4E-04	8E-03	8E-03	2E-05	6E-04	6E-04	3E-05	4E-03	4E-03
	Dermal Contact	NA	1E-03	1E-03	NA	1E-03	1E-03	NA	2E-05	2E-05	NA	2E-04	2E-04
	External Exposure	2E-02	NA	NA	2E-02	NA	NA	2E-03	NA	NA	2E-03	NA	NA
Surface Soil													
	Ingestion of Fruits and Vegetables	2E-04	2E-04	2E-04	2E-04	2E-04	2E-04	1E-05	1E-05	1E-05	1E-05	6E-05	6E-05
	Ingestion of Meat	7E-05	4E-04	5E-04	7E-05	4E-04	5E-04	5E-06	3E-05	3E-05	2E-06	7E-05	7E-05
	Ingestion of Milk Products	4E-04	5E-04	5E-04	4E-04	5E-04	6E-04	2E-05	2E-05	3E-05	9E-05	4E-04	5E-04
Buried Pit Material													
	External Exposure	1E-03	NA	NA	1E-03	NA	NA	2E-04	NA	NA	2E-07	NA	NA
On-property Surface Water													
	Ingestion of Meat	5E-05	5E-06	5E-06	5E-05	5E-06	5E-06	4E-06	4E-07	4E-07	2E-06	8E-07	8E-07
	Ingestion of Milk Products	2E-04	7E-07	7E-07	2E-04	7E-07	7E-07	1E-05	4E-08	4E-08	4E-05	6E-07	6E-07
Groundwater													
	Ingestion	2E-02	3E-02	3E-02	6E-01	1E-01	2E-01	1E-03	2E-03	2E-03	7E-04	6E-03	6E-03
	Ingestion of Fruits and Vegetables	5E-03	1E-02	1E-02	5E-03	1E-02	1E-02	3E-04	6E-04	6E-04	4E-04	3E-03	3E-03
	Ingestion of Meat	4E-05	1E-03	1E-03	4E-05	1E-03	1E-03	3E-06	9E-05	9E-05	1E-06	2E-04	2E-04
	Ingestion of Milk Products	5E-04	2E-04	2E-04	5E-04	2E-04	2E-04	3E-05	9E-06	9E-06	9E-05	2E-04	2E-04
	Inhalation of VOCs	NA	1E-13	1E-13	NA	3E-02	3E-02	NA	1E-14	1E-14	NA	5E-14	5E-14
	Dermal Contact while Bathing	NA	8E-05	8E-05	NA	9E-01	9E-01	NA	5E-06	5E-06	NA	1E-05	1E-05
Subtotal:		5E-02	5E-02	5E-02	5E-01	9E-01	9E-01	4E-03	4E-03	4E-03	3E-03	1E-02	2E-02
Total Carcinogenic Risk:			1E-01	1E-01		1E+00	1E+00		8E-03	8E-03		2E-02	2E-02

NA – Not Applicable. Exposure route not evaluated for this receptor.

[a] Risks calculated and total summed based on the use of the 1-hit equation for calculating risks from higher doses (EPA 1989a), therefore, total risks will not exceed 1.0 for this receptor.

[b] Seperate carcinogenic risk values were calculated assuming the toxicity equivalency factors (TEF approach) for PAHs and assuming all PAHs as carcinogenic as benzo(a)pyrene (BaP approach).

TABLE E.5-7 (con't)

TOTAL CARCINOGENIC RISKS
FUTURE LAND USE (AGRICULTURAL USE)
FUTURE SOURCE TERM

Source Medium	Exposure Route	Off-property Farmer			Off-property Young Child			On-property Homebuilder			Off-property User of Meat and Milk Products		
		Radiological	Chemical[a] (TEF for PAHs)	Chemical[a] (BaP for PAHs)	Radiological	Chemical (TEF for PAHs)	Chemical (BaP for PAHs)	Radiological	Chemical (TEF for PAHs)	Chemical (BaP for PAHs)	Radiological	Chemical (TEF for PAHs)	Chemical (BaP for PAHs)
Air													
	Inhalation	2E-04	9E-05	9E-05	4E-06	8E-06	8E-06	1E-04	4E-05	4E-05	NA	NA	NA
	Ingestion of Fruits and Vegetables	3E-06	2E-04	2E-04	2E-07	5E-05	5E-05	NA	NA	NA	NA	NA	NA
	Ingestion of Meat	9E-08	4E-05	4E-05	3E-09	6E-06	6E-06	NA	NA	NA	2E-06	7E-04	7E-04
	Ingestion of Milk Products	6E-07	7E-06	7E-06	1E-07	6E-06	6E-06	NA	NA	NA	1E-05	1E-04	1E-04
Exposed Waste Pit Materials													
	Incidental Ingestion	NA	NA	NA	NA	NA	NA	7E-06	2E-04	2E-04	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	9E-06	9E-06	NA	NA	NA
	External Exposure	NA	NA	NA	NA	NA	NA	7E-05	NA	NA	NA	NA	NA
Surface Soil													
	Ingestion of Fruits and Vegetables	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ingestion of Meat	NA	NA	NA	NA	NA	NA	NA	NA	NA	7E-05	4E-04	5E-04
	Ingestion of Milk Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	4E-04	5E-04	5E-04
Buried Pit Material													
	External Exposure	NA	NA	NA	NA	NA	NA	7E-09	NA	NA	NA	NA	NA
On-property Surface Water													
	Ingestion of Meat	NA	NA	NA	NA	NA	NA	NA	NA	NA	5E-05	5E-06	5E-06
	Ingestion of Milk Products	NA	NA	NA	NA	NA	NA	NA	NA	NA	2E-04	7E-07	7E-07
Groundwater													
	Ingestion	1E-03	0E+00	0E+00	6E-05	0E+00	0E+00	NA	NA	NA	NA	NA	NA
	Ingestion of Fruits and Vegetables	4E-04	0E+00	0E+00	3E-05	0E+00	0E+00	NA	NA	NA	NA	NA	NA
	Ingestion of Meat	3E-06	0E+00	0E+00	1E-07	0E+00	0E+00	NA	NA	NA	NA	NA	NA
	Ingestion of Milk Products	4E-05	0E+00	0E+00	7E-06	0E+00	0E+00	NA	NA	NA	NA	NA	NA
	Inhalation of VOCs	NA	0E+00	0E+00	NA	0E+00	0E+00	NA	NA	NA	NA	NA	NA
	Dermal Contact while Bathing	NA	0E+00	0E+00	NA	0E+00	0E+00	NA	NA	NA	NA	NA	NA
Subtotal:		2E-03	3E-04	3E-04	1E-04	7E-05	7E-05	2E-04	2E-04	2E-04	8E-04	2E-03	2E-03
Total Carcinogenic Risk:			2E-03	2E-03		2E-04	2E-04		4E-04	4E-04		2E-03	3E-03

NA - Not Applicable. Exposure route not evaluated for this receptor.

[a] Seperate carcinogenic risk values were calculated assuming the toxicity equivalency factors (TEF approach) for PAHs and assuming all PAHs as carcinogenic as benzo(a)pyrene (BaP approach).

5511

TABLE E.5-8

TOTAL HAZARD INDEX
FUTURE LAND USE (AGRICULTURAL USE)
FUTURE SOURCE TERM

Source Medium	Exposure Route	On-property RME Farmer	On-property RME Farmer (User of Perched GW)	On-property CT Farmer	On-property Young Child	Off-property Farmer	Off-property Young Child	Homebuilder	Off-property User of Meat and Milk Products
Air									
	Inhalation	1.5E+00	1.5E+00	8.4E-01	1.4E+00	1.0E-01	1.0E-01	6.4E+00	NA
	Ingestion of Fruits and Vegetables	5.1E+00	5.1E+00	2.6E+00	2.1E+01	3.1E-01	1.3E+00	NA	NA
	Ingestion of Meat	1.5E+00	1.5E+00	8.0E-01	2.8E+00	9.0E-02	1.6E-01	NA	1.5E+00
	Ingestion of Milk Products	3.3E-01	3.3E-01	1.4E-01	3.5E+00	1.8E-02	2.0E-01	NA	3.3E-01
Exposed Waste Pit Materials									
	Incidental Ingestion	1.7E+01	1.7E+01	9.1E+00	8.9E+01	NA	NA	4.7E+01	NA
	Dermal Contact	6.1E+00	6.1E+00	8.4E-01	9.9E+00	NA	NA	6.4E+00	NA
Surface Soil									
	Ingestion of Fruits and Vegetables	2.6E+00	2.6E+00	1.3E+00	1.1E+01	NA	NA	NA	NA
	Ingestion of Meat	1.3E+00	1.3E+00	6.8E-01	2.3E+00	NA	NA	NA	1.3E+00
	Ingestion of Milk Products	1.4E+00	1.4E+00	5.7E-01	1.4E+01	NA	NA	NA	1.4E+00
Buried Pit Material									
	External Exposure	NA	NA	NA	NA	NA	NA	NA	NA
On-property Surface Water									
	Ingestion of Meat	9.3E-02	9.3E-02	4.8E-02	1.7E-01	NA	NA	NA	9.3E-02
	Ingestion of Milk Products	2.4E-01	2.4E-01	9.9E-02	2.5E+00	NA	NA	NA	2.4E-01
Groundwater									
	Ingestion	3.6E+02	5.6E+03	2.0E+02	8.4E+02	2.2E+01	5.2E+01	NA	NA
	Ingestion of Fruits and Vegetables	1.2E+02	1.2E+02	5.8E+01	4.7E+02	6.7E+00	2.7E+01	NA	NA
	Ingestion of Meat	4.7E+00	4.7E+00	2.5E+00	8.5E+00	5.0E-02	8.9E-02	NA	NA
	Ingestion of Milk Products	9.0E+00	9.0E+00	3.8E+00	9.5E+01	6.1E-01	6.5E+00	NA	NA
	Inhalation of VOCs	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	NA
	Dermal Contact while Bathing	1.7E+01	2.7E+02	8.0E+00	2.8E+01	1.3E+00	2.1E+00	NA	NA
Subtotal:		5.4E+02	6.1E+03	2.9E+02	1.6E+03	3.2E+01	9.0E+01	6.0E+01	4.9E+00

NA - Not Applicable. Exposure route not evaluated for this receptor.

E.6.0 UNCERTAINTIES

5511

The types and magnitudes of uncertainties associated with each stage of the process are of major importance for evaluating and interpreting risk assessments at the FEMP. Uncertainties associated with calculations that occur in the risk assessment may be magnified in the final results. While it is not possible to eliminate all uncertainties from the analysis, they must be identified and discussed to determine their significance when making risk management decisions. This section presents an analysis of the major uncertainties contributing to the final results of the Operable Unit 1 baseline risk assessment.

E.6.1 TERMINOLOGY

This section introduces the evaluation of uncertainties inherent in the risk assessment process. Uncertainty is a measure of inaccuracy that must be considered in each step of the CPC selection process, exposure and toxicity assessments and risk characterization presented in the preceding sections. Each portion of the analysis contributes to the uncertainty of the final risk assessment. Uncertainty in CPC selection is primarily associated with the analytical data and procedures used to include or exclude constituents as CPCs. Uncertainty associated with the exposure assessment includes variations in sample analytical results, the values used for variables as input to a given intake route, the methods used and assumptions made to determine exposure point concentrations, the accuracy with which a particular fate and transport model represents actual environmental processes, and the manner in which the exposure scenario is developed. Uncertainty associated with the toxicity assessment includes the quality of the existing data to support a dose-response assessment, the high-to-low dose and interspecies extrapolations for dose-response relationships, and the weight of evidence used for determining the carcinogenicity of CPCs. Uncertainty associated with risk characterization includes that associated with exposure to multiple chemicals (i.e., additivity of dose, synergisms and antagonisms among chemicals, and the particular mode of action for each chemical), and the cumulative uncertainty from combining conservative assumptions made in the data, exposure assessment, and toxicity assessment. Each of these categories of potential uncertainty is discussed in this section.

Generally, risk assessments carry two types of uncertainty, measurement and informational uncertainty; each merits consideration. Measurement uncertainty refers to the usual variance that accompanies scientific measurements (e.g., instrument uncertainty associated with

contaminant concentrations). This type of uncertainty is generally associated with the analytical data, which impacts CPC selection and calculation of exposure point concentrations. The risk assessment results reflect the accumulated variances of the individual measured values used. A different kind of uncertainty stems from inadequate availability of information needed to complete the toxicity and exposure assessments. Often this informational gap is significant, such as the absence of information on the effects of human exposure to low doses of a chemical or on the biological mechanism of action of an agent (EPA 1992d).

Once the risk assessment is complete, the results must be reviewed and evaluated to identify the type and magnitude of uncertainty involved. Reliance on results from a risk assessment without consideration of uncertainties, limitations, and assumptions inherent in the risk assessment process can often be misleading. For example, to account for uncertainties in the development of exposure assumptions, conservative estimates must be made to ensure that the particular assumptions made are protective of all sensitive subpopulations, or maximum exposed individuals. If a number of conservative assumptions are combined in an exposure model, the resulting calculations can propagate the uncertainties associated with those assumptions, producing a much larger uncertainty for the final results. Thus, both the risk assessment's results and the uncertainties associated with those results should be considered when making risk management decisions.

This interpretation is especially relevant when resulting risk numbers exceed the point-of-departure for defining acceptable risk. For example, when a calculated risk incorporating a high degree of uncertainty falls below an acceptable risk level (e.g., below an incremental lifetime cancer risk [ILCR] of 10^{-6}), the interpretation is straight forward. However, when
422 calculated risks, incorporating a high degree of uncertainty, fall above an acceptable risk level (e.g., exceed an ILCR of 10^{-4}),} decision making can be difficult unless all of the uncertainties inherent in the calculations are carefully considered.

The actual risk may be one, two, or even three orders of magnitude smaller than the one calculated, which could lead risk managers to make a decision which is unnecessarily protective. This situation may occur in a Superfund risk assessment when the estimated risks are based on limited information. Calculations, exposure parameters, conservative assumptions on lifestyles and land-use scenarios, and maximum or near-maximum values for many of the modeling and exposure variables must be carefully assessed to ensure that the

risks are not underestimated. The combination of conservative assumptions over a number of areas often results in high risk values as a result of high uncertainty. Characterization of risk based on overly conservative model parameters, scenarios, and assumptions does not convey realistic information and is often misleading if reviewed out of context. A risk estimate for an RME individual in a Superfund risk assessment has been frequently and mistakenly viewed as an average risk to the receptor population being evaluated (EPA 1992d).

Such conservatism has been incorporated into the RME scenarios for Operable Unit 1 risk assessment. Although it is possible that the exposure, dose, and sensitivity combinations assumed might occur in the receptor population of interest, the probability of an individual actually receiving this degree of exposure is expected to be low.

Recent EPA guidance on risk assessment (EPA 1992d) requires risk assessors to use exposure and toxicity assumptions that are from the "high end" and "central tendency" of their distributions. These values correspond to the reasonable maximum exposure (RME) and central tendency (CT) scenarios, respectively, for the risk assessment. The RME scenario is to be a combination of average and upper-bound assumptions that estimate the reasonable maximum exposure for that pathway. The resulting risk for the RME scenario is assumed to fall between the average (i.e., the CT scenario) and the upper-bound scenario (a scenario that is based on all maximum values). The CT scenario is a combination of all average and median values for exposure parameters that provide an estimate of average risk posed to the receptor population being considered. It should be noted here that the CT scenario used in Operable Unit 1 incorporates many maximal values by direction of EPA Region V staff. The purpose for consideration of risks from both the CT and RME scenarios is to provide bounds on the expected risks posed by the site.

The ultimate goal of the risk assessment process is to provide an objective, realistic, and balanced risk estimate for making risk management decisions at the FEMP. In the past, Superfund risk assessments based on the "Risk Assessment Guidance for Superfund" (EPA 1989a) yielded calculated risks only for RME scenarios. The Operable Unit 1 RI incorporates this concept into the risk assessments at the FEMP. Accordingly, the risk assessment for Operable Unit 1 includes an additional scenario considering some average assumptions for the on-property resident adult. Based on the future land-use scenario, the on-property resident adult constitutes the most important receptor since they have the highest risk. This attempt at

characterizing the CT scenario side-by-side with the RME scenario presents a more realistic estimate of the range of possible risk for this receptor. Efforts will continue to incorporate the guidance as more exposure data at the FEMP become available and the additional guidance on estimating CT is completed by EPA.

E.6.2 SOURCES OF UNCERTAINTY IN OPERABLE UNIT 1

As noted previously, uncertainties are associated with the information and data used for the selection of CPCs, exposure and toxicity assessments, and risk characterization for the Operable Unit 1 baseline risk assessment. Uncertainty in the selection of CPCs is associated with the analytical data. In the exposure assessment, these uncertainties are the result of a number of factors, including assumptions on land use and receptors, assumptions made for parameters and parameter variability (random errors or natural variations), and the necessity of using computer models to predict complex environmental interactions. Uncertainty associated with the toxicity assessment is associated with the dose-response data. As EPA has pointed out in their guidance for human health risk assessments, "it is more important to identify the key site-related variables and assumptions that contribute most to the uncertainty than to precisely quantify the degree of uncertainty in the risk assessment" (EPA 1989a). Uncertainties are evaluated in this section to provide a basis for interpreting the overall quality of the risk assessment results. Sources of uncertainty are discussed below.

E.6.2.1 Selection of Constituents of Potential Concern

Uncertainty associated with the selection process used to determine the CPCs in Operable Unit
423 1 can be attributed to the following major sources:}

- Soil and groundwater data do not exist for the area directly beneath the waste pits and were inferred from indirect data sources. Data taken from adjacent borings and wells were used to estimate these conditions. These data were also used to determine which constituents are migrating toward the aquifer, and at what rate this migration is occurring.

- Sample results from the RI/FS and CIS sampling programs could not be combined, and, therefore, were evaluated separately in the data evaluation process. Each sampling and analysis program identified chemicals that were not identified by the other. This introduces uncertainties in the presence or absence of some of the chemicals reported and limits that data that is used to statistically determine source concentrations.

- CIS samples taken from the split-spoon sampler were immediately dissected into discrete depth samples for radiological analysis. Composites of the remaining soil were made in the open air and placed into sampling containers. As a result, concentrations of volatile chemicals may be underestimated since they may have volatized during this sampling procedure.

- Evaluation of the existing data raises the question as to whether all pockets of elevated contamination have been identified. In general, it is believed that they have been identified for most radionuclides at the FEMP because CIS sampling locations were generally biased, based on high radiation measurements in the field. This is particularly important because risks from radionuclides dominate the overall risks to all receptors evaluated in this risk assessment. No conclusion can be drawn for chemical constituents detected on the property.

- Sample analytical techniques produce results that have an unknown degree of uncertainty associated with them. These uncertainties are documented by using data qualifiers to reflect the assumed degree of certainty of measurement. These analytical uncertainties affect the selection of CPCs or the calculation of exposure point concentrations (either measured or modeled) that may be based on a particular analytical result.

- Concentrations of inorganics and radionuclides are compared to background concentrations to determine if their presence is do to naturally occurring concentrations from native soils or are due to site activities. However, sampling procedures for groundwater and air used to determine background concentrations have high detection limits. A chemical that was not detected during background sampling could result in the erroneous inclusion of a chemical from those selected for further evaluation.

- The RI organics data for the waste pit material were rejected during validation because of holding time problems and sampling techniques. However, several compounds were noted, and the exclusion of these compounds as CPCs may underestimate risks.

468 - A limited number of samples exist for some media types in the waste pit area. There is a limited database for pit cover surface soils, and there were no analyses for volatile and semi-volatile organic compounds in any Operable Unit 1 surface soil samples. A limited database has the potential to introduce either false positive results (i.e., introducing constituents as CPCs that are not site related), or false negative results (i.e., eliminating compounds that may be legitimate CPCs because they are site related and could contribute to site risks). It is anticipated that the limited database for Operable Unit 1 may introduce false negatives and as a result underestimate potential human health risks from exposure to organic chemicals.

48-US - ***Concentration terms for surface soil were derived from results recorded from 0 to 24 inches in depth. Since surface soil contamination levels are usually greater in the first 6 inches of soil, this approximation may underestimate risks from exposure to surface soil.***

The cumulative impacts of these uncertainties on the results of the exposure and risk assessments are judged to be low to moderate (i.e., are assumed to result in over or underestimation of risk by an order of magnitude or more). This is because a few constituents contribute the majority of the cancer risk for most receptors. Two examples are

external radiation exposure from U-238 and its immediate progeny, and arsenic in water. Risks from these constituents each exceed 10^{-4} by themselves. The relative contributions of these two constituents to the total risk are very significant: The impact to the total risk would be slight if other chemicals were added or deleted from the list of CPCs selected for evaluation in this risk assessment.

E.6.2.2 Uncertainty in Exposure Assessment

Sources of uncertainty for the exposure assessment arise from calculation of exposure point concentrations, selection of receptors, determination of land use scenarios and selection of exposure factors.

E.6.2.2.1 Exposure Point Concentrations

Uncertainty associated with calculation of exposure point concentrations in Operable Unit 1 can be attributed to the following sources:

- The material in the waste pits has been determined to be very heterogeneous in nature. In the effort to obtain radiological samples at the most contaminated locations, a radiological survey of the study area was conducted. Waste pit borings were placed at the locations having the highest gross radiation measurements. Selection of sampling locations in this way leads to a positive bias in the calculation of exposure point concentrations for certain radionuclides and uncertainty in the representativeness of the samples.

- According to the "Risk Assessment Guidance for Superfund" (EPA 1989a), the UCLs are used for all exposure concentrations. This means that 95 percent of the time, the actual mean concentration can be less than the value used in the exposure assessment. Conversely, 5 percent of the time the actual mean concentration can be greater than the value used in the exposure assessment. Therefore the exposure assessment may underestimate the exposures in 5 percent of the cases, and overestimate exposures 95 percent of the time.

- A limited number of samples for some waste pits introduces high uncertainty in the determination of exposure point concentrations for some compounds.

- Sample analytical techniques produce results that have a degree of uncertainty associated with them. These uncertainties are documented by using data qualifiers to reflect the degree of uncertainty of measurement. These analytical uncertainties affect the exposure point concentrations (either measured or modeled) that may be based on a particular analytical result.

- There is also large uncertainty when exposure concentrations were based on the maximum detected concentration. The conservative approach was taken in the statistical interpretation of the RI and CIS data bases (i.e., if less than four

detections, the maximum concentration is used as the representative), and may result in an overestimation of the concentrations to which a receptor could be exposed.

Predicted concentrations were used as exposure point concentrations when measured data were not available (e.g., the future). These predictions were made using mathematical representations (models) of the natural systems found or suspected to exist in the study area. Due to the complexity of natural environments, conservative assumptions were often used in these models to calculate exposure point concentrations. When a number of conservative assumptions are combined into one fate and transport model, uncertainties can be compounded and provide very conservative estimates of the exposure point concentration. These assumptions are typically made to avoid underestimating the concentrations of contaminants in transport or exposure media (e.g., air or groundwater). As a result, transport parameters are chosen from the upper bound of possible alternative values and the uncertainties associated with modeled concentrations will generally be much larger than those associated with measured data. Uncertainties associated with modeled exposure point concentrations in Operable Unit 1 can be attributed to the following sources:

- The geochemical model has several sources of uncertainty associated with it. The conceptual model assumes that mineral phases represent the actual solid phases of a chemical in the waste material. In addition, the geochemical model assumes dissolution and precipitation kinetics are instantaneous, and it does not evaluate adsorption processes. This leads to estimates of concentrations that are too high or too low.

- A limited number of organic chemicals can be accommodated by the geochemical model used to determine Leachate B concentrations in the till. This leads to low estimates of leachate concentrations for some inorganic constituents if complexation occurs with organic chemicals not present in the database.

- Total contact between the waste and the leaching fluid and no containment of the leachate concentrations are assumed. This produces higher estimated concentrations of Leachate B available for transport to the aquifer than would be anticipated under actual conditions. This uncertainty is reduced by the availability of in situ leachate concentrations for most chemicals in most sources.

- Use of Toxicity Characteristic Leaching Procedure (TCLP) data to characterize leachate concentrations in the natural environment adds conservatism to the groundwater fate and transport modeling process because TCLP leaching is performed with an acidic solution. This tends to overestimate the leachate concentration of inorganics over natural (more neutral) leaching conditions.

- The selection of parameters related to the attenuation and retardation of constituents is a major uncertainty in the analysis. The attenuation and retardation factors of every constituent except uranium were determined after an extensive literature search. It should be noted here that the actual retardation factors at the FEMP may not follow the assumed literature values, particularly over the long term. Site-specific attenuation and retardation factors are used when available. The use of site-specific values are assumed to result in lower uncertainty than using literature values.

- The organic decay rates at the FEMP were determined after an extensive literature search. The actual decay rates may or may not follow the assumed literature values because of site-specific conditions. The use of site data to determine organic decay rates is assumed to result in lower uncertainty than that resulting from the use of literature values.

- Transport through the vadose zone is approximated by using a one-dimensional model and assuming the zone is homogeneous. The unsaturated seepage flow rate is a function of several parameters, such as porosity, residual saturation, and pore size distribution index. Due to the heterogeneous nature of the till, these parameters change from location to location and from depth to depth.

- The total mass of each contaminant is calculated by multiplying the UCL by the volume of the entire waste area, thus assuming the UCL concentration is uniformly distributed through the entire source.

- The fate and transport modeling uses a "70-year rule" for these constituents where no or inadequate leachate data exist. This "rule" assumes all the chemical leaches from a particular waste unit in 70 years. This method is considered very conservative for compounds that are insoluble but may underestimate the maximum exposure for soluble compounds. The application of this procedure in a risk assessment primarily effects four of the systematic toxicants, which were evaluated in the Operable Unit 1 baseline risk assessment:} (benzo[g,h,i] fluoranthene; benzo[g,h,i]perylene; fluoranthene; and phenanthrene). However, the application of this methodology to these constituents is considered conservative because these particular compounds have rather low solubilities and high partitioning coefficients. PAHs, in general, contribute an insignificant proportion to the total hazard index. Therefore, the application of this assumption is assumed to have a low impact on the risk assessment.

- Air modeling is based on a number of conservative assumptions. In combination these assumptions appear to overestimate the exposure point concentrations for air based on site air monitoring data and according to a literature search for typical ambient air PM_{10} measurements for EPA Region V. The long-term average PM_{10} concentrations calculated are comparable to measured dust concentrations on constructions. This uncertainty is expected to moderately overestimate risk (i.e., overestimate risks by 1 to 2 orders-of-magnitude).

- Contaminant concentrations for the surface soil over Waste Pits 1-4 is not available. Air modeling is performed assuming that soil concentrations over the pits is equal to contaminant levels of surface soil between the pits. The impact of this assumption is assumed to be low to moderate.}

- The future configuration of the waste pits is uncertain at this time; thus, a reasonable worst-case configuration is used to determine source concentrations for both air and surface water modeling. If the actual configuration differs from that used in this evaluation, the future source concentrations may change and the models will have incorrectly estimated the exposure point concentrations.

- The transport models individually made assumptions regarding the fate of individual constituents within source media. However, these models were not combined or linked to consider assumptions made regarding depletion of chemicals from one model and the effect of that assumption on another model (i.e., the leaching models did not consider source depletion from volatilization or fugitive emissions and the air emissions models did not consider losses via leaching). Furthermore, the direct exposure pathways to a particular source (i.e., incidental ingestion of surface soil) did not consider source depletion by leaching, surface water transport, or air emissions. Consequently, this assumption is considered very conservative.

These uncertainties for modeling collectively are assumed to moderately overestimate the concentrations expected in groundwater and for aerial deposition (i.e., overestimate concentration and risk by a factor of one to two orders of magnitude).

Models were also used to calculate chemical concentrations in plants and animals. Each time concentrations at one level in the food chain are extrapolated from a lower level, uncertainty is introduced into the result. For example, soil-to-plant transfer factors (B_{iv} values) generally represent the maximum amount of contaminant transfer that may occur. In reality, the contaminant transfer is quite dependent on the form of the constituent (e.g., metal species) and other site-related physical conditions (e.g., soil type). Thus actual site transfer factors are unknown. The values chosen are intended to be conservative and they are likely to overestimate risk.

E.6.2.2.2 Determination of Land Uses

A major uncertainty associated with predicting future exposures at the FEMP is the future disposition of the property itself. Because it is not possible to accurately predict what the future uses of the land may be the most conservative (rather than the most likely) land use is evaluated, as stipulated by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). As noted in Section E.3.0, one of the on-property residents evaluated under future land use for Operable Unit 1 is the resident farmer. It is unlikely that the waste pits and surrounding soils could support a viable agricultural receptor, but the assumption of the resident farmer for future land use provides a worst-case scenario regarding future land use in the exposure assessment.

E.6.2.2.3 Selection of Receptors

The receptors selected for evaluation in this assessment have been generally selected to reflect and encompass those types of activities which may produce the reasonable maximum exposure individual. Some of these receptors, such as the on-property resident farmer living on the open waste pit, can possibly exist in the future but this scenario is considered very unlikely based on the use of this area for waste disposition. Risks from such a receptor may overstate probable risk from future use of the property when considered against more plausible land use alternatives. Uncertainty associated with the selection of receptors in the current land use scenario is assumed to be low (over- or underestimate risks by a one order of magnitude or less) because the current site environmental setting and configuration was the basis for selection of these receptors. Uncertainty associated with receptors identified in the future land use scenario is high (i.e., potential to overestimate risk by two or more orders-of-magnitude) due to the low probability of the site being used as a residence or for agricultural purposes.

E.6.2.2.4 Determination of Exposure Factors

Each exposure factor selected for use in this risk assessment has some uncertainty associated with it. Generally these factors are based on surveys of physiological and lifestyle profiles across the United States. The attributes and activities studied in these surveys generally have a broad distribution. To avoid the underestimation of exposure, this risk assessment followed EPA's recommendation and used the 95th percentile for most of the exposure parameters used in this risk assessment. In other words, the values selected represent the observed or expected habits of a small percentage of the population (usually the upper 5 or 10 percent). For example, the resident farmer scenarios were assumed to inhale air at the location of the highest annual average concentration for 350 days per year for 70 years. Seventy years represents the maximum exposure duration and is not based on a statistical assessment of local or regional residence time for farm families. This factor tends to overestimate risk.

Generally, the uncertainty can be assessed quantitatively for a number of assumptions made in determining factors for calculating exposure and intakes. Many of these parameters were determined from statistical analyses on human population characteristics. Often the database used to summarize a particular exposure parameter (i.e., inhalation rate) is quite large. Consequently, the values chosen for such variables in the RME scenario have low uncertainty (i.e., over or underestimate risks by one order of magnitude or less). For many parameters for which limited information exists (i.e., dermal adsorption of organic chemicals from soils)

there is greater uncertainty. However, there is often sufficient data to estimate these parameters with low uncertainty. Few intake parameters have high uncertainty associated with them. In the risk assessment for Operable Unit 1, the particular exposure parameters with the greatest uncertainty are judged to be those associated with time (combination of frequency and duration on the site). The particular exposure pathway with the combination of exposure parameters with the highest uncertainty is dermal contact, which is assumed to result in moderate uncertainty (over- or underestimate actual exposure by one to two orders of magnitude) for exposure.

Many of the quantities used to calculate exposures and risks in this report are selected from a distribution of possible values. For the RME scenarios, the value representing the 95th percentile is generally selected for each parameter to assure that the assessment bounds the actual risks from a postulated exposure. This risk number is used in risk management decisions, but does not indicate what a more average exposure might be, or what risk range might be expected for individuals in the exposed population. To address these issues, a risk estimate closer to the central tendency is presented for the maximally exposed individual using the CT scenario described in Section E.3. The range of risk for this receptor from the CT scenario to the RME scenario seeks to incorporate the range of uncertainty regarding intake assumptions for this receptor.

E.6.2.3 Toxicity Assessment

Uncertainty associated with the toxicity assessment is associated with hazard assessment and dose-response evaluations for CPCs. The hazard assessment deals with characterizing the nature and strength of the evidence of causation, or the likelihood that a chemical that induces adverse effects in animals will induce adverse effects in humans. Hazard assessment of carcinogenicity is evaluated as a weight-of-evidence determination, using either the IARC (1987) or EPA (1986b) methods. Positive animal cancer test data suggest that human tissue(s) may also manifest a carcinogenic response; however, animal data do not always accurately predict the same response on the same target tissue in humans. In the hazard assessment of noncancer effects, however, positive animal data suggest the nature of the possible adverse effects (i.e., the target tissues and type of effects) anticipated to occur in humans (EPA 1989i).

Uncertainty in hazard assessment arises from the nature and quality (sensitivity and selectivity) of the animal and human data. Uncertainty is decreased when similar effects are observed across species, strain, sex, and exposure route; when the magnitude of the response is clearly dose-related; when pharmacokinetic data indicate a similar fate in animals and humans; when postulated mechanisms of toxicity are similar for humans and animals; and when the CPC is structurally similar to other chemicals for which the toxicity is more completely characterized.

Uncertainty in the dose-response evaluation includes the determination of a slope factor for the carcinogenic assessment and derivation of an RfD or RfC for the noncarcinogenic assessment. Uncertainty is introduced from interspecies (animal-to-human) extrapolation, which, in the absence of quantitative pharmacokinetic, dosimetric, or mechanistic data, is usually based on consideration of interspecies differences in basic metabolism. Uncertainty also results from intraspecies, or individual, variation. Most toxicity experiments are performed with animals that are very similar in age and genotype, so that intragroup biological variation is minimal. However the human population of concern may reflect a great deal of heterogeneity including unusual sensitivity or tolerance to the CPC. Even toxicity data from human occupational exposures reflect a bias because only those individuals sufficiently healthy to attend work regularly and those not unusually sensitive to the CPC, are likely to be occupationally exposed. Finally, uncertainty arises from the quality of the key study (from which the quantitative estimate is derived) and the database. For cancer effects, the uncertainty associated with dose-response factors is mitigated by assuming the 95 percent upper bound for the slope factor. Another source of uncertainty regarding quantitative risk estimation for the carcinogenic assessment is the method by which high dose data animal studies are extrapolated to the dose range expected for environmentally exposed humans. The linearized multistage model, which is used in nearly all quantitative estimations of human risk from animal data, is based on a nonthreshold assumption of carcinogenesis. An impressive body of evidence, however, suggests that epigenetic carcinogens, as well as many genotoxic carcinogens, have a threshold below which they are noncarcinogenic (Williams and Weisburger 1991); therefore, the use of the linearized multistage model is conservative for chemicals that exhibit a threshold for carcinogenicity.

For noncancer effects, additional uncertainty factors may be applied in the derivation of the RfD or RfC to mitigate poor quality of the key study or gaps in the database. Additional

uncertainty for noncancer effects arises from use of an effect level in the estimation of an RfD or RfC, because this estimation is predicated on the assumption of a threshold below which adverse effects are not expected. Therefore, an additional uncertainty factor is usually applied to estimate a no-effect level. Additional uncertainty arises from estimation of an RfD or RfC for chronic exposure from less than chronic data. Unless empirical data indicate that effects do not worsen with increasing duration of exposure, an additional uncertainty factor is applied to the no-effect level in the less than chronic study. Uncertainty in the derivation of reference doses is mitigated by the use of uncertainty and modifying factors that normally range between three and ten. Uncertainty factors (UF) and modifying factors (MF) are assigned as follows:

- A UF of ten is used to account for sensitive subpopulations.
- A UF of ten is used when extrapolating from animals to humans to account for interspecies variability.
- A UF of ten is applied to a NOAEL (no observed adverse effect level) derived from a subchronic study rather than a chronic study.
- A UF of ten is applied to a LOAEL (lowest observed adverse effect level) to estimate a NOAEL.
- An MF from zero to ten is applied to data to reflect the quality of the data from the critical study used to derive the reference dose.

As a result, a combination of uncertainty and modifying factors may exceed 100, 1000, or more for a particular compound. These uncertainty factors are discussed in Section E.4 for the CPCs in Operable Unit 1.

Uncertainty arises in the dose-response assessment for Operable Unit 1 for values derived for principle CPCs from studies with limitations. As an example of this type of uncertainty, consider the toxicity information for uranium. Uranium as an alpha particle emitter is also considered a carcinogen; however, absolute evidence of uranium-induced excess human cancer risks are very difficult to obtain. This is largely because the human data available for radiocarcinogenic effects of uranium exposure are for underground miners, who are also simultaneously exposed to radon and radon progeny as a confounding factor. The studies of humans frequently lack information concerning uranium exposure, potential uranium exposure through previous employment, concurrent smoking patterns, or concurrent radon exposure

levels. Accurate exposure data are needed to more definitively determine the risk attributable to uranium exposure. The human studies of cancer from exposure to uranium frequently reveal a slight excess risk above the natural risk. These facts weaken the power of the human studies to detect any excess risk. These uncertainties are not well known or easily determined and, as a consequence, introduce moderate to high uncertainty into the Operable Unit 1 risk assessment.

Other toxicity information used in the Operable Unit 1 risk assessment that introduces uncertainty include:

- The EPA inhalation slope factor of 7.7 x 10^{-12} pCi^{-1} for Rn-222 plus its daughters is used to calculate risks resulting from indoor inhalation of radon gases. The EPA bases this slope factor on a 50% equilibrium ratio between Rn-222 and its short-lived daughters. Studies cited in NCRP Report No. 78 (NCRP, 1984) report a lower value for this equilibrium ratio in indoor air (i.e.: 100/50/30/20/20 for Ra-222, Po-218, Pb-214, Bi-214, and Po-214, respectively). Since the concentration of daughters expected in indoor air is lower than the EPA assumption, the slope factor is probably conservative in this respect.

- PAHs that are classified as B2 probable human carcinogens for which no toxicity data were available are evaluated using benzo(a)pyrene toxicity data. This assumption likely leads to an overestimation of the carcinogenicity of those PAHs because conservative assumptions were used to relate their carcinogenicity to that of benzo(a)pyrene. However, when toxicity equivalency factors were used in this assessment to evaluate their carcinogenicity, this may either underestimate or overestimate the carcinogenic risks. Overall, this increased conservatism does not significantly impact the overall risks from Operable Unit 1 since the majority of risks are posed by other CPCs.

- The only PCB with positive carcinogenicity results is Aroclor-1260. The carcinogenicity of all PCB isomers were assumed to be equal to the carcinogenicity of Aroclor-1260 because the dose-response data for other isomers are inconclusive. Statistically significant cancer results were not seen for Aroclors with lower percentages of chlorine atoms. The conservatism introduced in the evaluation of PCBs is not anticipated to impact the selection of CPCs for final risks because they did not exceed the concentration-toxicity screen.

- As with PAHs, the carcinogenicity of dioxins and furans other than the 2,3,7,8-isomer were determined using EPA's revised Toxicity Equivalency Factors (TEFs) in the absence
428 of toxicity values for the different isomers (Clement International, 1990).} The TEFs are based on the assumption that all dioxin and furan congeners are carcinogenic. This may introduce a large positive bias to the results of the assessment.

A significant source of uncertainty for calculating risks from radionuclides in surface soil is the use of EPA slope factors for external radiation exposure. In deriving these slope factors, EPA has assumed that an individual continuously stands on an infinitely thick slab of soil with a uniform radionuclide

concentration. To manage complicated calculations for photon attenuation and scattering in soil, EPA has assumed that the activity in the slab source is present on an infinite plane with uniform surface concentration. The slope factors for external radiation exposure are, therefore, based on calculated exposures (and associated risks of cancer incidence) from the hypothetical plane source.

In addition, EPA calculates slope factors for ingestion of many radionuclides using the maximum value for the GI absorption factor. The actual chemical form(s) that influence the magnitude of the GI absorption factor have not been considered.

To summarize, the uncertainty associated with the toxicity assessment is chemical-specific since it depends on the existing information used to derive the dose-response factor. In general, this uncertainty tends to be more high (overestimate risks by two or more orders of magnitude) for the chemical risk assessment, but tends to be low (overestimate risks by an order or magnitude or less) for radionuclides. This difference is the result of animal versus human data used for chemical and radiological compounds, respectively.

E.6.2.4 Risk Characterization

Uncertainty in risk characterization results from assumptions made regarding additivity of effects from exposure to multiple compounds from various exposure routes. High uncertainty exists when summing cancer risks or hazard indices for several substances across different exposure pathways. This assumes that each substance has a similar effect and/or mode of action. Often compounds affect different organs, have different mechanisms of action, and differ in their fate in the body where additivity is not appropriate. However, the assumption of additivity is made to provide a conservative
429 estimate of risk. This particular source of uncertainty is insignificant for Operable Unit 1 because the majority of cancer risks and hazard index is due to a few constituents of potential concern (CPCs).}

Risk characterization does not consider antagonistic or synergistic effects. Little to no information is available to determine the potential for antagonism or synergism for CPCs. Therefore, this uncertainty cannot be discussed based on the impact on the risk assessment since it has the potential to either over-or under-estimate potential human health risks.

The additivity of risks from radionuclides and chemical carcinogens is the subject of considerable debate. EPA guidance (EPA 1989a) indicates that the two sets of estimates should be considered separately because 1) chemical CSFs are developed using laboratory experiments and radionuclide

toxicity values are based on human epidemiological data, and 2) chemical CSFs represent an upper bound limit value while radionuclide slope factors are "best estimates." Therefore, cancer risks from exposure to radionuclides are presented separately from those from chemical CPCs.

E.6.3 Summary of Uncertainties in Operable Unit 1 Baseline Risk Assessment

Uncertainties encountered during the preparation of this assessment vary from waste pit to waste pit because their individual physical and chemical characterizations vary. While many of the uncertainties listed in these tables are shared between operable units, others are limited to a few of the waste pits. Table E.6-1 presents a qualitative evaluation of the uncertainties described in the preceding sections.

Although uncertainties arise from many sources, those deriving from the toxicity assessment (i.e., determination of dose-response factors) provide the greatest uncertainty for the chemical risk assessment because few chemical dose-response factors are based on human epidemiological studies. Thus, extrapolations from animal studies must be made. For the radiological assessment, the greatest uncertainty arises from the exposure assessment where exposure point concentration are often based on the maximum reported analytical result, and where conservative assumptions were made regarding future land uses and exposure scenarios. Unlike chemical toxicity data, radiological dose-response factors are derived from human studies which is assumed to result in lower uncertainty.

Generally, uncertainty arises wherever data gaps exist. Data gaps in the risk assessment were mitigated by making conservative assumptions for individual parameters. Significant uncertainty results for those particular pathways that required fate and transport modeling to support the assessment of exposure. Such uncertainty was generated for the air and groundwater pathways of exposure. Thus, interpretation of risk from these media must consider the high uncertainty. Also, certain exposure pathways for a particular medium tend to have higher or lower uncertainty depending on their assumptions. For example, incidental ingestion of soils by residents tends to have significantly less uncertainty than ingestion of fruits and vegetables, and meat and milk raised on contaminated soils. These latter exposure pathways must make some assumptions regarding their uptake from soil to plant and plant to live stock while the soil ingestion pathway does not.

Receptors with the highest uncertainty in the current source term are the off-property resident farmer and off-property user of meat/milk from livestock grazed on site. The off-property resident farmer scenario is evaluated based on modeled concentrations for the air pathway and results in high

uncertainty. The bioaccumulation of CPCs into meat/milk are modeled, and as a result, provide moderate to high uncertainty for this receptor. The greatest uncertainty in the risk assessment of Operable Unit 1 is associated with the assumptions made in the future source. These particular receptors include the on-property resident farmer, Great Miami River user, and off-property used of meat and milk. For the on-property resident farmer and home builder, the highest uncertainty is associated with the proposed land used and potential exposure pathway. This receptor scenario is included in response to guidance and is anticipated to have a low likelihood of occurrence due to the history of the site and the particular waste management activities within Operable Unit 1. Uncertainty associated with the off-property resident farmer and Great Miami River water user is primarily the result of surface water and air modeling used to support those scenarios. The modeling assumptions are conservative, which result in conservative estimates for the exposure point concentrations.

Taken together, the uncertainties identified with site data, exposure parameters, fate and transport, toxicity assessment and risk characterization are judged to be high (i.e., potential to over-estimate risk by two or more orders of magnitude).

E.6.3.1 Risk Sensitivity Impact Analysis (1993 Supplemental Sampling Program).
In late June/early July 1993, twenty-nine additional surface soil samples were collected from an area in and around Operable Unit 1. To accomplish this field sampling, a portion of an OU1 Technical Engineering Data Acquisition Program (TEDAP), which was in initial planning stages, was accelerated to fully utilize field resources and laboratory capacity which would become available between demobilizing OU2's RI field program and mobilizing OU5's field program. The purpose of this sampling program was to supplement available data used to describe the nature and extent of contamination in OU1, to provide additional confidence in calculations and modeling that supported the baseline risk assessment, and to support preliminary remedial design.

22-O ***Due to the time required to select CPCs, perform fate and transport modeling, enter data into the database, calculate risks and to write the text of the baseline risk assessment, it was required that the database be frozen at a date substantially prior to the document submittal. Therefore, data from the 1993 sampling event was not included in the baseline risk assessment. However, the 1993 data was quantitatively evaluated and included in this section. A sensitivity analysis of the 1993 data to the total database was performed.***

Data from the 1993 sampling event is presented in Appendix G-4. The following provides an evaluation of the 1993 data and its potential impact on the risk values presented in the baseline risk assessment. As all risks can be directly related to the source terms, the impact analysis was performed by evaluating changes to the source term. As presented here-in, the presence of additional constituents or increased concentrations of existing constituents found in the 1993 data have no impact on the incremental lifetime cancer risks or hazard quotients reported in the baseline risk assessment nor do they impact the existing list of COCs.

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Methodology

A four step process was used to evaluate the 1993 surface soil data as it relates to the baseline risk assessment. In the first step, the 1993 surface soil data were statistically evaluated and compared to background in order to identify contaminants of potential concern (COPCs). Statistical methods used to perform this evaluation are described in Section E.2.

In step 2, the COPCs from the 1993 data set were compared to the RI surface soil values. This comparison identified chemicals/radionuclides that were not previously detected and chemicals/radionuclides which were detected in concentrations greater than those previously reported. COPCs passing this test were retained. All other constituents were dismissed from further consideration.

In step 3, the retained COPCs were subjected to a toxicity screen, using the methodology described in Section E.2, to screen out those constituents that were considered to be benign or innocuous. Chemicals passing this test were identified as CPCs.

Step four consisted of a qualitative risk evaluation. For those CPCs which were not considered in the RI report and for those CPCs whose concentration increased by 20 percent or more over the value used in the RI report, a semi-quantitative analysis was performed to estimate the magnitude of the associated change in the baseline risk assessment for all predominant pathways.

Screening Criteria

Table E.6-1 lists the chemicals/radionuclides detected in the RI and the 1993 surface soil sampling, the representative concentrations of the detected constituents (as defined in Section E.2.2.2), and the representative concentrations used in the baseline risk assessment. Column 7 identifies those constituents which have representative concentrations above background levels (COPCs). In column 8, the COPCs are divided into four categories. The noted categories, shown below, identify those constituents which required evaluation to determine if the 1993 data might impact the baseline risk assessment. The CPC and Screen Code columns identify those constituents that are CPCs. For those constituents not considered to be a CPC, a screening code(s) is listed.

1. The representative concentration from the 1993 data is less than or equal to the representative concentration derived from the RI data. No change to the representative concentration is required and the constituent need not be considered further.

000272

2. The constituent was originally screened from the baseline risk assessment (i.e., the constituent was not a CPC), but the representative concentration from the 1993 data is greater than the representative concentration from the RI data. The constituent should be evaluated to determine if the increase in representative concentration will cause the constituent to become a CPC which may then impact the baseline risk assessment.

3. The constituent was defined as a CPC and considered in the baseline risk assessment and the representative concentration from the 1993 data is greater than the representative concentration used in the baseline risk assessment. The constituent should be evaluated to determine if the increase in representative concentration has an impact on the baseline risk assessment.

4. The constituent was detected in the 1993 sampling event but was not previously detected during RI sampling. The constituent should be evaluated to determine if the addition of the constituent has an impact on the baseline risk assessment.

Those chemicals/radionuclides which were identified as CPCs and which fell into category 3 or 4 are shaded in Table E.6-1 and listed separately in Table E.6-2. Four CPCs were detected at higher concentrations than previously reported. In addition, two of the chemicals/radionuclides detected in the 1993 data were found to be CPCs which had not been previously detected in the RI samples. The ratio of the 1993 representative concentrations for the CPCs to the representative concentrations used in the baseline risk assessment are shown in Table E.6-2. All ratios indicate that the 1993 data would result in small increases in the representative concentration terms over those used in the baseline risk assessment.

Identification of Critical Exposure Receptors and Pathways

The radiological and chemical RME receptors, predominant exposure pathways, and the major risk contributors for each land-use scenario were evaluated for the soil/air pathways in the RI report, Attachment E.IV. The scenarios that resulted in the highest risk were the off-property user of meat and dairy products for current land use and the on-property resident farmer for future land use. Of the two scenarios, the future on-property resident farmer scenario has the higher total risk. Therefore, the future on-property resident farmer scenario was used to perform a sensitivity analysis for the constituents listed in Table E.6-2.

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Sensitivity Analysis

As presented below, an analysis of the additional constituents, or of the increased concentrations of existing constituents found in the 1993 data, indicates no additional impact on the incremental lifetime cancer risk or hazard quotient nor do they impact the existing list of COCs.

As shown in Table E.6-1, 1993 radionuclide representative concentrations are less than those used in the baseline risk assessment, with the exception of Np-237 which is greater by approximately 30 percent. For radionuclides, the greatest risk to the on-site resident farmer is due to external exposure. The fractional contribution of Np-237 to the total radiological risk from external exposure is 0.22 percent, as calculated from the data in Table E.IV-16. Since the external risk from any uniformly distributed gamma emitting radionuclide is proportional to its concentration, increasing the concentration by approximately 30 percent will increase the risk value for Np-237 by 30 percent. However, Np-237 contributes less than 0.5 percent to the total risk. Thus, use of the increased representative concentration of Np-237 from the 1993 data would result in a negligible increase (30% x 0.5% = 1.5%) in the total risk value reported for this scenario.

Thorium-total, benzo(a)pyrene, and benzo(b)fluoranthene represent the only CPCs whose representative concentrations from the 1993 surface soil data are greater than the representative concentrations used in
24-O the baseline risk assessment. ~~In addition, only two chemicals, octachlorodibenzo-p-dioxin and phenanthrene, represent CPCs which were detected in the 1993 data but not in the RI.~~ In the case of total-thorium, the 1993 representative concentration is greater than the RI representative concentration by a factor of 2.0. Total-thorium was not used in calculating either the incremental lifetime cancer risk (ILCR) nor the hazard quotient (HQ), so the noted increase has no effect on the total risk.

The total ILCR for the incidental ingestion pathway of the on-site resident farmer is 1.4×10^{-2}, see Table E.IV-16. Benzo(a)pyrene and benzo(b)fluoranthene contribute less than 0.005 percent of the total risk, having risk values of 6.9×10^{-7} and 1.8×10^{-7}, respectively. The increases in the representative concentrations for benzo(a)pyrene and benzo(b)fluoranthene result in a negligible increase in the total risk.

With regard to the additional CPCs, phenanthrene is identified as a class D chemical. There are no reference values for phenanthrene in IRIS, HEAST, or the EPA screening document used for toxicity screening. Thus, it is not considered to be a chemical of concern. Octochlorodibenzo-p-dioxin (OCDD) was detected in the 1993 surface soil data at a representative concentration of 0.9 ppb. The baseline risk assessment model was used to evaluate the associated risk under worst-case conditions. The model was

run for the RME resident farmer under the future source term, future scenario. The model considered the contribution of risk due to OCDD in surface soil via all applicable pathways used in the baseline risk assessment. The calculated incremental lifetime causes risk to the RME resident farmer due to 0.9 ppb of OCDD in surface soil is 5.1×10^{-5}. Under this same scenario, the total risk due to non-radiological constituents in surface soil is 5.4×10^{-2}. In other words, the risk due to OCDD is 1/1000th of the total ILCR due to non-radiological constituents in surface soil. Based upon this comparison, it is projected that the presence of 0.9 ppb OCDD in Operable Unit 1 surface soil has virtually no impact on the risk values presented in the baseline risk assessment.

26-US *E.6.3.2 Evaluation of TICs*

Based upon the methods used for the analysis, validation and the quantification of COCs, a number of tentatively identified compounds (TICs) were removed from the list of chemicals destined for quantitative analysis. These constituents were removed based upon the protocol established in the risk assessment guidelines. Qualifiers used for evaluation of these constituents indicate the positive nature of the compound and the concentration was in question and insufficiently reliable for quantitative assessment. However, a qualitative toxicological evaluation of Operable Unit 1's TICs was prepared, in order to ascertain the probable impact to site risk.

The evaluation of potential toxicity and contribution to site risk of TICs is examined in relation to the chemical classes to which they belong. Related target organ systems, and a toxic effect, based upon estimated levels and the potential for exposure were also considered. A list of TICs and their chemical classes are presented. Estimated maximum concentrations are in (ug/kg) unless otherwise noted.

E.6.3.2.1 General Discussion

Tentatively identified compounds are of uncertain origin and are defined as those compounds that may result from chromatographic responses that exceed 10 percent of the response of the nearest internal standard (EPA, 1989a). Reporting requirements for analyses presume a maximum of 10 TICs to be reported for volatiles and a maximum of 20 TICs to be reported for semivolatiles. In general, TICs may be associated with the presence of blank contamination, laboratory artifacts such as aldol condensation products, chromatographic column bleed, biological compounds present in soil, residual compounds previous analyses, and exotic organics, esters, and nitrogenous compounds from soil and plant life.

Organic compounds may exhibit response factors in the range of 0.05 to 2.0, as opposed to a factor of 1.0 for equal chromatographic responses based upon the reference to the nearest internal standard. Due to the variability in potential response factors of organic compounds, any estimate of TIC presence, origin, or concentration is questionable. Given a response factor range of 0.05 to 2.0, the quantitative sum of all TICs in a given sample with 10 parts per million, would have an actual value as low as 0.25 parts per million, or a maximum value as high as 400 parts per million. The range is based on the uncertainty of identification, response, and concentration. The TICs listed in Table E-6-4 such as tributyl phosphate and the several solvents may be associated with residual process products or materials. Various compounds appear to be either chemical degradation or condensation products, generated during chemical separation-chromatographic analysis, or progeny of solid phase constituents in the chromatographic column.

Tentatively identified compounds were found in 25 of 61 semivolatile samples and 17 of 68 volatile samples of pit material. Concentrations were detected at the low ug/kg (ppb) levels, and occasionally in the low parts per million range (mg/kg). Generally, their presence in deeper pit media (below 4 feet) and the low concentrations of many constituents would preclude any serious cause for concern.

The potential for toxicity of TICs is qualitative since their estimated levels are uncertain and the availability of experimental or clinical information on dose response and toxicity for most TICs is non-existent.

Chromatographic separation and analysis is known to produce synthetic artifacts. Degradation and/or condensation products are well known and occur on the solid phase during separation. Such compounds are usually present in low concentrations and usually of varying composition.

The disparity of the magnitude of concentrations between the results of concurrent analyses of total organic contents and TIC items adds to uncertainty, suggesting these estimated values cannot be relied upon as factual. Accordingly, toxicity cannot be adequately defined.

E.6.3.2.2 Toxicity Assessment By TIC Classes

Table E.6-4 presents a TICs found in Operable Unit 1 by compound class.

000276

Alcohol-Glycols

Most alcohols and glycols do not usually present a serious hazard to most individuals, even in the industrial setting. Specific compounds such as methanol and ethylene glycol are involved in epidemics and in isolated instances of intoxication. However, these observations indicate they are generally the result of intentional consumption.

Industrial exposure to most alcohols and glycol compounds rarely produce symptoms of chronic systemic intoxication. Methanol can cause blindness in humans and ethylene glycol has produced fatalities. Toxicity from the vapors are generally to the conjunctivae of the eyes and the mucous membranes of the upper respiratory tract and possibly the skin. The low vapor pressure of the low molecular weight alcohols (ethanol and methanol) and glycols (ethylene glycol) would not achieve significant air concentrations unless the compound was heated or sprayed as a mist. Also at the soil depths discussed above, they would not be likely to produce concern. Although they have narcotic properties, they are much less prominent than those associated with solvent or halogenated hydrocarbons. Alcohols are rapidly removed from the body via the dehydrogenase enzymes present in the liver. The potential for toxicity rests on the amount consumed; generally large doses are required for toxicity.

Propanols have little potential for serious or chronic toxicity. Ingestion causes symptoms typical of ethanol intoxication; central nervous system depression, drowsiness and headaches. Butanols have been shown to be toxic when ingested, but systemic effects have not been noted at concentrations below 100 parts per million. At 200 parts per million air concentration, optic irritation, blurred vision, burning and lacrimation of the eyes are noted. Pentanols are irritating and narcotic and produce illness when ingested. Methanol, 2-propanol, 2-butanol and 2-methyl propanol mimic the effects of ethanol poisoning and, like many ketones, can increase the hepatic effects of halogenated hydrocarbons. Toxicologically, this group appears to be of very little significance to risk.

Hexanol (like hexane) can be metabolized to hexanone. This metabolite may initiate nerve damage and if the exposure is chronic, it could cause serious peripheral neuropathies. However, this occurs only under chronic exposure and at fairly high concentrations. It is generally found in the industrial setting. This is unlikely at the FEMP. Alcohol solvents are liquid and highly volatile. Because of their widespread use there is a potential for adverse effects from the industrial setting. FEMP concentrations of the alcohols do not contribute to the site risk.

CONCLUSION: IMPACT FROM ALCOHOLS/GLYCOLS ON RISK IS LOW

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Aldehydes/Ketones

Together this group comprises a group of chemicals known as carbonyl compounds. There are a few that are toxicologically important and affect the eyes, skin and mucous membranes. Some are irritants of the eyes, skin and mucous membranes. However, their metabolism is too rapid to produce any cumulative effects needed for systemic toxicity. Halogenated ketones can be considered highly toxic; however there are no such compounds in this list of TICs. Derivatives of butanone and 2-hexanone maybe be considered harmful, especially to muscle/nerve tissue in that they are able of causing peripheral polyneuropathies. However, chronic exposures are required to initiate such pathology.

2-heptanone, 2-pentanone, methyl isobutyl ketone is also used as a solvent for lacquer thinner. Its strong odor limits use and minimizes exposures. Most of these compounds irritate the mucous membranes and are strongly narcotic at higher concentrations, possibly requiring levels above 200 parts per million to demonstrate these effects.

CONCLUSION: IMPACT ON RISK FROM ALDEHYDE/KETONES IS LOW.

Aliphatics

The aliphatic hydrocarbons includes saturated as well as unsaturated compounds. They are products of petroleum cracking. The lower weight compounds are gaseous (methane, ethane, propane, and butanes). The pentane series (C_5-C_{16}) tends to be volatile liquids. These materials are not chronic toxins. These are simple asphyxiants and tend only to displace oxygen when present in high concentration causing hypoxia. In general the saturated hydrocarbons (C_4-C_8) show very strong narcotic properties. Heavier members of the series are not highly volatile and require heat to generate vapor concentrations capable of causing narcosis.

The hexane molecule is capable of peripheral neuropathies. Large doses over long periods of time would be required for this adverse effect to occur. The closely related pentane and heptane molecules (C_5 and C_7), are unlikely to cause any such adverse effects. However, high concentrations of vapors from heptane (C_7) and octane (C_8) molecules can cause giddiness, vertigo headache and anesthetic stupor. These symptoms tend to be reversible and full recovery generally occurs. Based upon the levels and at the depths present of these materials in the pits, these responses are unlikely.

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CONCLUSION: THE IMPACT ON RISK FROM ALIPHATICS IS LOW.

Amino/Nitro Compounds

Aromatic amino and nitro compounds are fundamental to manufacture of explosives, pharmaceuticals, herbicides, plastic, paint and rubber industries. Aniline and coal tar dyes are products that contain nitrogen groups. There are general toxic properties characteristic of this group in that many of these compounds can cause methemoglobinemia. However, some are proven to be bladder carcinogens while others affect the oxidative phosphorylation mechanism.

Several herbicides contain nitrile compounds. The nitriles have been shown to cause headache, fever, dizziness, vomiting, weight loss and leg myalgia. The lethal dose in rats occurs at levels above 270 mg/kg.

CONCLUSION:IMPACT TO RISK FROM AMINO/NITRO GROUPS IS MODERATE.

Aromatic/Polyaromatic Hydrocarbons

Among the aromatics, benzene presents the greatest potential threat to human health due to its known potential to cause leukemia. Related alkyl benzene compounds have the potential to cause central nervous system narcosis. However, the alkylbenzenes tend to be relatively non-toxic except at high concentrations during acute exposures. Thus the hydrocarbons identified above as TICs are not likely to be of serious concern.

Pyridines are a special group of compounds, that are fat soluble and tend to penetrate the intact corneal epithelium, then rapidly reaches the iris and causes iritis. This causes leakage of proteins and leukocytes if sufficient concentrations develop.

Polyaromatic compounds such as the chlorinated biphenyls, phenanthrene and anthracene were identified as COCs and the risk was quantified. However, additional compounds, could increase the risk for adverse effects, such as skin chloracne. However, these compounds require a certain molecular shape and if present, induce the hepatic enzyme, arylhydrocarbon hydroxylase which correlates highly with chloracne. These agents are capable of initiating other adverse skin reactions and considered to be skin carcinogens. They may be considered as co-carcinogens. They could increase the impact on risk.

CONCLUSION: THE IMPACT ON SITE RISK FROM AROMATIC/POLYAROMATIC HYDROCARBONS COULD BE MODERATE.

Carboxylic Acids

Carboxylic acids are soluble forms of compounds that are easily conjugated by the liver enzymes and are rapidly removed from tissue due to their high solubility as conjugated polar compounds. Toxicity of these compounds is generally unknown: however, due to their high solubility and rapid removal from the body, effects would appear to be minimal.

CONCLUSION: IMPACT ON RISK FROM CARBOXYLIC ACIDS WOULD BE LOW.

Esters

Esters are chemical compounds that are formed when an organic radical group (R) replaces the hydrogen atom in an organic acid. Generally these compounds are found in the plastics industry either as resins, as plasticizers or as solvents for lacquers. Generally, esters of organic acids tend to be of low toxicity; although there are exceptions. The more saturated the compound, the more likely it will be harmless. Higher levels of double bonds in these molecules tend to increase the ability for skin irritation.

Esters used as plasticizers, with the exception of certain phosphate esters, are usually physiologically inert. In those instances from exposure to acrylates, methacrylates, crotonates and vinyl and allyl esters are the source of exposure, toxicity demonstrated by conjunctivitis, upper respiratory irritation and pulmonary edema may occur.

Tributyl phosphate (TBP) ester has found use as a solvent in the uranium extraction process. Its harmful effects are limited to the respiratory system, the skin and eyes. There do not appear to be any chronic manifestations of exposure. As with most acute toxins, removal of the source will allow reverse of the symptoms. The ACGIH established an air level of 1300 mg/m^3 TBP as immediately dangerous to life.

As a rule, mammalian metabolic systems have broads classes of esterase enzymes present in the liver and kidney to hydrolyze the linkages of foreign compounds. They are rapid in their action and remove such materials from the body quickly through increased solubility.

CONCLUSION: THE IMPACT TO RISK FROM THESE ESTERS IS LOW.

Furans

Furans cause irritation of the eyes and upper respiratory system. Nausea, dizziness and headaches are a symptom of exposures above 200 parts per million. In experimental animals, liver and kidney damage have been caused by furan exposures.

CONCLUSION: THE IMPACT ON RISK IS LOW FROM THESE FURANS.

Dimethyl Sulfide

The impact from this compound is unknown. Toxicity data is lacking and precludes an evaluation of any possible toxic effects.

CONCLUSION: THE IMPACT TO RISK IS UNKNOWN.

Unknown Organic Compounds

There are a number of unidentified unknowns present in the LIST OF TICs; their impact on risk cannot be evaluated.

CONCLUSION: THE IMPACT ON RISK IS UNKNOWN.

E.6.3.2.3 Overall Impact of TICs on Risk

The overall impact on risk from these compounds is low. This is due to the fact that these materials appear to be relatively non-toxic, and because the potential for exposure is minimal, primarily from the pit material. Although there is risk of hazard from the exposure to the eyes and skin, this appears to be minimal because the source material has a very low level concentration in the pit materials. The volume of soil required for ingestion to produce an adverse effect from these levels of materials would be in excess of a few kilograms (2-3 lbs or more) and is highly unlikely. Any possible risk, would likely be occupational, considering its likely that a construction or remedial worker, digging in the soil, would be exposed to the sub-surface soil TICs.

These materials may be present due to the various reasons stated above, from residuals blown over from crop farms and/or present due to existing biological (plants, insects, microbes) products present naturally in the soils. This would tend to reduce the expectation that these materials would be toxic,

except under fairly large exposure conditions. Although plant alkaloids can be toxic, there are few only at very small amounts and it would require the receptor to consume inordinately large volumes of pit material to reach toxic levels.

Under chronic conditions of exposure, a positive impact on risk always exists. The primary potential of such materials is to irritate the mucous membranes of the eyes and the respiratory tract. Given their presence in the pit materials, the impact is minimal, if at all.

The variability of these TIC compounds suggest residues from many biological activities, not likely associated with the site process activity. Together with the very low ppb levels, it reaffirms our belief that the presence of these tentatively identified compounds, at levels estimated, are unlikely to negatively impact human health and site risk.

The question of the degree of impact is a professional judgment: the certainty of its lack of impact on risk is fairly high. The low concentrations and the low potential for an exposure, effects of these TICs, if present, and their bioavailability, would be non-existent to very low. The impact on the overall site risk is very low.

Appendix E-6

Tables

TABLE E.6-3

UNCERTAINTIES ASSOCIATED WITH ESTIMATED RISKS FROM OPERABLE UNIT 1

Source of Uncertainty	Magnitude [a]	Expected Direction [b]	Remark
Selection of CPCs:			
• Adequacy of database	Low to Moderate	Increases or decreases conservatism	CPCs may be underestimated. Principal constituents were identified.
Exposure Assessment:			
• Calculated exposure point concentrations			
- positive bias in sampling	Moderate	Increases conservatism	Source concentrations based on 95% UCL or maximum. Sampling was biased for radiological CPCs
- conservative modeling assumptions	High	Increases conservatism	Modeled concentrations were conservative.
• Determination of land uses			
- current scenario	Low	Increases conservatism	Scenario based on current environmental setting
- future scenario	High	Increases conservatism	Worst case scenario assumed.
• Assumptions for source terms			
- current source term	Low	Increases or decreases conservatism	Current source term assumes waste pits covered and surface water runoff treated.
- future source term	Moderate	Increases conservatism	Future source term assumes failure of Waste Pit 3 cover.
• Selection of receptors			
- current scenario	Low	Increases conservatism	Scenario based on current environmental setting.
- future scenario	High	Increases conservatism	Worst case scenario assumed.
• Determination of exposure factors	Low to moderate	Increases conservatism	Receptor and exposure pathway specific.

TABLE E.6-3
(Continued)

Source of Uncertainty	Magnitude [a]	Expected Direction [b]	Remark
Toxicity Assessment:			
• Dose-response assessment			
- chemical CPCs	High	Increases conservatism	Dose-response based on animal data.
- radiological CPCs			
internal	Low	Increases conservatism	Dose-response based on human data.
external	Moderate to high	Increases conservatism	Conservative assumptions made for external exposure.
• Other OU1 CPCs			
- dose-response for PAHs	Low	Increases conservatism	PAHs pose low risk.
- dose-response for PCBs	Low	Increases conservatism	PCBs pose relatively low risk.
- dose-response for dioxins/furans	Low	Increases conservatism	Furans/dioxins relatively low risk.
- dose-response for Rn-222 (indoors)	Low to moderate	Increases conservatism	Assumptions for indoor Rn-222 differ from those made for the CSF.
Risk Characterization:			
• Additivity	Low to moderate	Increases conservatism	Health effects dominated from few CPCs and exposure pathways.
• Effect of tentatively identified compounds (TICs)	Low	Decreases conservatism	Relatively few TICs.
• Failure to consider antagonism	Unknown	Increases conservatism	Data unknown.
• Failure to consider synergism	Unknown	Decreases conservatism	Data unknown.
• Failure to consider segregation of HIs	Low	Increases conservatism	HIs dominated by few CPCs and exposure pathways.
Overall	High	Increases conservatism	High uncertainty from combining low, moderate, and highly uncertain parameters.

[a] Magnitude is assessed qualitatively based on professional judgment and includes the following:
Low-impact risk by a factor of 10 or less.
Moderate-impact risk by a factor of 10 to 100.
High-impact risk by a factor of 100 or more.

[b] Direction is assessed qualitatively where an increased conservatism increases final health effects and a decreased conservatism decreases final health effects calculated in risk assessment.

TABLE E.6-4
LIST OF TICS BY CLASS

ALCOHOL/GLYCOL
3-methyl-2-butanol(13000)
4-butanediol-diacetate(370)
2-butoxyethanol(28)
2-cyclohexanemethanol(78)
dodecylcyclohexanol(14000)
2-propyl-1-heptanol(47)
tetrahydropyran-2,3-diol(4900)
2,4-dimethyl pentanol(31)
tetracontanol(5800)
undecen-1-ol(34)

ALDEHYDE/KETONE
1-(3-ethyloziranyl)-7-ethanone(680)
2-ethoxy-1,2-diphenyl ethanone(160)
butanal(140)
3-methyl-2-butanone(13mg/kg)
6-acetyloxy-2-hexanone(22mg/kg)
dihydroxy-2-hexanone(450)
5-methyl-3-hexen-2-one(660)
3h-naphtha-2,1-b-pyran-3-one(2700)
2h-pyran-2,3-diol-tetrahydrodiacetate(5180)

ALIPHATICS
bicyclononane(61)
1,4-dimethylcyclooctane(32)
bicycloheptane(220)
azabicyclohexane(190)
decyl-cyclohexane(2400)
eicosyl-cyclopentane(2300)
1-methyl-1,4-cyclohexadiene(30)
1-methyl-3-(1-methylethyl)-cyclopentane(55)
cyclopropane(4700)
hexatriacontane(910)
tetra-1,3-dioxalane(410)
2-methyl-6-propyldodecane(200)
2-methyl-4,5-nonadiene(61)
2-methyl-1-propene(45)
4-methyloctane(190)
spirodecane(1000)
tetradecane(590)
tricyclodecane(140)
1,3,6-trioxocane(39)
tri-tetracontane(240)

AMINO/NITRO COMPOUNDS
2,4-pentadiene nitrile(45)
2-methyl-1-nitropropane(20)
1,4-dibutyl-tetrazine(2300)

AROMATIC/POLYAROMATIC
cyclohexyloxy-benzene(2500)
1-choloromethyl-isobenzene(25)
Isoquinolinium(6400)
decahydronaphthalene(150)
dibenzothiophene(1500)
5h-indeno-1,2-pyridine(41mg/kg)
pentachlorobiphenyl(6.8mg/kg))
tetrachlorobiphenyl(2.0mg/kg)
benzanthracene(22mg/kg)
cyclopentaphenanthrene(3000)
methylphenanthrene(15mg/kg)

CARBOXYLIC ACIDS
2,4-dinitrobenzeneacetic acid(4000)
hexanedioic acid(16mg/kg)
1-phenyl-cyclopropane-carboxylic acid(57)
2-methylpentanoic acid(6600)
octadecanoic acid(4400)

ESTERS
tributylphosphoricacid(7700)
hexanedioicacid(12.0mg/kg)

FURANS
tetrahydrofuran(14)
2-propylfuran(1200)

SULFUR COMPOUNDS
dimethyl sulfide(40)

UNKNOWNS
C_6 THROUGH C_{30}

child were considered applicable for consideration with current access controls. The receptors considered applicable if access controls were removed are the trespassing youth, off-property RME resident farmer and child, and off-property user of meat and dairy products (an individual that would ingest meat and dairy products from livestock grazed on-site). With access controls, the exposure pathway contributing the greatest risk is external exposure of the groundskeeper to radiological constituents in buried pit materials. Under current land use without access controls the principle exposure pathways from the current source term are biotransfer of chemical CPCs into meat and milk products. The receptor with the greatest risk for current land use, current source term is the off-property user of meat and milk products from cows grazed on site with a total carcinogenic risks of 2 x 10^{-3}. The primary

DOE contributors to this risk are total PCBs and ~~U238~~ ***U-238*** in the surface soil and ~~C_{s137}~~ Cs_{137} in surface water as a result of their biotransfer to meat and milk products. The Hazard Indices for all these receptors are acceptable (less than 1) except for the off-property user of meat and milk products with a hazard index of 2.9. Antimony and cadmium in surface soils are the systemic toxins most significantly contributing to total cancer risk.

Tables E.7-3 and E.7-4 contain a summary of risks associated with current land use and future source term. Assumptions were made for the future source term regarding the configuration of the operable unit that would result in higher exposure to stored waste materials. The receptors given in Tables E.7-3 and E.7-4 include the trespassing youth and Great Miami River User (i.e., an individual that uses the river as a source of domestic water and for recreational purposes). A number of other receptors were also identified as relevant under current land use, future source term. These receptors include the off-property farmer and child, and off-property user of meat and milk products. The cancer risks and hazard indices are not dependent upon on-site land uses, and therefore, are applicable under the current and future land use scenarios. The cancer risks and hazard indices are presented under future land use, future source term evaluation.

Cancer risks for the current land use, future source term range from 3 x 10^{-7} for the Great Miami River User to 2 x 10^{-3} for the off-property RME farmer. The pathway contributing the majority of risk is ingestion of groundwater by the off-property RME farmer with uranium isotopes the primary contributors to total cancer risk. Total hazard indices range from 0.004 (Great Miami River User) to 90 for the off-property child. Groundwater was the pathway contributing the majority to the total hazard index for this receptor. Other exposure pathways

Appendix E-7

Tables

TABLE E.7-1

INCREMENTAL LIFETIME CANCER RISK SUMMARY
CURRENT LAND USE, CURRENT SOURCE TERM

Media	Groundskeeper	Off-property Farmer	Off-property Young Child	Trespassing Youth	Off-property User of Meat and Milk Products
Air					
Radiocarcinogenic Risk	6E-06	3E-06	2E-07	7E-07	NA
Chemical Carcinogenic Risk	1E-08	2E-07	8E-08	2E-09	NA
Total[a]:	6E-06	3E-06	2E-07	7E-07	NA
Surface Soil					
Radiocarcinogenic Risk	8E-05	NA	NA	3E-05	5E-04
Chemical Carcinogenic Risk	1E-05	NA	NA	9E-06	9E-04
Total:	9E-05	NA	NA	4E-05	1E-03
Buried Pit Material					
Radiocarcinogenic Risk	5E-05	NA	NA	2E-05	NA
Chemical Carcinogenic Risk	NA	NA	NA	NA	NA
Total:	5E-05	NA	NA	2E-05	NA
On-property Surface Water					
Radiocarcinogenic Risk	NA	NA	NA	NA	2E-04
Chemical Carcinogenic Risk	NA	NA	NA	NA	6E-06
Total:	NA	NA	NA	NA	2E-04
Sum All Media					
Radiocarcinogenic Risk	1E-04	3E-06	2E-07	5E-05	7E-04
Chemical Carcinogenic Risk	1E-05	2E-07	8E-08	9E-06	9E-04
Total:	1E-04	3E-06	2E-07	5E-05	2E-03

NA – Not applicable. Exposure route not evaluated for receptor.
[a] Radiocarcinogenic and chemocarcinogenic risks are not truly additive. A total is provided for reference only.

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TABLE E.7–2

HAZARD INDEX SUMMARY
CURRENT LAND USE, CURRENT SOURCE TERM

Media	Groundskeeper	Off–property Farmer	Off–property Young Child	Trespassing Youth	Off–property User of Meat and Milk Products
Air	0.0E+00	2.7E–04	1.3E–03	0.0E+00	NA
Surface Soil	3.0E–01	NA	NA	4.9E–01	2.7E+00
On–property Surface Water	NA	NA	NA	NA	2.3E–01
Sum All Media	3.0E–01	2.7E–04	1.3E–03	4.9E–01	2.9E+00

NA – Not applicable. Exposure route not evaluated for receptor.

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TABLE E.7-3

INCREMENTAL LIFETIME CANCER RISK SUMMARY CURRENT LAND USE, FUTURE SOURCE TERM

Medium	Trespassing Youth	Great Miami River User
Air		
Radiocarcinogenic Risk	8E-05	NA
Chemical Carcinogenic Risk	4E-05	NA
Total[a]:	1E-04	NA
Surface Soil		
Radiocarcinogenic Risk	1E-04	NA
Chemical Carcinogenic Risk	7E-05	NA
Total[a]:	2E-04	NA
Buried Pit Material		
Radiocarcinogenic Risk	7E-06	NA
Chemical Carcinogenic Risk	NA	NA
Total[a]:	7E-06	NA
Paddys Run Surface Water		
Radiocarcinogenic Risk	7E-08	NA
Chemical Carcinogenic Risk	6E-08	NA
Total[a]:	1E-07	NA
Paddys Run Sediment		
Radiocarcinogenic Risk	4E-06	NA
Chemical Carcinogenic Risk	9E-06	NA
Total[a]:	1E-05	NA
Great Miami River Surface Water		
Radiocarcinogenic Risk	NA	3E-07
Chemical Carcinogenic Risk	NA	3E-08
Total[a]:	NA	3E-07
All Media		
Radiocarcinogenic Risk	2E-04	3E-07
Chemical Carcinogenic Risk	1E-04	3E-08
Total[a]:	3E-04	3E-07

NA – Not Applicable. Exposure route not evaluated for this receptor.
[a] Radiocarcinogenic risk and chemocarcinogenic risk are not truly additive. A total is provided for reference only.

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TABLE E.7-4

HAZARD INDEX SUMMARY
CURRENT LAND USE, FUTURE SOURCE TERM

Medium	Trespassing Youth	Great Miami River User
Air	2.5E-01	NA
Surface Soil	1.5E+00	NA
Paddys Run Surface Water	3.9E-02	NA
Paddys Run Sediment	1.1E-01	NA
Great Miami River Surface Water	NA	4.2E-03
All Media	1.9E+00	4.2E-03

NA – Not Applicable. Exposure route not evaluated for this receptor.

000292

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TABLE E.7-5

INCREMENTAL LIFETIME CANCER RISK SUMMARY FUTURE LAND USE (GOVERNMENT RESERVE) FUTURE SOURCE TERM

Medium	On-property Groundskeeper	Expanded Trespasser
Air		
Radiocarcinogenic Risk	7E-04	1E-04
Chemical Carcinogenic Risk	2E-04	6E-05
Total[a]:	9E-04	2E-04
Surface Soil/Exposed Pit Material		
Radiocarcinogenic Risk	4E-04	3E-04
Chemical Carcinogenic Risk	2E-04	2E-04
Total[a]:	7E-04	5E-04
Buried Pit Material		
Radiocarcinogenic Risk	5E-05	3E-05
Chemical Carcinogenic Risk	NA	NA
Total[a]:	5E-05	3E-05
Paddys Run Surface Water		
Radiocarcinogenic Risk	NA	7E-08
Chemical Carcinogenic Risk	NA	6E-08
Total[a]:	NA	1E-07
Paddys Run Sediment		
Radiocarcinogenic Risk	NA	4E-06
Chemical Carcinogenic Risk	NA	9E-06
Total[a]:	NA	1E-05
All Media		
Radiocarcinogenic Risk	1E-03	4E-04
Chemical Carcinogenic Risk	4E-04	3E-04
Total[a]:	2E-03	7E-04

NA – Not Applicable. Exposure route not evaluated for this receptor.
[a] Radiocarcinogenic risk and chemocarcinogenic risk are not truly additive. A total is provided for reference only.

000293

TABLE E.7-6

HAZARD INDEX SUMMARY
FUTURE LAND USE (GOVERNMENT RESERVE)
FUTURE SOURCE TERM

Medium	Groundskeeper	Expanded Trespasser
Air	6.2E-01	2.9E-01
Surface Soil/Exposed Pit Material	1.6E+00	3.5E+00
Paddys Run Surface Water	NA	3.9E-02
Paddys Run Sediment	NA	1.1E-01
All Media	2.2E+00	4.0E+00

NA – Not Applicable. Exposure route not evaluated for this receptor.

TABLE E.7-7

INCREMENTAL LIFETIME CANCER RISK SUMMARY
FUTURE LAND USE (AGRICULTURAL USE)
FUTURE SOURCE TERM

Media	On-property RME Farmer[b]	On-property RME Farmer[b] (User of Perched GW)	On-property CT Farmer	On-property Young Child	Off-property Farmer	Off-property Young Child	Homebuilder	Off-property User of Meat and Milk Products
Air								
Radiocarcinogenic Risk	5E-03	5E-03	4E-04	9E-05	2E-04	4E-06	1E-04	1E-05
Chemical Carcinogenic Risk	5E-03	5E-03	3E-04	1E-03	3E-04	7E-05	4E-05	8E-04
Total[a]:	1E-02	1E-02	7E-04	1E-03	5E-04	8E-05	2E-04	8E-04
Exposed Waste Pit Materials								
Radiocarcinogenic Risk	2E-02	2E-02	2E-03	2E-03	NA	NA	7E-05	NA
Chemical Carcinogenic Risk	9E-03	9E-03	6E-04	4E-03	NA	NA	2E-04	NA
Total[a]:	3E-02	3E-02	3E-03	6E-03	NA	NA	2E-04	NA
Surface Soil								
Radiocarcinogenic Risk	7E-04	7E-04	4E-05	1E-04	NA	NA	NA	5E-04
Chemical Carcinogenic Risk	1E-03	1E-03	6E-05	5E-04	NA	NA	NA	9E-04
Total[a]:	2E-03	2E-03	1E-04	6E-04	NA	NA	NA	1E-03
Buried Pit Material								
Radiocarcinogenic Risk	1E-03	1E-03	2E-04	2E-07	NA	NA	7E-09	NA
Chemical Carcinogenic Risk	NA	NA	NA	NA	NA	NA	NA	NA
Total[a]:	1E-03	1E-03	2E-04	2E-07	NA	NA	7E-09	NA
On-property Surface Water								
Radiocarcinogenic Risk	3E-04	3E-04	1E-05	4E-05	NA	NA	NA	3E-04
Chemical Carcinogenic Risk	6E-06	6E-06	4E-07	1E-06	NA	NA	NA	6E-06
Total[a]:	3E-04	3E-04	1E-05	4E-05	NA	NA	NA	3E-04
Groundwater								
Radiocarcinogenic Risk	2E-02	5E-01 b	2E-03	1E-03	2E-03	9E-05	NA	NA
Chemical Carcinogenic Risk	4E-02	9E-01 b	3E-03	9E-03	0E+00	0E+00	NA	NA
Total[a]:	6E-02	1E+00 b	4E-03	1E-02	2E-03	9E-05	NA	NA
All Media								
Radiocarcinogenic Risk	5E-02	5E-01 b	4E-03	3E-03	2E-03	1E-04	2E-04	8E-04
Chemical Carcinogenic Risk	5E-02	9E-01 b	4E-03	1E-02	3E-04	7E-05	2E-04	2E-03
Total[a]:	1E-01	1E+00 b	8E-03	2E-02	2E-03	2E-04	4E-04	2E-03

NA – Not applicable. Exposure route not evaluated for receptor.

[a] Radiocarcinogenic and chemocarcinogenic risks are not truly additive. A total is provided for reference only.

[b] Risks calculated and total summed based on the use of the 1-hit equation for calculating risks from higher doses (EPA 1989a), therefore, total risks will not exceed 1.0.

5511

TABLE E.7-8

HAZARD INDEX SUMMARY
FUTURE LAND USE (AGRICULTURAL USE)
FUTURE SOURCE TERM

Media	On-property RME Farmer	On-property RME Farmer (User of Perched GW)	On-property CT Farmer	On-property Young Child	Off-property Farmer	Off-property Young Child	Homebuilder	Off-property User of Meat and Milk Products
Air	8.4E+00	8.4E+00	4.3E+00	2.8E+01	5.2E-01	1.7E+00	6.4E+00	1.9E+00
Exposed Waste Pit Materials	2.3E+01	2.3E+01	9.9E+00	9.8E+01	NA	NA	5.4E+01	NA
Surface Soil	5.3E+00	5.3E+00	2.6E+00	2.7E+01	NA	NA	NA	2.7E+00
On-property Surface Water	3.3E-01	3.3E-01	1.5E-01	2.7E+00	NA	NA	NA	3.3E-01
Groundwater	5.0E+02	6.0E+03	2.7E+02	1.4E+03	3.1E+01	8.8E+01	NA	NA
All Media	5.4E+02	6.1E+03	2.9E+02	1.6E+03	3.2E+01	9.0E+01	6.0E+01	4.9E+00

NA - Not applicable. Exposure route not evaluated for receptor.

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TABLE E.7-9

INCREMENTAL LIFETIME CANCER RISKS FOR SOIL PATHWAYS
RME RESIDENT FARMER
NATURAL BACKGROUND CONCENTRATIONS

Radionuclide	0"-6" UCL Background Soil Concentration[a] (pCi/g)	Background Risk	Cancer Risks Operable Unit 1
Cs-137 + 1 dtr	4.4×10^{-1}	4×10^{-5}	4×10^{-4}
Ra-226 + 8 dtrs	1.2×10^{0}	3×10^{-4}	1×10^{-2}
Th-230	1.5×10^{0}	1×10^{-7}	1×10^{-4}
Th-232 + 10 dtrs	1.1×10^{0}	4×10^{-4}	2×10^{-2}
U-234	1.0×10^{0}	3×10^{-7}	3×10^{-5}
U-235 + 1 dtr	8.8×10^{-2}	9×10^{-7}	4×10^{-4}
U-238 + 2 dtrs	1.1×10^{0}	2×10^{-6}	1×10^{-3}
K-40[d]	1.7×10^{1}	1×10^{-3}[d]	NA
Total Risk	--	**7×10^{-4}**[d]	**4×10^{-2}**

Chemical	0"-6" UCL Background Soil Concentration[b] (mg/kg)	Background Risk	Cancer Risks Operable Unit 1
Arsenic	6.0×10^{0}	2×10^{-4}	1×10^{-2}
Beryllium[c]	6.0×10^{-1}	2×10^{-4}	1×10^{-3}
Total Risk	--	**4×10^{-4}**	**1×10^{-2}**

[a]Radionuclide UCL background concentrations in soil (0"-6") are obtained from Attachment E.I,
Table E.I-5.
[b]Chemical UCL background concentrations in soil (0"-6") are obtained from Attachment E.I,
Table E.I-4.
[c]UCL was not calculated; frequency of detection was 1/30.
[d]The background risk for K-40 was not included in total background risk because K-40 was not
selected as a CPC for this operable unit. Including it in the total risk from background could bias decisions if the total background risk were compared directly with the total site-related risks calculated in this report. It is included here because it is a ubiquitous component of background.

000297

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TABLE E.7-10

TOXIC EFFECTS FOR SOIL PATHWAYS
RME RESIDENT FARMER
NATURAL BACKGROUND CONCENTRATIONS

Chemical	0"-6" UCL Background Soil Concentration[a] (mg/kg)	Background Hazard Quotient	Hazard Quotients Operable Unit 1
Arsenic	6.0×10^{0}	0.4	26
Beryllium[b]	6.0×10^{-1}	0.009	0.05
Barium	7.9×10^{0}	0.04	0.1
Boron	1.2×10^{1}	0.5	0.004
Cadmium	4.0×10^{-1}	0.1	1.5
Chromium	1.2×10^{1}	0.008	0.06
Cobalt	1.1×10^{1}	0.008	0.009
Manganese	9.8×10^{2}	0.9	0.8
Mercury[b]	3.0×10^{-1}	6	0.04
Molybdenum	ND[c]	--	0.2
Nickel	1.3×10^{1}	0.08	0.1
Silver	ND	--	3
Thallium[b]	5.8×10^{-1}	0.3	0.2
Uranium[d]	2.3×10^{0}	0.02	5
Vanadium	2.2×10^{1}	0.03	0.6
Total Hazard Index	--	**8**	**38**

[a]Chemical UCL background concentrations in soil (0"-6") are obtained from Attachment E.I,
Table E.I-4.
[b]UCL was not calculated; frequency of detection was 1/30 and maximum is presented.
[c]ND - Not detected.
[d]Total uranium arithmetic mean background concentration in soil is obtained from Table 4-9 of the
CERCLA/RCRA Background Soil Study (March 19, 1993).

000298

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Appendix E-I

Tables

TABLE E.I–4

SUMMARY STATISTICS FOR BACKGROUND CONCENTRATIONS OF INORGANIC CHEMICALS IN SOIL

PARAMETER	Dataset	Unit	Hits	Min. Hit	Max. Hit	Min. SQL	Max. SQL	Distribution	Concentration Term	95th P
ALUMINUM	0" – 6"	mg/kg	30 / 30	5350	15000			LogNormal	8,812.15	11,880.19
	36" – 54"	mg/kg	51 / 51	3250	16100			LogNormal	9737.08	16063.97
ANTIMONY	0" – 6"	mg/kg	0 / 30			7.1	8.8	Undefined		
	36" – 54"	mg/kg	0 / 37			3.5	7.4	Undefined		
ARSENIC	0" – 6"	mg/kg	26 / 30	3.4	9.2	2.9	5.6	Normal	5.56	8.20
	36" – 54"	mg/kg	44 / 51	1.6	14.5	3.5	8.7	LogNormal	5.65	9.57
BARIUM	0" – 6"	mg/kg	29 / 29	31	94.1			LogNormal	67.70	94.10
	36" – 54"	mg/kg	51 / 51	13.7	134			LogNormal	67.17	119.17
BERYLLIUM	0" – 6"	mg/kg	1 / 30	0.6	0.6	0.47	0.59	Undefined	0.60	0.60
	36" – 54"	mg/kg	15 / 50	0.48	0.68	0.23	0.48	Undefined	0.48	0.62
BORON	0" – 6"	mg/kg	11 / 29	12.6	25.4	12.2	14.7	Undefined	12.60	25.10
	36" – 54"	mg/kg	49 / 51	18.6	47.1	12.1	12.1	Normal	31.27	42.95
CADMIUM	0" – 6"	mg/kg	6 / 30	0.52	0.95	0.47	0.72	Undefined	0.52	0.87
	36" – 54"	mg/kg	6 / 51	0.47	1.3	0.23	0.61	Undefined	0.47	0.91
CALCIUM	0" – 6"	mg/kg	30 / 30	856	5340			LogNormal	2,581.16	4,339.17
	36" – 54"	mg/kg	51 / 51	3310	335000			Undefined	108000.00	150000.00
CHROMIUM	0" – 6"	mg/kg	30 / 30	6.7	17.7			LogNormal	11.62	15.50
	36" – 54"	mg/kg	51 / 51	4.5	22.4			LogNormal	12.63	20.68
COBALT	0" – 6"	mg/kg	30 / 30	4.3	16.5			Normal	10.78	14.16
	36" – 54"	mg/kg	51 / 51	3.6	17.9			LogNormal	10.04	15.75
COPPER	0" – 6"	mg/kg	27 / 30	3.2	17.3	2.4	2.9	Normal	8.60	14.07
	36" – 54"	mg/kg	50 / 51	6.8	24.3	8.2	8.2	LogNormal	13.41	20.03
CYANIDE	0" – 6"	mg/kg	12 / 30	0.14	0.29	0.12	0.15	Undefined	0.15	0.27
	36" – 54"	mg/kg	2 / 50	0.13	0.17	0.1	0.12	Undefined	0.13	0.13
IRON	0" – 6"	mg/kg	30 / 30	9370	24900			Normal	16,244.47	21,728.17
	36" – 54"	mg/kg	51 / 51	8970	30700			LogNormal	20138.49	30700.00
LEAD	0" – 6"	mg/kg	28 / 30	11	36.4	15.6	21.2	LogNormal	18.90	26.40
	36" – 54"	mg/kg	47 / 51	3	18.4	5.7	11.7	LogNormal	9.52	15.58

TABLE E.I–4
(Continue)

PARAMETER	Dataset	Unit	Hits	Min. Hit	Max. Hit	Min. SQL	Max. SQL	Distribution	Concentration Term	95th P
MAGNESIUM	0" – 6"	mg/kg	30 / 30	1020	3590			LogNormal	1,926.10	2,776.97
	36" – 54"	mg/kg	51 / 51	2930	54100			Normal	24206.82	42648.21
MANGANESE	0" – 6"	mg/kg	29 / 29	189	1500			LogNormal	814.16	1,348.04
	36" – 54"	mg/kg	51 / 51	251	1750			Undefined	534.00	1300.00
MERCURY	0" – 6"	mg/kg	2 / 30	0.12	0.3	0.12	0.14	Undefined	0.12	0.12
	36" – 54"	mg/kg	1 / 51	0.29	0.29	0.1	0.22	Undefined	0.29	0.29
MOLYBDENUM	0" – 6"	mg/kg	0 / 30			2.4	2.9	Undefined		
	36" – 54"	mg/kg	1 / 51	2.7	2.7	1.2	2.5	Undefined	2.70	2.70
NICKEL	0" – 6"	mg/kg	29 / 30	5.8	22.7	4.9	4.9	LogNormal	12.72	20.87
	36" – 54"	mg/kg	51 / 51	8.5	41.9			LogNormal	21.90	34.35
POTASSIUM	0" – 6"	mg/kg	29 / 30	374	1590	260	260	Normal	834.25	1,231.34
	36" – 54"	mg/kg	51 / 51	340	2180			LogNormal	1178.62	1979.99
SELENIUM	0" – 6"	mg/kg	1 / 30	0.72	0.72	0.36	0.88	Undefined	0.72	0.72
	36" – 54"	mg/kg	0 / 51			0.25	0.73	Undefined		
SILICON	0" – 6"	mg/kg	29 / 29	480	2230			LogNormal	1,276.44	1,797.03
	36" – 54"	mg/kg	51 / 51	449	1850			LogNormal	1060.12	1593.08
SILVER	0" – 6"	mg/kg	0 / 30			2.4	2.9	Undefined		
	36" – 54"	mg/kg	0 / 51			1.2	2.5	Undefined		
SODIUM	0" – 6"	mg/kg	27 / 30	26.9	54.7	24.9	26.8	Normal	37.50	51.10
	36" – 54"	mg/kg	51 / 51	53.8	345			Undefined	131.00	285.00
THALLIUM	0" – 6"	mg/kg	1 / 30	0.58	0.58	0.36	0.59	Undefined	0.58	0.58
	36" – 54"	mg/kg	3 / 51	0.49	0.55	0.17	0.49	Undefined	0.49	0.49
VANADIUM	0" – 6"	mg/kg	30 / 30	11.3	32.7			LogNormal	22.28	30.37
	36" – 54"	mg/kg	51 / 51	8.4	44.5			Undefined	18.50	37.80
ZINC	0" – 6"	mg/kg	30 / 30	29.4	70			LogNormal	44.60	59.61
	36" – 54"	mg/kg	51 / 51	27.3	101			LogNormal	52.29	72.58

TABLE E.I-5

SUMMARY STATISTICS FOR BACKGROUND CONCENTRATIONS OF RADIONUCLIDES IN SOIL

Parameter	Dataset	Units	Hits	Min. Hit	Max. Hit	Min. SQL	Max. SQL	Distribution	Concentration	95th P
ACTINIUM-227	0" - 6"	pCi/g	1 / 30	0.09	0.09	0.04	0.06	Undefined	0.09	0.09
	36" - 54"	pCi/g	3 / 51	0.06	0.1	0.03	0.07	Undefined	0.06	0.06
CESIUM-137	0" - 6"	pCi/g	30 / 30	0.15	0.71			LogNormal	0.44	0.71
	36" - 54"	pCi/g	0 / 51			0.01	0.01	Undefined		
LEAD-210	0" - 6"	pCi/g	30 / 30	0.53	1.3			LogNormal	1.00	1.30
	36" - 54"	pCi/g	43 / 51	0.31	0.97	0.3	0.3	Undefined	0.57	0.81
POTASSIUM-40	0" - 6"	pCi/g	30 / 30	13.1	21.4			LogNormal	16.89	19.71
	36" - 54"	pCi/g	51 / 51	8.6	31			LogNormal	18.71	27.76
PROTACTINIUM-231	0" - 6"	pCi/g	0 / 30			0.26	0.4	Undefined		
	36" - 54"	pCi/g	0 / 51			0.16	0.45	Undefined		
RADIUM-224	0" - 6"	pCi/g	30 / 30	0.54	0.93			Undefined	0.86	0.90
	36" - 54"	pCi/g	51 / 51	0.29	1.07			LogNormal	0.66	1.01
RADIUM-226	0" - 6"	pCi/g	30 / 30	0.85	1.48			Normal	1.22	1.42
	36" - 54"	pCi/g	51 / 51	0.59	1.61			Undefined	0.88	1.47
RADIUM-228	0" - 6"	pCi/g	30 / 30	0.8	1.27			Normal	1.10	1.25
	36" - 54"	pCi/g	51 / 51	0.36	1.37			LogNormal	0.85	1.31
RUTHENIUM-106	0" - 6"	pCi/g	0 / 30			0.07	0.09	Undefined		
	36" - 54"	pCi/g	0 / 51			0.04	0.11	Undefined		
STRONTIUM-90	0" - 6"	pCi/g	0 / 30			0.5	0.5	Undefined		
	36" - 54"	pCi/g	1 / 51	0.56	0.56	0.5	0.5	Undefined	0.56	0.56
TECHNETIUM-99	0" - 6"	pCi/g	0 / 30			0.9	0.9	Undefined		
	36" - 54"	pCi/g	0 / 51			0.9	0.9	Undefined		
THORIUM-228	0" - 6"	pCi/g	29 / 30	0.68	1.43	0.6	0.6	Normal	1.12	1.43
	36" - 54"	pCi/g	41 / 51	0.6	1.39	0.6	1	Normal	0.88	1.33

TABLE E.I-5
(Continue)

Parameter	Dataset	Units	Hits	Min. Hit	Max. Hit	Min. SQL	Max. SQL	Distribution	Concentration	95th P
THORIUM-230	0" - 6"	pCi/g	29 / 30	0.9	2.01	0.6	0.6	Normal	1.50	1.97
	36" - 54"	pCi/g	45 / 51	0.62	2.34	0.6	1	Normal	1.24	1.88
THORIUM-232	0" - 6"	pCi/g	30 / 30	0.64	1.52			LogNormal	1.08	1.36
	36" - 54"	pCi/g	36 / 51	0.63	1.35	0.6	1	Undefined	0.85	1.26
THORIUM-TOTAL	0" - 6"	ug/g	2 / 2	8.31	10.7			Undefined	10.70	10.70
	36" - 54"	ug/g	3 / 3	8.24	9.47			Undefined	9.47	9.47
URANIUM-234	0" - 6"	pCi/g	30 / 30	0.67	1.31			LogNormal	1.04	1.24
	36" - 54"	pCi/g	47 / 51	0.48	1.3	0.6	0.6	Undefined	0.73	1.04
URANIUM-235/236	0" - 6"	pCi/g	27 / 30	0.03	0.2	0.05	0.07	LogNormal	0.09	0.15
	36" - 54"	pCi/g	46 / 51	0.03	0.2	0.02	0.11	Undefined	0.06	0.15
URANIUM-238	0" - 6"	pCi/g	30 / 30	0.85	1.33			LogNormal	1.08	1.22
	36" - 54"	pCi/g	48 / 51	0.6	1.23	0.6	0.6	Normal	0.84	1.12

Appendix E-II

Tables

ATTACHMENT E.II
LEGEND

A Based on the t-test, WRS test or in conjunction with the 95th percentile confidence limit (CL) on the arithmetic mean, the constituent concentration is not statistically higher than 95th percentile background concentrations.

B Essential macronutrients for which there are no known toxic effects at the concentrations defined.

C Essential micronutrients for which there are no toxic effects at the concentrations found.

D Ubiquitous elements in soil, not toxic except at high levels

~~E Detected infrequently (less than 5%) at less than 5 times the method detection limit.~~

~~F Naturally occurring soil elements soil found in surface water at concentrations consistent with soil levels and that are non toxic at concentrations found~~

E Nonspecific chemical classes that are either too general to be useful for risk assessment or for which chemical-specific results are presented in the same analysisNot a specific chemical that is evaluated in a human health risk assessment.

~~H Probable organic decomposition product occurring at less than 1 part per million.~~

~~I Volatile organic compound with a vapor pressure less than 10mmHg at 20°C~~

F Chemicals that present a HQ less than 0.1 or ILCR lower than 10^{-7} when evaluated against screening criteria calculated from EPA RAGS Part B (EPA 1991f).

G No dose response data available. Retained as CPC but not quantitatively assessed.

TABLE E.II-1
SUMMARY OF PIT 1 ANALYTICAL RESULTS

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Aluminum	mg/Kg	5 / 5	20200.0	U	NA	6 / 6	4690.0	U	NA	20200.0	16064.0	No	D
Antimony	mg/Kg	1 / 5	0.4	U	NA	6 / 6	125.0	U	NA	125.0	NA	Yes	
Arsenic	mg/Kg	5 / 5	15.0	U	NA	5 / 6	1.7	U	NA	15.0	9.6	Yes	
Barium	mg/Kg	5 / 5	365.0	U	NA	6 / 6	439.0	U	NA	439.0	119.2	No	F
Beryllium	mg/Kg	4 / 5	2.2	U	NA	6 / 6	12.5	U	NA	12.5	0.6	Yes	
Boron	mg/Kg					4 / 5	1650.0	U	NA	1650.0	43.0	No	F
Cadmium	mg/Kg	4 / 5	5.0	U	NA	6 / 6	18.5	U	NA	18.5	0.9	Yes	
Calcium	mg/Kg	1 / 5	4760.0	U	NA	6 / 6	197000.0	U	NA	197000.0	150000.0	No	B
Chromium	mg/Kg	5 / 5	46.0	U	NA	6 / 6	347.0	U	NA	347.0	20.7	Yes	
Cobalt	mg/Kg	3 / 5	28.0	U	NA	6 / 6	46.8	U	NA	46.8	15.8	No	F
Copper	mg/Kg	1 / 5	20.0	U	NA	6 / 6	113.0	U	NA	113.0	20.0	No	F
Iron	mg/Kg	5 / 5	19700.0	U	NA	6 / 6	2610.0	U	NA	19700.0	30700.0	No	A
Lead	mg/Kg	1 / 5	17.0	U	NA	5 / 5	53.4	U	NA	53.4	15.6	Yes	G
Magnesium	mg/Kg	1 / 5	7610.0	U	NA	6 / 6	129000.0	U	NA	129000.0	42648.2	No	F
Manganese	mg/Kg	5 / 5	2910.0	U	NA	6 / 6	3720.0	U	NA	3720.0	1300.0	No	F
Mercury	mg/Kg	1 / 5	0.3	U	NA		NA			0.3	0.3	No	F
Molybdenum	mg/Kg					6 / 6	32.7	U	NA	32.7	2.7	No	F
Nickel	mg/Kg	5 / 5	65.0	U	NA	6 / 6	57.4	U	NA	65.0	34.4	No	F
Potassium	mg/Kg	5 / 5	2560.0	U	NA	6 / 6	1210.0	U	NA	2560.0	1980.0	No	B
Silicon	mg/Kg					5 / 5	7190.0	U	NA	7190.0	1593.1	No	D
Silver	mg/Kg	4 / 5	33.0	U	NA	6 / 6	189.0	U	NA	189.0	NA	Yes	
Sodium	mg/Kg	4 / 5	3640.0	U	NA	5 / 6	1930.0	U	NA	3640.0	285.0	No	B
Thallium	mg/Kg	1 / 5	0.3	U	NA	1 / 6	0.5	U	NA	0.5	0.5	No	A
Vanadium	mg/Kg	5 / 5	67.0	U	NA	6 / 6	142.0	U	NA	142.0	37.8	No	F
Zinc	mg/Kg	3 / 5	58.0	U	NA	6 / 6	24.9	U	NA	58.0	72.6	No	A
4,4-DDT	ug/Kg	1 / 6	1600.0	U	NA		NA			1600.0		Yes	
Aroclor-1221	ug/Kg		NA			1 / 6	4600.0	U	NA	4600.0		Yes	
Aroclor 1248	ug/Kg	1 / 6	3500.0	U	NA	5 / 6	10000.0	U	NA	10000.0		Yes	
Aroclor 1254	ug/Kg	6 / 6	11500.0	U	NA	5 / 5	13000.0	U	NA	13000.0		Yes	
Aroclor 1260	ug/Kg	2 / 6	7800.0	U	NA		NA			7800.0		Yes	

TABLE E.II-1
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Cesium-137	pCi/g	1 / 5	1.1	U	NA	1 / 6	0.3	U	NA	1.1	NA	Yes	
Plutonium-238	pCi/g					1 / 5	1.0	U	NA	1.0		Yes	
Plutonium-239/240	pCi/g					1 / 6	1.0	U	NA	1.0		Yes	
Radium-226	pCi/g					5 / 6	99.6	U	NA	99.6	1.5	Yes	
Radium-228	pCi/g					5 / 6	41.0	U	NA	41.0	1.3	Yes	
Ruthenium-106						1 / 6	2.4	U	NA	2.4	NA	Yes	
Strontium-90						5 / 6	7.7	U	NA	7.7	0.6	Yes	
Technetium-99	pCi/g	1 / 5	15.0	U	NA	1 / 6	1.1	U	NA	15.0	NA	Yes	
Thorium-228	pCi/g	5 / 5	52.0	U	NA	2 / 4	790.0	U	NA	790.0	1.3	Yes	
Thorium-230	pCi/g	5 / 5	3600.0	U	NA	4 / 4	5460.0	U	NA	5460.0	1.9	Yes	
Thorium-232	pCi/g	5 / 5	55.0	U	NA	2 / 4	490.0	U	NA	490.0	1.3	Yes	
Thorium-Total	mg/Kg					2 / 4	4400.0	U	NA	4400.0	9.5	Yes	G
Uranium-234	pCi/g	5 / 5	1180.0	U	NA	4 / 4	830.0	U	NA	1180.0	1.0	Yes	
Uranium-235/236	pCi/g	5.0 / 5	151.0	U	NA	5 / 5	259.0	U	NA	259.0	0.2	Yes	
Uranium-238	pCi/g	5 / 5	6980.0	U	NA	5 / 5	16160.0	U	NA	16160.0	1.1	Yes	
Uranium-Total	mg/Kg					6 / 6	48480.0	U	NA	48480.0		Yes	
2-Methylnaphthalene	ug/Kg	2 / 6	240.0	U	NA		NA			240.0		Yes	G
3,3-Dichlorobenzidine	ug/Kg	1 / 6	130.0	U	NA		NA			130.0		No	F
Anthracene	ug/Kg	1 / 6	74.0	U	NA		NA			74.0		No	F
Benzo(A)Anthracene	ug/Kg	2 / 6	100.0	U	NA		NA			100.0		Yes	
Benzo(A)Pyrene	ug/Kg	1 / 6	140.0	U	NA		NA			140.0		Yes	
Benzo(B)Fluoranthene	ug/Kg	5 / 6	330.0	U	NA		NA			330.0		Yes	
Benzo(K)Fluoranthene	ug/Kg	1 / 6	140.0	U	NA		NA			140.0		Yes	
Bis(2-Ethylhexyl)Phthalate	ug/Kg	2 / 6	1800.0	U	NA		NA			1800.0		No	F
Chrysene	ug/Kg	5 / 6	540.0	U	NA		NA			540.0		Yes	
Di-N-Octylphthalate	ug/Kg	4 / 6	830.0	U	NA		NA			830.0		No	F
Fluoranthene	ug/Kg	6 / 6	430.0	U	NA		NA			430.0		No	F
Naphthalene	ug/Kg	2 / 6	67.0	U	NA		NA			67.0		No	F
Phenanthrene	ug/Kg	6 / 6	2400.0	U	NA		NA			2400.0		Yes	G
Pyrene	ug/Kg	6 / 6	360.0	U	NA		NA			360.0		No	F
1,1,1-Trichloroethane	ug/Kg	1 / 4	120.0	U	NA		NA			120.0		No	F
2-Butanone	ug/Kg	4 / 4	3800.0	U	NA		NA			3800.0		No	F
Acetone	ug/Kg	1 / 4	320.0	U	NA		NA			320.0		No	F

TABLE E.II-1
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Chloroform	ug/Kg	2 / 4	210.0	U	NA		NA			210.0		No	F
Ethylbenzene	ug/Kg	2 / 4	55.0	U	NA		NA			55.0		No	F
Methylene Chloride	ug/Kg	2 / 4	180.0	U	NA		NA			180.0		No	F
Toluene	ug/Kg	2 / 4	96.0	U	NA		NA			96.0		No	F
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg					5 / 6	1.2	U	NA	1.2		Yes	
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg					5 / 6	1.2	U	NA	1.2		Yes	
1,2,3,4,7,8-HxCDF[4]	ug/Kg					3 / 6	0.8	U	NA	0.8		Yes	
1,2,3,6,7,8-HxCDD[4]	ug/Kg					4 / 6	0.8	U	NA	0.8		Yes	
1,2,3,6,7,8-HxCDF[4]	ug/Kg					3 / 6	0.3	U	NA	0.3		Yes	
1,2,3,7,8,9-HxCDD[4]	ug/Kg					3 / 6	0.5	U	NA	0.5		Yes	
1,2,3,7,8-PeCDF[4]	ug/Kg					5 / 6	1.2	U	NA	1.2		Yes	
2,3,4,6,7,8-HxCDF[4]	ug/Kg					3 / 6	0.4	U	NA	0.4		Yes	
2,3,4,7,8-PeCDF[4]	ug/Kg					4 / 6	1.2	U	NA	1.2		Yes	
2,3,7,8-TCDF[4]	ug/Kg					5 / 6	14.0	U	NA	14.0		Yes	
Heptachlorodibenzo-p-dioxin	ug/Kg					5 / 6	2.3	U	NA	2.3		Yes	
Heptachlorodibenzofuran	ug/Kg					5 / 6	2.7	U	NA	2.7		Yes	
Hexachlorodibenzo-p-dioxin	ug/Kg					5 / 6	4.9	U	NA	4.9		Yes	
Hexachlorodibenzofuran	ug/Kg					4 / 6	2.9	U	NA	2.9		Yes	
Octachlorodibenzo-p-dioxin	ug/Kg					5 / 6	0.7	U	NA	0.7		Yes	
Octachlorodibenzofuran	ug/Kg					3 / 6	0.8	U	NA	0.8		Yes	
Pentachlorodibenzofuran	ug/Kg					5 / 6	7.9	U	NA	7.9		Yes	
Tetrachlorodibenzofuran	ug/Kg					6 / 6	35.0	U	NA	35.0		Yes	
Ammonia	ug/Kg					1 / 1	48000.0	U	NA	48000.0		No	E
Cyanide	mg/Kg					3 / 6	730.0	U	NA	730.0		No	F
Phosphorus	ug/Kg					1 / 1	6730.0	U	NA	6730.0		No	B
Total Kjeldahl Nitrogen	ug/Kg					1 / 1	47700.0	U	NA	47700.0		No	E
Total Organic Carbon	ug/Kg					3 / 3	33600000.0	U	NA	33600000.0		No	E
1,4 Dioxane	ug/Kg					2 / 4	57.7	U	NA	57.7		No	F

Notes:
1 - Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 - NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 - The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 - TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCCD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenz-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran
5 - The 95th percentile background concentrations for subsurface soils are compared with maximum values.

TABLE E.II–2
SUMMARY OF PIT 2 ANALYTICAL RESULTS

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Aluminum	mg/Kg	5 / 5	22400.0	U	NA	4 / 4	23100.0	U	NA	23100.0	16064.0	No	D
Antimony	mg/Kg	2 / 5	1.2	U	NA	4 / 4	55.4	U	NA	55.4	NA	Yes	
Arsenic	mg/Kg	5 / 5	10.0	U	NA	4 / 4	423.0	U	NA	423.0	9.6	Yes	
Barium	mg/Kg	5 / 5	208.0	U	NA	4 / 4	1920.0	U	NA	1920.0	119.2	Yes	
Beryllium	mg/Kg	5 / 5	8.9	U	NA	4 / 4	26.9	U	NA	26.9	0.6	Yes	
Boron	mg/Kg					4 / 4	238.0	U	NA	238.0	43.0	No	F
Cadmium	mg/Kg	5 / 5	9.6	U	NA	4 / 4	12.8	U	NA	12.8	0.9	Yes	
Calcium	mg/Kg	5 / 5	80100.0	U	NA	4 / 4	104000.0	U	NA	104000.0	150000.0	No	B
Chromium	mg/Kg	5 / 5	91.0	U	NA	4 / 4	282.0	U	NA	282.0	20.7	Yes	
Cobalt	mg/Kg	5 / 5	451.0	U	NA	4 / 4	1470.0	U	NA	1470.0	15.8	No	F
Copper	mg/Kg	5 / 5	329.0	U	NA	4 / 4	1340.0	U	NA	1340.0	20.0	Yes	
Iron	mg/Kg	5 / 5	24000.0	U	NA	4 / 4	39200.0	U	NA	39200.0	30700.0	No	B
Lead	mg/Kg	5 / 5	190.0	U	NA	4 / 4	758.0	U	NA	758.0	15.6	Yes	
Magnesium	mg/Kg	5 / 5	26700.0	U	NA	4 / 4	67900.0	U	NA	67900.0	42648.2	No	B
Manganese	mg/Kg	5 / 5	917.0	U	NA	4 / 4	2850.0	U	NA	2850.0	1300.0	No	F
Mercury	mg/Kg	4 / 5	0.7	U	NA	4 / 4	2.6	U	NA	2.6	0.3	No	F
Molybdenum	mg/Kg					4 / 4	215.0	U	NA	215.0	2.7	Yes	
Nickel	mg/Kg	5 / 5	609.0	U	NA	4 / 4	1740.0	U	NA	1740.0	34.4	Yes	
Potassium	mg/Kg	5 / 5	4320.0	U	NA	4 / 4	10800.0	U	NA	10800.0	1980.0	No	B
Selenium	mg/Kg	3 / 5	10.0	U	NA	4 / 4	131.0	U	NA	131.0		No	F
Silicon	mg/Kg					4 / 4	2640.0	U	NA	2640.0	1593.1	No	D
Silver	mg/Kg	3 / 5	23.0	U	NA	4 / 4	42.5	U	NA	42.5	NA	No	F
Sodium	mg/Kg	5 / 5	2300.0	U	NA	4 / 4	8710.0	U	NA	8710.0	285.0	No	B
Thallium	mg/Kg					1 / 4	2.4	U	NA	2.4	0.5	Yes	
Vanadium	mg/Kg	5 / 5	106.0	U	NA	4 / 4	594.0	U	NA	594.0	37.8	Yes	
Zinc	mg/Kg	5 / 5	3250.0	U	NA	4 / 4	488.0	U	NA	3250.0	72.6	No	F
4,4–DDT	ug/Kg	2 / 5	1400.0	U	NA					1400.0		Yes	
Aroclor 1248	ug/Kg	1 / 5	321.0	U	NA	2 / 4	4900.0	U	NA	4900.0		Yes	
Aroclor 1254	ug/Kg	1 / 5	323.0	U	NA					323.0		Yes	
Cesium–137	pCi/g	2 / 5	3.6	U	NA	1 / 4	0.5	U	NA	3.6	NA	Yes	
Plutonium–238	pCi/g	2 / 5	0.1	U	NA					0.1	NA	Yes	
Plutonium–239/240	pCi/g	2 / 5	0.6	U	NA					0.6	NA	Yes	
Radium–226	pCi/g					4 / 4	951.0	U	NA	951.0	1.5	Yes	
Radium–228	pCi/g					4 / 4	437.0	U	NA	437.0	1.3	Yes	
Ruthenium–106	pCi/g					1 / 4	4.0	U	NA	4.0	NA	Yes	
Strontium–90	pCi/g					3 / 4	4.0	U	NA	4.0	0.6	Yes	
Technetium–99	pCi/g	3 / 5	618.0	U	NA	1 / 4	1.6	U	NA	618.0	NA	Yes	
Thorium–228	pCi/g	5 / 5	164.0	U	NA	2 / 2	697.0	U	NA	697.0	1.3	Yes	
Thorium–230	pCi/g	5 / 5	3980.0	U	NA	2 / 2	18400.0	U	NA	18400.0	1.9	Yes	
Thorium–232	pCi/g	5 / 5	88.0	U	NA	2 / 2	340.0	U	NA	340.0	1.3	Yes	
Thorium–Total	mg/kg					2 / 2	2780.0	U	NA	2780.0	9.5	Yes	

TABLE E.II-2
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Uranium-234	pCi/g	5 / 5	18200.0	U	NA	2 / 2	1651.0	U	NA	18200.0	1.0	Yes	
Uranium-235/236	pCi/g	5 / 5	8780.0	U	NA	2 / 2	130.0	U	NA	130.0	0.2	Yes	
Uranium-238	pCi/g	5 / 5	17900.0	U	NA	2 / 2	1861.0	U	NA	17900.0	1.1	Yes	
Uranium-Total	mg/kg					4 / 4	5803.0	U	NA	5803.0		Yes	
2-Chlorophenol	ug/Kg					1 / 7	220.0	U	NA	220.0		No	F
2,4-Dimethylphenol	ug/Kg	1 / 5	150.0	U	NA					150.0		No	F
2-Methylnaphthalene	ug/Kg	2 / 5	7000.0	U	NA	3 / 7	7800.0	U	NA	7800.0		Yes	
4-Chloro-3-Methylphenol	ug/Kg					1 / 7	230.0	U	NA	230.0		Yes	
4-Methylphenol	ug/Kg	1 / 5	350.0	U	NA	1 / 7	190.0	U	NA	350.0		No	F
4-Nitroaniline	ug/Kg	1 / 5	4900.0	U	NA					4900.0		No	F
4-Nitrophenol	ug/Kg					1 / 7	190.0	U	NA	190.0		No	F
Acenaphthene	ug/Kg	3 / 5	43000.0	U	NA	3 / 7	31000.0	U	NA	43000.0		No	F
Acenaphthylene	ug/Kg					1 / 7	110.0	U	NA	110.0		Yes	G
Anthracene	ug/Kg	4 / 5	120000.0	U	NA	3 / 7	56000.0	U	NA	120000.0		No	F
Benzo(A)Anthracene	ug/Kg	5 / 5	130000.0	U	NA	3 / 7	100000.0	U	NA	130000.0		Yes	
Benzo(A)Pyrene	ug/Kg	4 / 5	120000.0	U	NA	3 / 7	68000.0	U	NA	120000.0		Yes	
Benzo(B)Fluoranthene	ug/Kg	5 / 5	110000.0	U	NA	3 / 7	130000.0	U	NA	130000.0		Yes	
Benzo(G,H,I)Perylene	ug/Kg	3 / 5	42000.0	U	NA	3 / 7	42000.0	U	NA	42000.0		Yes	G
Benzo(K)Fluoranthene	ug/Kg	4 / 5	75000.0	U	NA	3 / 7	44000.0	U	NA	75000.0		Yes	
Benzoic Acid	ug/Kg					4 / 7	850.0	U	NA	850.0		No	F
Chrysene	ug/Kg	4 / 5	4200.0	U	NA	2 / 7	86000.0	U	NA	86000.0		Yes	
Di-N-Butylphthalate	ug/Kg	1 / 5	96.0	U	NA					96.0		No	F
Di-N-Octylphthalate	ug/Kg	4 / 5	570.0	U	NA	1 / 7	480.0	U	NA	570.0		No	F
Dibenzo(A,H)Anthracene	ug/Kg	2 / 5	16000.0	U	NA	3 / 7	20000.0	U	NA	20000.0		Yes	
Dibenzofuran	ug/Kg	3 / 5	36000.0	U	NA	3 / 7	21000.0	U	NA	36000.0		Yes	
Diethyl Phthalate	ug/Kg					1 / 7	110.0	U	NA	110.0		No	F
Fluoranthene	ug/Kg	5 / 5	490000.0	U	NA	5 / 7	280000.0	U	NA	490000.0		Yes	
Fluorene	ug/Kg	3 / 5	62000.0	U	NA	3 / 7	37000.0	U	NA	62000.0		No	F
Indeno(1,2,3-Cd)Pyrene	ug/Kg	3 / 5	46000.0	U	NA	3 / 7	37000.0	U	NA	46000.0		Yes	
N-Nitrosodiphenylamine	ug/Kg					1 / 7	170.0	U	NA	170.0		No	F
Naphthalene	ug/Kg	3 / 5	16000.0	U	NA	3 / 7	23000.0	U	NA	23000.0		No	F
Pentachlorophenol	ug/Kg					2 / 7	1600.0	U	NA	1600.0		Yes	
Phenanthrene	ug/Kg	5 / 5	370000.0	U	NA	5 / 7	280000.0	U	NA	370000.0		Yes	
Phenol	ug/Kg	1 / 5	330.0	U	NA	2 / 7	230.0	U	NA	330.0		No	F
Pyrene	ug/Kg	5 / 5	250000.0	U	NA	5 / 7	230000.0	U	NA	250000.0		Yes	
Tributyl Phosphate	ug/Kg					4 / 4	39000.0	U	NA	39000.0		Yes	
Bis(2-Ethylhexyl) Phthalate	ug/Kg					1 / 7	980.0	U	NA	980.0		No	F
1,1,1-Trichloroethane	ug/Kg	1 / 4	150.0	U	NA	8 / 10	150.0	N	113.9	150.0		No	F
1,1-Dichloroethane	ug/Kg					7 / 10	23.0	L	12.4	12.4		No	F
1,1-Dichloroethene	ug/Kg					6 / 10	120.0	U	NA	120.0		Yes	

TABLE E.II-2
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
1,2-Dichloroethane	ug/Kg					7 / 10	20.0	L	16.7	16.7		No	F
1,4-Dioxane	ug/Kg					2 / 3	654.0	U	NA	654.0		No	F
2-Butanone	ug/Kg	2 / 2	2700.0	U	NA					2700.0		No	F
Acetone	ug/Kg	2 / 4	540.0	U	NA	2 / 6	71.0	U	NA	540.0		No	F
Benzene	ug/Kg					1 / 10	4.0	U	NA	4.0		Yes	
Chloroform	ug/Kg					7 / 10	84.0	L	67.6	67.6		No	F
Ethylbenzene	ug/Kg	1 / 4	48.0	U	NA	2 / 10	26.0	U	NA	48.0		No	F
Methylene Chloride	ug/Kg	2 / 4	200.0	U	NA	1 / 8	66.0	U	NA	200.0		No	F
Tetrachlorethene	ug/Kg					1 / 10	45.0	U	NA	45.0		No	F
Total Xylenes	ug/Kg	1 / 4	260.0	U	NA	1 / 10	15.0	U	NA	260.0		No	F
Trichloroethene	ug/Kg					1 / 10	7.0	U	NA	7.0		No	F
Vinyl Chloride	ug/Kg	1 / 4	670.0	U	NA	6 / 10	1900.0	U	NA	1900.0		Yes	
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg					2 / 4	3.8	U	NA	3.8		Yes	
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg					1 / 4	1.0	U	NA	1.0		Yes	
1,2,3,4,7,8-HxCDF[4]	ug/Kg					1 / 4	0.3	U	NA	0.3		Yes	
HpCDD[4]	ug/Kg					3 / 4	8.1	U	NA	8.1		Yes	
HpCDF[4]	ug/Kg					3 / 4	5.9	U	NA	5.9		Yes	
HxCDD[4]	ug/Kg					1 / 4	0.3	U	NA	0.3		Yes	
HxCDF[4]	ug/Kg					2 / 4	2.7	U	NA	2.7		Yes	
OCDD[4]	ug/Kg					4 / 4	45.9	U	NA	45.9		Yes	
OCDF[4]	ug/Kg					3 / 4	4.9	U	NA	4.9		Yes	
PeCDF[4]	ug/Kg					1 / 4	0.6	U	NA	0.6		Yes	
Ammonia	ug/Kg					2 / 4	2400.0	U	NA	2400.0		No	E
Chloride	ug/Kg					2 / 2	4898000.0	U	NA	4898000.0		No	D
Cyanide	ug/Kg					4 / 4	2900.0	U	NA	2900.0		No	F
Nitrate	ug/Kg					2 / 2	9054000.0	U	NA	9054000.0		No	C
Oil And Grease	ug/Kg					3 / 3	16000000.0	U	NA	16000000.0		No	E
Phosphate	ug/Kg					2 / 2	1235000.0	U	NA	1235000.0		No	C
Phosphorus	ug/Kg					3 / 3	43703000.0	U	NA	43703000.0		No	B
Sulfate	ug/Kg					2 / 2	739000.0	U	NA	739000.0		No	D
Total Organic Carbon	ug/Kg					2 / 2	113712000.0	U	NA	113712000.0		No	E
Total Organic Nitrogen	ug/Kg					2 / 4	11700000.0	U	NA	11700000.0		No	E

Notes:
1 - Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 - NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 - The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 - TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCCD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenz-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran
5 - The 95th percentile background concentration for subsurface soils are compared with maximum values.

TABLE E.II-3

SUMMARY OF PIT 3 ANALYTICAL RESULTS

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %	CPC?	Justify
Aluminum	mg/Kg	7 / 7	64100.0	L	46238.2	6 / 6	17400.0	U	NA	46238.2	16064.0	No	D
Antimony	mg/Kg	2 / 7	18	U	NA	4 / 6	63.5	U	NA	63.5	0.0	Yes	
Arsenic	mg/Kg	7 / 7	3050	N	1970.1	6 / 6	37200.0	U	NA	37200.0	9.6	Yes	
Barium	mg/Kg	7 / 7	14400	U	NA	6 / 6	3570.0	U	NA	14400.0	119.2	Yes	
Beryllium	mg/Kg	7 / 7	24	L	42.8	6 / 6	10.7	U	NA	24.0	0.6	Yes	
Boron	mg/Kg		0		0.0	4 / 6	236.0	U	NA	236.0	43.0	No	F
Cadmium	mg/Kg	7 / 7	13	L	13.4	6 / 6	38.6	U	NA	38.6	0.9	Yes	
Calcium	mg/Kg	7 / 7	178000	L	153622.1	6 / 6	190000.0	U	NA	190000.0	150000.0	No	B
Chromium	mg/Kg	7 / 7	152	L	271.0	6 / 6	234.0	U	NA	234.0	20.7	yes	
Cobalt	mg/Kg	7 / 7	21	L	23.9	6 / 6	50.7	U	NA	50.7	15.8	No	F
Copper	mg/Kg	4 / 7	2330	U	NA	6 / 6	2010.0	U	NA	2330.0	20.0	Yes	
Iron	mg/Kg	7 / 7	26900	U	NA	6 / 6	25800.0	U	NA	26900.0	30700.0	No	A
Lead	mg/Kg	5 / 7	613	U	NA	6 / 6	837.0	U	NA	837.0	15.6	Yes	G
Magnesium	mg/Kg	7 / 7	51600	L	39326.0	6 / 6	51700.0	U	NA	51700.0	42648.2	No	B
Manganese	mg/Kg	7 / 7	10600	L	18063.6	6 / 6	20200.0	U	NA	20200.0	1300.0	Yes	
Mercury	mg/Kg	5 / 7	4	U	NA	5 / 6	5.1	U	NA	5.1	0.3	No	F
Molybdenum	mg/Kg		0		0.0	6 / 6	284.0	U	NA	284.0	2.7	Yes	
Nickel	mg/Kg	7 / 7	504	L	1120.6	6 / 6	292.0	U	NA	504.0	34.4	Yes	
Potassium	mg/Kg	7 / 7	3180	N	2716.4	6 / 6	3370.0	U	NA	3370.0	1980.0	No	C
Selenium	mg/Kg	5 / 7	90	U	NA	5 / 6	6.0	U	NA	90.0		No	F
Silicon	mg/Kg		0		0.0	6 / 6	5000.0	U	NA	5000.0	1593.1	No	D
Silver	mg/Kg	4 / 7	8.1	U	NA	6 / 6	41.8	U	NA	41.8		No	F
Sodium	mg/Kg	7 / 7	7640	L	7115.1	6 / 6	10100.0	U	NA	10100.0	285.0	No	B
Thallium	mg/Kg	3 / 7	12	U	NA	4 / 6	4.1	U	NA	12.0	0.5	Yes	
Tin	mg/Kg		0		0.0	1 / 5	191.0	U	NA	191.0		No	F
Vanadium	mg/Kg	7 / 7	9700	N	5756.7	6 / 6	2200.0	U	NA	5756.7	37.8	Yes	
Zinc	mg/Kg	3 / 7	311	U	NA	6 / 6	325.0	U	NA	325.0	72.6	No	F
Aroclor-1248	ug/Kg					4 / 6	4800.0	U	NA	4800.0		Yes	
Aroclor-1254	ug/Kg	2 / 7	550.0	U	NA	5 / 6	3400.0	U	NA	3400.0		Yes	
Cesium-137	pCi/g					1 / 6	0.5	U	NA	0.5		Yes	
Neptunium-237	pCi/g	3 / 7	2.1	U	NA					2.1		Yes	
Plutonium-238	pCi/g	3 / 7	1.0	U	NA	1 / 5	1.0	U	NA	1.0		Yes	
Plutonium-239/240	pCi/g	3 / 7	14.0	U	NA	2 / 5	1.6	U	NA	14.0		Yes	
Radium-226	pCi/g					6 / 6	451.0	U	NA	451.0	1.5	Yes	
Radium-228	pCi/g					6 / 6	241.0	U	NA	241.0	1.3	Yes	
Ruthenium-106	pCi/g					2 / 6	4.2	U	NA	4.2	0.0	Yes	
Strontium-90	pCi/g	1 / 7	5.2	U	NA	3 / 6	4.9	U	NA	5.2	0.6	Yes	

TABLE E.II-3
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Max Hit	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %	CPC?	Justify
Technetium-99	pCi/g	6 / 7	1110.0	U	NA	6 / 6	33.0	U	NA	1110.0	0.0	Yes	
Thorium-228	pCi/g	7 / 7	40.0	L	174.5	4 / 5	554.0	U	NA	554.0	1.3	Yes	
Thorium-230	pCi/g	7 / 7	11680.0	N	9115.9	6 / 6	11370.0	U	NA	11370.0	1.9	Yes	
Thorium-232	pCi/g	7 / 7	59.0	U	NA	4 / 5	396.0	U	NA	396.0	1.3	Yes	
Thorium-Total	mg/Kg					4 / 5	3570.0	U	NA	3570.0	9.5	Yes	
Uranium-234	pCi/g	7 / 7	475.0	L	986.8	4 / 4	991.0	U	NA	991.0	1.0	Yes	
Uranium-235/236	pCi/g	7 / 7	21.0	N	17.6	5 / 5	89.2	U	NA	89.2	0.2	Yes	
Uranium-238	pCi/g	7 / 7	1380.0	L	1260.7	6 / 6	1740.0	U	NA	1740.0	1.1	Yes	
Uranium-Total	mg/Kg					6 / 6	5938.0	U	NA	5938.0		Yes	
Acenaphthylene	ug/Kg					1 / 4	96.0	U	NA	96.0		Yes	G
Anthracene	ug/Kg					1 / 7	130.0	U	NA	130.0		No	F
Benzo(A)Anthracene	ug/Kg	1 / 7	60.0	U	NA	1 / 7	360.0	U	NA	360.0		Yes	
Benzo(A)Pyrene	ug/Kg					1 / 7	280.0	U	NA	280.0		Yes	
Benzo(B)Fluoranthene	ug/Kg	1 / 7	110.0	U	NA	1 / 7	560.0	U	NA	560.0		Yes	
Benzo(G,H,I)Perylene	ug/Kg					1 / 7	160.0	U	NA	160.0		Yes	G
Benzoic Acid	ug/Kg					2 / 4	370.0	U	NA	370.0		No	F
Chrysene	ug/Kg	1 / 7	75.0	U	NA	1 / 7	370.0	U	NA	370.0		Yes	
Di-N-Butylphthalate	ug/Kg	3 / 7	84.0	U	NA	2 / 7	310.0	U	NA	310.0		No	F
Diethyl Phthalate	ug/Kg					2 / 4	4300.0	U	NA	4300.0		No	F
Fluoranthene	ug/Kg	1 / 7	230.0	U	NA	2 / 7	720.0	U	NA	720.0		No	F
Indeno(1,2,3-Cd)Pyrene	ug/Kg					1 / 7	130.0	U	NA	130.0		Yes	
Isophorone	ug/Kg					3 / 5	470.0	U	NA	470.0		No	F
N-Nitroso-Di-N-Propylamine	ug/Kg					2 / 4	460.0	U	NA	460.0		Yes	
Pentachlorophenol	ug/Kg	2 / 6	1300.0	U	NA	5 / 5	1000.0	U	NA	1300.0		Yes	
Phenanthrene	ug/Kg	1 / 7	120.0	U	NA	2 / 7	580.0	U	NA	580.0		Yes	G
Pyrene	ug/Kg	1 / 7	190.0	U	NA	2 / 7	620.0	U	NA	620.0		No	F
Bis(2-Ethylhexyl) Phthalate	ug/Kg	6 / 7	1100.0	U	NA	7 / 7	840.0	N	620.6	1100.0		No	F
1,1,1-Trichloroethane	ug/Kg					2 / 10	170.0	U	NA	170.0		No	F
2-Butanone	ug/Kg	1 / 1	3600.0	U	NA	3 / 6	86.0	U	NA	3600.0		No	F
2-Hexanone	ug/Kg					4 / 10	17.0	U	NA	17.0		Yes	G
4-Methyl-2-Pentanone	ug/Kg					4 / 10	17.0	U	NA	17.0		No	F
Acetone	ug/Kg					3 / 6	1200.0	U	NA	1200.0		No	F
Chloroform	ug/Kg					5 / 10	110.0	U	NA	110.0		No	F
Methylene Chloride	ug/Kg	1 / 1	420.0	U	NA	2 / 10	92.0	U	NA	420.0		No	F
Tetrachlorethene	ug/Kg					5 / 10	22.0	U	NA	22.0		No	F
Toluene	ug/Kg					1 / 10	8.0	U	NA	8.0		No	F

TABLE E.II-3
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Max Hit	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	CPC?	Justify
Trichloroethene	ug/Kg					1 / 10	6.0	U	NA	6.0	No	F
Trichlorofluoromethane	ug/Kg					1 / 2	4.1	U	NA	4.1	No	F
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg					5 / 6	1.7	U	NA	1.7	Yes	
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg					3 / 6	0.2	U	NA	0.2	Yes	
1,2,3,6,7,8-HxCDD[4]	ug/Kg					1 / 6	0.0	U	NA	0.0	Yes	
HpCDD[4]	ug/Kg					5 / 6	3.2	U	NA	3.2	Yes	
HpCDF[4]	ug/Kg					5 / 6	1.0	U	NA	1.0	Yes	
HxCDD[4]	ug/Kg					1 / 6	0.3	U	NA	0.3	Yes	
HxCDF[4]	ug/Kg					4 / 6	0.4	U	NA	0.4	Yes	
OCDD[4]	ug/Kg					6 / 6	19.4	U	NA	19.4	Yes	
OCDF[4]	ug/Kg					5 / 6	1.1	U	NA	1.1	Yes	
Tetrachlorodibenzofuran	ug/Kg					1 / 6	0.2	U	NA	0.2	Yes	
Chloride	ug/Kg					4 / 4	23700000.0	U	NA	23700000.0	No	D
Cyanide	ug/Kg					3 / 6	1700.0	U	NA	1700.0	No	F
Fluoride	ug/Kg					2 / 5	2350000.0	U	NA	2350000.0	Yes	
Nitrate	ug/Kg					4 / 4	57400000.0	U	NA	57400000.0	No	C
Oil And Grease	ug/Kg					4 / 4	1510000.0	U	NA	1510000.0	No	E
Phosphorus	ug/Kg					6 / 6	57817000.0	U	NA	57817000.0	No	C
Sulfate	ug/Kg					4 / 4	44345000.0	U	NA	44345000.0	No	D
Sulfide	ug/Kg					1 / 2	8600.0	U	NA	8600.0	No	D
Total Organic Carbon	ug/Kg					2 / 2	176000000.0	U	NA	176000000.0	No	E
Total Organic Nitrogen	ug/Kg					6 / 6	8914000.0	U	NA	8914000.0	No	E

Notes:
1 - Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 - NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 - The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 - TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCCD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenz-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran

TABLE E.II–4

SUMMARY OF PIT 4 ANALYTICAL RESULTS

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Aluminum	mg/Kg	4 / 4	10300.0	U	NA	5 / 5	10700.0	U	NA	10700.0	16064.0	No	A
Antimony	mg/Kg	1 / 4	0.5	U	NA	4 / 5	317.0	U	NA	317.0	NA	Yes	
Arsenic	mg/Kg	2 / 4	4.6	U	NA	5 / 5	6.5	U	NA	6.5	9.6	No	A
Barium	mg/Kg	4 / 4	6670.0	U	NA	5 / 5	3720.0	U	NA	6670.0	119.2	No	F
Beryllium	mg/Kg	4 / 4	13.0	U	NA	3 / 5	50.6	U	NA	50.6	0.6	Yes	
Boron	mg/Kg					5 / 5	1010.0	U	NA	1010.0	43.0	No	F
Cadmium	mg/Kg	3 / 4	29.0	U	NA	5 / 5	34.8	U	NA	34.8	0.9	Yes	
Calcium	mg/Kg	4 / 4	61200.0	U	NA	5 / 5	32700.0	U	NA	61200.0	150000.0	No	A
Chromium	mg/Kg	4 / 4	94.0	U	NA	5 / 5	1500.0	U	NA	1500.0	20.7	Yes	
Cobalt	mg/Kg	3 / 4	84.0	U	NA	4 / 5	183.0	U	NA	183.0	15.8	No	F
Copper	mg/Kg	4 / 4	188.0	U	NA	5 / 5	482.0	U	NA	482.0	20.0	No	F
Iron	mg/Kg	4 / 4	16100.0	U	NA	5 / 5	7420.0	U	NA	16100.0	30700.0	No	A
Lead	mg/Kg	4 / 4	63.0	U	NA	5 / 5	63.2	U	NA	63.2	15.6	Yes	
Magnesium	mg/Kg	4 / 4	24300.0	U	NA	5 / 5	34000.0	U	NA	34000.0	42648.2	No	A
Manganese	mg/Kg	4 / 4	3600.0	U	NA	5 / 5	5620.0	U	NA	5620.0	1300.0	Yes	
Mercury	mg/Kg	3 / 4	0.6	U	NA	3 / 5	0.6	U	NA	0.6	0.3	No	F
Molybdenum	mg/Kg					5 / 5	95.6	U	NA	95.6	2.7	No	F
Nickel	mg/Kg	4 / 4	50.0	U	NA	5 / 5	223.0	U	NA	223.0	34.4	Yes	
Potassium	mg/Kg	4 / 4	1920.0	U	NA	5 / 5	4210.0	U	NA	4210.0	1980.0	No	A
Silicon	mg/Kg		NA			5 / 5	4080.0	U	NA	4080.0	1593.1	No	D
Silver	mg/Kg	3 / 4	444.0	U	NA	5 / 5	755.0	U	NA	755.0	NA	Yes	
Sodium	mg/Kg	4 / 4	1240.0	U	NA	5 / 5	2280.0	U	NA	2280.0	285.0	No	B
Tin	mg/Kg	3 / 3	87.0	U	NA	4 / 5	133.0	U	NA	133.0		No	D
Vanadium	mg/Kg	4 / 4	235.0	U	NA	5 / 5	558.0	U	NA	558.0	37.8	Yes	
Zinc	mg/Kg	4 / 4	84.0	U	NA	5 / 5	200.0	U	NA	200.0	72.6	No	F
Aroclor 1242	ug/Kg	2 / 5	1034.0	U	NA					1034.0		Yes	
Aroclor 1248	ug/Kg	3 / 5	854.0	U	NA	4 / 6	7500.0	U	NA	7500.0		Yes	
Aroclor 1254	ug/Kg	5 / 5	1008.0	U	NA	3 / 6	6800.0	U	NA	6800.0		Yes	
Neptunium–237	pCi/g	1 / 4	0.4	U	NA					0.4		Yes	
Plutonium–238	pCi/g	2 / 4	0.5	U	NA					0.5	NA	Yes	
Plutonium–239/240	pCi/g	1 / 4	0.4	U	NA					0.4	NA	Yes	
Radium–226	pCi/g					5 / 6	50.1	U	NA	50.1	1.5	Yes	
Radium–228	pCi/g					6 / 6	141.0	U	NA	141.0	1.3	Yes	
Ruthenium–106	pCi/g					1 / 6	1.1	U	NA	1.1	NA	Yes	
Strontium–90	pCi/g					5 / 6	144.0	U	NA	144.0	0.6	Yes	

5511

TABLE E.II-4
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Technetium-99	pCi/g	4 / 4	225.0	U	NA	5 / 6	9.4	U	NA	225.0	NA	Yes	
Thorium-228	pCi/g	4 / 4	395.0	U	NA	4 / 4	2469.0	U	NA	2469.0	1.3	Yes	
Thorium-230	pCi/g	4 / 4	566.0	U	NA	6 / 6	1815.0	U	NA	1815.0	1.9	Yes	
Thorium-232	pCi/g	4 / 4	92.0	U	NA	4 / 4	838.0	U	NA	838.0	1.3	Yes	
Thorium-Total	mg/Kg					4 / 4	7565.0	U	NA	7565.0	9.5	Yes	
Uranium-234	pCi/g	4 / 4	2320.0	U	NA	3 /3	4100.0	U	NA	4100.0	1.0	Yes	
Uranium-235/236	pCi/g	4 / 4	426.0	U	NA	4 / 4	934.0	U	NA	934.0	0.2	Yes	
Uranium-238	pCi/g	4 / 4	15800.0	U	NA	4 / 4	41900.0	U	NA	41900.0	1.1	Yes	
Uranium-Total	mg/Kg					6 / 6	0.1	U	NA	0.1		Yes	
2,4-Dimethylphenol	ug/Kg	1 / 5	240.0	U	NA					240.0		No	F
2,4-Dichlorophenol	ug/Kg					1 / 9	230.0	U	NA	230.0		No	F
2,4-Dinitrophenol	ug/Kg					1 / 9	47.0	U	NA	47.0		No	F
2-Methylnaphthalene	ug/Kg	2 / 5	1100.0	U	NA	2 / 9	480.0	U	NA	1100.0		Yes	G
2-Methylphenol	ug/Kg	1 / 5	96.0	U	NA					96.0		No	F
4-Methylphenol	ug/Kg	1 / 5	360.0	U	NA					360.0		No	F
4-Chloro-3-Methylphenol	ug/Kg					2 / 9	77.0	U	NA	77.0		Yes	G
Acenaphthene	ug/Kg	3 / 5	1900.0	U	NA	2 / 9	1900.0	U	NA	1900.0		No	F
Anthracene	ug/Kg	4 / 5	3300.0	U	NA	2 / 9	2700.0	U	NA	3300.0		No	F
Benzo(A)Anthracene	ug/Kg	5 / 5	4100.0	U	NA	2 / 9	4700.0	U	NA	4700.0		Yes	
Benzo(A)Pyrene	ug/Kg	4 / 5	4800.0	U	NA	2 / 9	2900.0	U	NA	4800.0		Yes	
Benzo(B)Fluoranthene	ug/Kg	4 / 5	5800.0	U	NA	2 / 9	5200.0	U	NA	5800.0		Yes	
Benzo(G,H,I)Perylene	ug/Kg	3 / 5	1300.0	U	NA	1 / 9	990.0	U	NA	1300.0		Yes	G
Benzo(K)Fluoranthene	ug/Kg	4 / 5	3700.0	U	NA					3700.0		Yes	
Benzoic Acid	ug/Kg					6 / 9	580.0	U	NA	580.0		No	F
Bis(2-Ethylhexyl) Phthalate	ug/Kg	3 / 5	270.0	U	NA	6 / 9	2700.0	U	NA	2700.0		No	F
Chrysene	ug/Kg	5 / 5	4500.0	U	NA	2 / 9	3300.0	U	NA	4500.0		Yes	
Di-N-Butyl Phthalate	ug/Kg	4 / 5	490.0	U	NA	2 / 9	150.0	U	NA	490.0		No	F
Di-N-Octyl Phthalate	ug/Kg	2 / 5	190.0	U	NA	6 / 9	1000.0	U	NA	1000.0		No	F
Dibenzo(A,H)Anthracene	ug/Kg	2 / 5	560.0	U	NA					560.0		Yes	
Dibenzofuran	ug/Kg	4 / 5	1700.0	U	NA	2 / 9	1200.0	U	NA	1700.0		Yes	
Diethyl Phthalate	ug/Kg					1 / 9	89.0	U	NA	89.0		No	F
Fluoranthene	ug/Kg	5 / 5	18000.0	U	NA	2 / 9	11000.0	U	NA	18000.0		No	F
Fluorene	ug/Kg	4 / 5	3400.0	U	NA	2 / 9	2000.0	U	NA	3400.0		No	F
Indeno(1,2,3-Cd)Pyrene	ug/Kg	4 / 5	1400.0	U	NA	1 / 9	990.0	U	NA	1400.0		Yes	

TABLE E.II-4
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	CPC?	Justify
Naphthalene	ug/Kg	4 / 5	2700.0	U	NA	2 / 9	740.0	U	NA	2700.0	No	F
Phenanthrene	ug/Kg	5 / 5	16000.0	U	NA	2 / 9	12000.0	U	NA	16000.0	Yes	
Phenol	ug/Kg	1 / 5	310.0	U	NA					310.0	No	F
Pyrene	ug/Kg	5 / 5	6600.0	U	NA	2 / 9	9000.0	U	NA	9000.0	No	F
Tributyl Phosphate	ug/Kg					2 / 2	72000.0	U	NA	72000.0	Yes	G
1,1,1-Trichloroethane	ug/Kg	1 / 4	120.0	U	NA	6 / 9	140.0	U	NA	140.0	No	F
1,1-Dichloroethane	ug/Kg					6 / 9	330.0	U	NA	330.0	No	F
1,1-Dichloroethene	ug/Kg					3 / 9	11.0	U	NA	11.0	No	F
1,2-Dichloroethane	ug/Kg					1 / 9	3.0	U	NA	3.0	No	F
1,2-Dichloroethylene	ug/Kg					3 / 9	110.0	U	NA	110.0	No	F
2-Butanone	ug/Kg	1 / 1	100.0	U	NA	2 / 7	59.0	U	NA	100.0	No	F
2-Hexanone	ug/Kg					4 / 9	29.0	U	NA	29.0	Yes	G
3-Chloropropene	ug/Kg					1 / 2	3.0	U	NA	3.0	Yes	G
4-Methyl-2-Pentanone	ug/Kg					5 / 9	83.0	U	NA	83.0	No	F
Acetone	ug/Kg	1 / 4	350.0	U	NA	1 / 6	17.0	U	NA	350.0	No	F
Benzene	ug/Kg					1 / 9	14.0	U	NA	14.0	Yes	
Carbon Tetrachloride	ug/Kg					1 / 9	2.0	U	NA	2.0	No	F
Carbon Disulfide	ug/Kg					1 / 9	3.0	U	NA	3.0	No	F
Chloroethane	ug/Kg					1 / 9	35.0	U	NA	35.0	No	F
Chloroform	ug/Kg	4 / 4	1300.0	U	NA	6 / 9	630.0	U	NA	1300.0	No	F
Ethylbenzene	ug/Kg					3 / 9	28.0	U	NA	28.0	No	F
Isobutyl Alcohol	ug/Kg					1 / 2	17.0	U	NA	17.0	No	F
Methylene Chloride	ug/Kg	3 / 4	2200.0	U	NA	3 / 9	230.0	U	NA	2200.0	No	F
Styrene	ug/Kg					1 / 9	3.0	U	NA	3.0	No	F
Tetrachlorethene	ug/Kg	1 / 3	530.0	U	NA	6 / 8	240.0	U	NA	530.0	No	F
Toluene	ug/Kg	2 / 4	67.0	U	NA	4 / 9	33.0	U	NA	67.0	No	F
Trans-1,2-Dichloroethene	ug/Kg	1 / 4	60.0	U	NA					60.0	No	F
Total Xylenes	ug/Kg					5 / 9	230.0	U	NA	230.0	No	F
Trichloroethene	ug/Kg	1 / 4	300.0	U	NA	7 / 9	210.0	U	NA	300.0	No	F
Trichlorofluoromethane	ug/Kg					1 / 2	2.0	U	NA	2.0	No	F
Vinyl Chloride	ug/Kg					2 / 9	14.0	U	NA	14.0	Yes	
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg					4 / 6	2.6	U	NA	2.6	Yes	
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg					5 / 6	3.2	U	NA	3.2	Yes	
1,2,3,4,7,8,9-HpCDD[4]	ug/Kg					3 / 6	2.4	U	NA	2.4	Yes	

TABLE E.II–4
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	CPC?	Justify
1,2,3,4,7,8–HxCDD[4]	ug/Kg					1 / 6	0.1	U	NA	0.1	Yes	
1,2,3,4,7,8–HxCDF[4]	ug/Kg					5 / 6	2.9	U	NA	2.9	Yes	
1,2,3,6,7,8–HxCDD[4]	ug/Kg					2 / 6	0.2	U	NA	0.2	Yes	
1,2,3,6,7,8–HxCDF[4]	ug/Kg					5 / 6	1.1	U	NA	1.1	Yes	
1,2,3,7,8,9–HxCDD[4]	ug/Kg					2 / 6	0.2	U	NA	0.2	Yes	
1,2,3,7,8,9–HxCDF[4]	ug/Kg					3 / 6	0.8	U	NA	0.8	Yes	
1,2,3,7,8–PeCDF[4]	ug/Kg					5 / 6	2.1	U	NA	2.1	Yes	
2,3,4,6,7,8–HxCDF[4]	ug/Kg					4 / 6	1.2	U	NA	1.2	Yes	
2,3,4,7,8–PeCDF[4]	ug/Kg					5 / 6	2.7	U	NA	2.7	Yes	
2,3,7,8–TCDF[4]	ug/Kg					5 / 6	9.9	U	NA	9.9	Yes	
HpCDD[4]	ug/Kg					5 / 6	4.0	U	NA	4.0	Yes	
HpCDF[4]	ug/Kg					5 / 6	4.4	U	NA	4.4	Yes	
HxCDD[4]	ug/Kg					4 / 6	2.7	U	NA	2.7	Yes	
HxCDF[4]	ug/Kg					5 / 6	8.5	U	NA	8.5	Yes	
OCDD[4]	ug/Kg					5 / 6	9.0	U	NA	9.0	Yes	
OCDF[4]	ug/Kg					4 / 6	4.9	U	NA	4.9	Yes	
PeCDF[4]	ug/Kg					5 / 6	15.3	U	NA	15.3	Yes	
TCDD[4]	ug/Kg					2 / 6	0.5	U	NA	0.5	Yes	
TCDF[4]	ug/Kg					6 / 6	34.1	U	NA	34.1	Yes	
Ammonia	ug/Kg					2 / 3	235000.0	U	NA	235000.0	No	E
Chloride	ug/Kg					1 / 2	53000.0	U	NA	53000.0	No	D
Cyanide	ug/Kg					1 / 5	240.0	U	NA	240.0	No	F
Fluoride	ug/Kg					1 / 2	3793000.0	U	NA	3793000.0	Yes	
Oil And Grease	ug/Kg					3 / 4	17902000.0	U	NA	17902000.0	No	E
Phosphorus	ug/Kg					4 / 4	146000.0	U	NA	146000.0	No	B
Sulfide	ug/Kg					1 / 2	29100.0	U	NA	29100.0	No	D
Total Organic Carbon	ug/Kg					2 / 2	53646000.0	U	NA	53646000.0	No	E
Total Organic Nitrogen	ug/Kg					4 / 4	833200.0	U	NA	833200.0	No	E

Notes:
1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 – TCDD = Tetrachlorodibenzo–p–dioxin
PeCDD = Pentachlorodibenzo–p–dioxin
HxCDD = Hexachlorodibenzo–p–dioxin
HpCCD = Heptachlorodibenzo–p–dioxin
OCDD = Octachlorodibenz–p–dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran
5 – The 95th percentile background concentrations for subsurface soil are compared to maximum values.

5511

TABLE E.II–5

SUMMARY OF PIT 5 ANALYTICAL RESULTS

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95%[4]	CPC?	Justify
Aluminum	mg/Kg	6 / 6	15400.0	U	NA	10 / 10	11900.0	N	10285.2	15400.0	16064.0	No	A
Antimony	mg/Kg	5 / 6	64.0	U	NA	10 / 10	88.1	L	96.2	88.1	NA	Yes	
Arsenic	mg/Kg	6 / 6	2800.0	U	NA	8 / 10	715.0	N	561.3	2800.0	9.6	Yes	
Barium	mg/Kg	6 / 6	36900.0	U	NA	10 / 10	18100.0	L	12941.7	36900.0	119.2	Yes	
Beryllium	mg/Kg	6 / 6	18.0	U	NA	10 / 10	22.4	N	14.4	18.0	0.6	Yes	
Cadmium	mg/Kg	4 / 6	17.0	U	NA	10 / 10	4.7	L	3.5	17.0	0.9	Yes	
Calcium	mg/Kg	6 / 6	206000.0	U	NA	10 / 10	250000.0	N	213927.7	213927.7	150000.0	No	B
Chromium	mg/Kg	6 / 6	223.0	U	NA	10 / 10	108.0	L	92.5	223.0	20.7	Yes	
Cobalt	mg/Kg	4 / 6	44.0	U	NA	10 / 10	17.1	L	12.0	44.0	15.8	Yes	
Copper	mg/Kg	5 / 6	18200.0	U	NA	10 / 10	8680.0	N	5300.9	18200.0	20.0	Yes	
Iron	mg/Kg	6 / 6	17900.0	U	NA	10 / 10	20700.0	L	15401.4	17900.0	30700.0	No	A
Lead	mg/Kg	5 / 6	236.0	U	NA	10 / 10	134.0	L	109.8	236.0	15.6	Yes	G
Magnesium	mg/Kg	6 / 6	63200.0	U	NA	10 / 10	43000.0	N	38520.2	63200.0	42648.2	No	B
Manganese	mg/Kg	6 / 6	4740.0	U	NA	10 / 10	599.0	N	501.6	4740.0	1300.0	Yes	
Mercury	mg/Kg	6 / 6	1.8	U	NA	10 / 10	1.5	N	1.1	1.8	0.3	No	F
Molybdenum	mg/Kg					10 / 10	1350.0	L	1931.9	1350.0	2.7	Yes	
Nickel	mg/Kg	6 / 6	247.0	U	NA	10 / 10	189.0	N	138.6	247.0	34.4	Yes	
Potassium	mg/Kg	3 / 5	1490.0	U	NA	10 / 10	2160.0	L	1605.5	1605.5	1980.0	No	B
Selenium	mg/Kg	5 / 6	18.0	U	NA		NA		NA	18.0		No	F
Silver	mg/Kg	2 / 6	9.4	U	NA	6 / 10	22.2	U	NA	22.2	NA	No	F
Sodium	mg/Kg	6 / 6	9980.0	U	NA	10 / 10	16300.0	L	12207.0	12207.0	285.0	No	B
Thallium	mg/Kg	4 / 6	11.0	U	NA	4 / 10	52.0	U	NA	52.0	0.5	Yes	
Tin	mg/Kg					10 / 10	92.8	L	66.1	66.1		No	F
Vanadium	mg/Kg	6 / 6	5380.0	U	NA	10 / 10	4530.0	N	2794.5	5380.0	37.8	Yes	
Zinc	mg/Kg	4 / 6	211.0	U	NA	10 / 10	278.0	N	215.0	215.0	72.6	No	F
Aroclor 1248	ug/Kg	2 / 6	550.0	U	NA					550.0		Yes	
Aroclor 1254	ug/Kg	2 / 6	750.0	U	NA					750.0		Yes	
Cesium–137	pCi/g	2 / 6	76.0	U	NA	10 / 10	106.0	L	223.5	106.0	NA	Yes	
Gross Alpha	pCi/g					10 / 10	9400.0	L	5684.8	5684.8		No	E
Gross Beta	pCi/g					10 / 10	1280.0	L	1044.3	1044.3		No	E
Neptunium–237	pCi/g	5 / 6	19.0	U	NA	3 / 3	83.0	U	NA	83.0		Yes	
Plutonium–238	pCi/g	5 / 6	4.4	U	NA	3 / 10	0.3	U	NA	4.4	NA	Yes	
Plutonium–239/240	pCi/g	5 / 6	13.0	U	NA	5 / 10	3.7	U	NA	13.0	NA	Yes	

TABLE E.II-5
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95%[4]	CPC?	Justify
Potassium-40	pCi/g					1 / 1	11.0	U	NA	11.0	19.7	No	A
Radium-226	pCi/g					10 / 10	180.0	L	159.9	159.9	1.5	Yes	
Radium-228	pCi/g					9 / 10	49.0	N	32.6	32.6	1.3	Yes	
Ruthenium-106	pCi/g					2 / 10	1.6	U	NA	1.6	NA	Yes	
Strontium-90	pCi/g	6 / 6	31.0	U	NA	9 / 10	18.0	N	9.7	31.0	0.6	Yes	
Technetium-99	pCi/g	6 / 6	2990.0	U	NA	10 / 10	3020.0	L	2247.5	2990.0	NA	Yes	
Thorium-228	pCi/g	6 / 6	44.0	U	NA	10 / 10	38.0	U	NA	44.0	1.3	Yes	
Thorium-230	pCi/g	6 / 6	8480.0	U	NA	10 / 10	2600.0	U	NA	8480.0	1.9	Yes	
Thorium-232	pCi/g	6 / 6	55.0	U	NA	7 / 10	10.0	U	NA	55.0	1.3	Yes	
Thorium-Total	mg/Kg					8 / 10	92.0	U	92.0	92.0	9.5	Yes	
Uranium-234	pCi/g	6 / 6	1250.0	U	NA	10 / 10	1400.0	N	892.9	1250.0	1.0	Yes	
Uranium-235/236	pCi/g	6 / 6	79.0	U	NA	5 / 10	58.0	U	NA	58.0	0.2	Yes	
Uranium-238	pCi/g	6 / 6	1230.0	U	NA	10 / 10	2800.0	L	1473.4	1473.4	1.1	Yes	
Uranium-Total	mg/Kg					10 / 10	3700.0	N	2770.0	2770.0		Yes	
Bis(2-Ethylhexyl)Phthalate	ug/Kg	4 / 6	2300.0	U	NA					2300.0		No	F
C-10 Unk Hydrocarbon	ug/Kg	1 / 1	2100.0	U	NA					2100.0		No	E
Di-N-Butylphthalate	ug/Kg	1 / 6	56.0	U	NA					56.0		No	F
Phenol	ug/Kg	1 / 6	200.0	U	NA					200.0		No	F
Acetone	ug/Kg	3 / 6	6300.0	U	NA					6300.0		No	F
Methylene Chloride	ug/Kg	4 / 6	410.0	U	NA					410.0		No	F
Ammonia, As Nitrogen	ug/Kg					10 / 10	2410000.0	N	1477992.6	1477992.6		No	E
Chloride	ug/Kg					7 / 10	1380000.0	L	856647.2	856647.2		No	D
Nitrate/Nitrite	ug/Kg					10 / 10	53800000.0	L	39983391.6	39983391.6		No	C
Sulfate	ug/Kg					4 / 4	6790000.0	U	NA	6790000.0		No	D
Total Kjeldahl Nitrogen	ug/Kg					10 / 10	1940000.0	L	1776582.2	1776582.2		No	E
Total Organic Carbon	ug/Kg					10 / 10	35000000.0	N	27138934.9	27138934.9		No	E
Total Organic Nitrogen	ug/Kg					10 / 10	626000.0	N	428847.7	428847.7		No	E
Total Phosphorus	ug/Kg					10 / 10	1097000.0	L	867175.3	867175.3		No	E

Notes:
1 - Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 - NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 - The representative concentration is the maximum of the UCL/Max value from either the CIS or WMC data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 - The 95th percentile background concentrations for subsurface soil are compared to maximum values.

TABLE E.II-6

SUMMARY OF PIT 6 ANALYTICAL RESULTS

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Aluminum	mg/kg	1 / 1	4730.0	U	NA	9 / 9	22800.0	N	17621.0	17621.0	16064.0	No	D
Arsenic	mg/kg	1 / 1	7.6	U	NA	9 / 9	76.7	L	65.3	65.3	9.6	Yes	
Barium	mg/kg	1 / 1	95.0	U	NA	9 / 9	71.7	N	60.4	95.0	119.2	No	F
Beryllium	mg/kg	1 / 1	5.7	U	NA	9 / 9	2.1	N	1.5	5.7	0.6	Yes	
Cadmium	mg/kg	1 / 1	5.7	U	NA	1 / 9	1.3	U	NA	5.7	0.9	Yes	
Calcium	mg/kg	1 / 1	22200.0	U	NA	9 / 9	157000.0	N	121629.4	121629.4	150000.0	No	B
Chromium	mg/kg	1 / 1	30.0	U	NA	4 / 9	8.3	U	NA	30.0	20.7	No	F
Cobalt	mg/kg	1 / 1	26.0	U	NA	5 / 9	5.4	U	NA	26.0	15.8	No	F
Copper	mg/kg	1 / 1	222.0	U	NA	4 / 9	10.8	U	NA	222.0	20.0	No	F
Iron	mg/kg	1 / 1	2750.0	U	NA	9 / 9	18300.0	N	13783.0	13783.0	30700.0	No	C
Lead	mg/kg	1 / 1	60.0	U	NA	9 / 9	113.0	L	90.4	90.4	15.6	Yes	G
Magnesium	mg/kg	1 / 1	32100.0	U	NA	9 / 9	41900.0	L	28975.5	32100.0	42648.2	No	B
Manganese	mg/kg	1 / 1	35.0	U	NA	9 / 9	318.0	N	259.5	259.5	1300.0	No	A
Nickel	mg/kg	1 / 1	51.0	U	NA	9 / 9	22.7	N	20.5	51.0	34.4	No	F
Potassium	mg/kg	1 / 1	913.0	U	NA	9 / 9	6390.0	N	4862.2	4862.2	1980.0	No	B
Silver	mg/kg	1 / 1	158.0	U	NA	7 / 9	9.2	L	12.7	158.0		Yes	
Sodium	mg/kg	1 / 1	600.0	U	NA	9 / 9	586.0	L	500.3	600.0	285.0	No	B
Thallium	mg/kg					5 / 9	108.0	U	NA	NA	0.5	No	
Tin	mg/kg					6 / 9	21.5	U	NA	NA		No	F
Vanadium	mg/kg	1 / 1	100.0	U	NA				NA	100.0	37.8	No	F
Zinc	mg/kg	1 / 1	48.0	U	NA	9 / 9	61.0	N	50.9	50.9	72.6	No	F
Aroclor 1254	ug/Kg	1 / 4	81.0	U	NA					81.0		Yes	
Cesium-137	pCi/g	3 / 4	31.0	U	NA	9 / 9	14.0	N	10.6	31.0	NA	Yes	
Gross Alpha	pCi/g					9 / 9	14000.0	L	13552.5	13552.5		No	E
Gross Beta	pCi/g					9 / 9	23000.0	L	19612.7	19612.7		No	E
Neptunium-237	pCi/g	4 / 4	3.6	U	NA					3.6		Yes	
Plutonium-238	pCi/g	4 / 4	1.4	U	NA	6 / 9	1.0	U	NA	1.4	NA	Yes	
Plutonium-239/240	pCi/g	4 / 4	15.0	U	NA	9 / 9	14.0	N	11.1	15.0	NA	Yes	
Radium-226	pCi/g					9 / 9	4.9	L	4.3	4.3	1.5	Yes	
Radium-228	pCi/g					9 / 9	191.0	L	257.5	191.0	1.3	Yes	
Strontium-90	pCi/g	4 / 4	5.1	U	NA	6 / 9	4.8	U	NA	5.1	0.6	Yes	

TABLE E.II-6
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	Constituent is CPC?	
Technetium-99	pCi/g	4 / 4	164.0	U	NA	5 / 9	45.0	U	NA	164.0	NA	Yes	
Thorium-228	pCi/g	4 / 4	1.2	U	NA	9 / 9	1.7	N	1.5	1.5	1.3	Yes	
Thorium-230	pCi/g	4 / 4	44.0	U	NA	9 / 9	62.0	N	45.2	45.2	1.9	Yes	
Thorium-232	pCi/g	4 / 4	1.2	U	NA	9 / 9	1.0	N	0.7	1.2	1.3	Yes	
Uranium-234	pCi/g	4 / 4	5330.0	U	NA	9 / 9	4064.0	L	3455.2	5330.0	1.0	Yes	
Uranium-235/236	pCi/g	4 / 4	1750.0	U	NA	9 / 9	337.0	L	286.4	1750.0	0.2	Yes	
Uranium-238	pCi/g	4 / 4	18700.0	U	NA	9 / 9	28746.0	L	22721.3	22721.3	1.1	Yes	
Uranium-Total	mg/kg					9 / 9	27733.0	L	45960.0	27733.0		Yes	
Bis(2-Ethylhexyl)Phthalate	ug/Kg	2 / 4	910.0	U	NA					910.0		No	F
2-Butanone	ug/Kg	1 / 4	530.0	U	NA					530.0		No	F
Butanoic Acid, Methyl Ester4	ug/Kg	2 / 2	6.0	U	NA					6.0		No	D
Methylene Chloride	ug/Kg	1 / 3	280.0	U	NA					280.0		No	F
Tetrachloroethene	ug/Kg	4 / 4	29000.0	U	NA					29000.0		Yes	
Trichloroethene	ug/Kg	1 / 4	170.0	U	NA					170.0		No	F
Ammonia, As Nitrogen	ug/Kg					9 / 9	141000.0	U	NA	141000.0		No	E
Bromide	ug/Kg					1 / 9	366000.0	U	NA	366000.0		No	E
Chloride	ug/Kg					5 / 9	2250000.0	U	NA	2250000.0		No	D
Nitrate/Nitrite	ug/Kg					4 / 9	55400.0	U	NA	55400.0		No	C
Oil & Grease	ug/Kg					2 / 9	46000.0	U	NA	46000.0		No	E
Sulfate	ug/Kg					3 / 9	1610000.0	U	NA	1610000.0		No	D
Total Kjeldahl Nitrogen	ug/Kg					9 / 9	1030000.0	N	834942.4	834942.4		No	E
Total Organic Carbon	ug/Kg					9 / 9	35000000.0	N	23108430.1	23108430.1		No	E
Total Organic Nitrogen	ug/Kg					8 / 8	982000.0	L	823404.0	823404.0		No	E
Total Phosphorus	ug/Kg					9 / 9	3850000.0	N	3019032.8	3019032.8		No	E

Notes:
1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RI/FS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 – Laboratory contaminant, not considered a CPC.
5 – The 95th percentile background concentrations for subsurface soil are compared with maximum values.

TABLE E.II-7

SUMMARY OF SURFACE SOIL (0-24 INCHES DEEP) ANALYTICAL DATA

		CIS Data				RIFS Data							
Parameters	Units	Frequency of Detection	Maximum Value	Dist.[1]	Representative Concentration[2]	Frequency of Detection	Maximum Value	Dist.[1]	Representative Concentration[2]	Representative Concentration[3]	Background 95 %[4]	Constituent is CPC?	
Aluminum	mg/Kg					17 / 17	13500.0	L	8091.1	8091.1	11880.9	No	D
Antimony	mg/Kg					17 / 17	32.8	L	27.9	27.9		Yes	
Arsenic	mg/Kg					17 / 17	11.2	L	5.6	5.6	8.2	No	A
Barium	mg/Kg					17 / 17	123.0	L	66.1	66.1	94.1	No	A
Beryllium	mg/Kg					17 / 17	1.0	L	0.8	0.8	0.6	Yes	
Cadmium	mg/Kg					17 / 17	7.7	L	5.9	5.9	0.9	Yes	
Calcium	mg/Kg					17 / 17	155000.0	N	117759.2	117759.2	4339.2	No	B
Chromium	mg/Kg					17 / 17	24.5	N	15.7	15.7	15.5	No	F
Cobalt	mg/Kg					17 / 17	17.0	L	10.9	10.9	14.2	No	A
Copper	mg/Kg					17 / 17	25.9	L	18.1	18.1	14.1	No	F
Iron	mg/Kg					17 / 17	24500.0	N	16809.5	16809.5	21728.2	No	A
Lead	mg/Kg					17 / 17	34.3	L	16.1	16.1	26.4	No	A
Magnesium	mg/Kg					17 / 17	39000.0	N	26468.0	26468.0	2777.0	No	B
Manganese	mg/Kg					17 / 17	841.0	L	611.9	611.9	1348.0	No	A
Molybdenum	mg/Kg					16 / 17	5.7	N	4.5	4.5		No	F
Nickel	mg/Kg					17 / 17	50.2	L	30.1	30.1	20.9	No	F
Potassium	mg/Kg					17 / 17	1300.0	N	976.0	976.0	1231.3	No	A
Selenium	mg/Kg					2 / 17	0.6	U	0.6	0.6	0.7	No	A
Silver	mg/Kg					17 / 17	10.3	N	9.0	9.0		No	F
Sodium	mg/Kg					15 / 16	185.0	L	140.2	140.2	51.1	No	B
Thallium	mg/Kg					1 / 17	0.7	U	0.7	0.7	0.6	No	F
Vanadium	mg/Kg					17 / 17	33.0	L	21.4	21.4	30.4	No	A
Zinc	mg/Kg					17 / 17	79.9	L	49.5	49.5	59.6	No	A
Aroclor-1254	ug/Kg					3 / 17	1400.0	U	1400.0	1400.0		Yes	
Cesium-137	pCi/g	11 / 24	6	L	0.8					0.8	0.7	Yes	
Neptunium-237	pCi/g	1 / 24	0.5	U	0.5					0.5		Yes	
Plutonium-238	pCi/g	4 / 24	0.7	U	0.1					0.1		Yes	
Plutonium-239/240	pCi/g	4 / 24	0.6	U	0.2					0.2		Yes	
Radium-226	pCi/g					10 / 13	2.2	N	1.4	1.4	1.4	Yes	
Radium-228	pCi/g					10 / 13	4.7	L	2.2	2.2	1.3	Yes	
Strontium-90	pCi/g	1 / 24	1.5	U	1.5	3 / 11	0.9	U	0.9	1.5		Yes	
Technetium-99	pCi/g	10 / 24	58	U	5.6	1 / 12	0.9	U	0.9	5.6		Yes	

TABLE E.II–7
(Continue)

Parameters	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data Representative Concentration[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data Representative Concentration[2]	Representative Concentration[3]	Background 95 %[4]	Constituent is CPC?	
Thorium–228	pCi/g	20 / 24	48.0	U	7.8	11 / 11	4.1	L	2.2	7.8	1.4	Yes	
Thorium–230	pCi/g	22 / 24	972.0	U	146.0	11 / 11	6.1	L	3.5	146.0	2.0	Yes	
Thorium–232	pCi/g	19 / 24	31.0	U	5.5	11 / 11	1.6	L	1.2	5.5	1.4	Yes	
Thorium–Total	mg/Kg					1 / 1	5.8	U	5.8	5.8	10.7	Yes	G
Uranium–234	pCi/g	24 / 24	241.0	L	117.5	13 / 13	28.5	L	17.5	117.5	1.2	Yes	
Uranium–235/236	pCi/g	24 / 24	51.0	U	18.6	5 / 13	3.9	U	3.9	18.6	0.2	Yes	
Uranium–238	pCi/g	24 / 24	1500.0	U	788.0	13 / 13	103.7	L	103.7	788.0	1.2	Yes	
Uranium–Total	mg/Kg					9 / 9	413.5	U	413.5	413.5		Yes	
4–Methylphenol	ug/Kg					1 / 16	390.0	U	390.0	390.0		No	F
Benzo(A)Anthracene	ug/Kg					1 / 16	98.0	U	98.0	98.0		Yes	
Benzo(A)Pyrene	ug/Kg					1 / 16	42.0	U	42.0	42.0		Yes	
Benzo(B)Fluoranthene	ug/Kg					1 / 16	59.0	U	59.0	59.0		Yes	
Benzo(K)Fluoranthene	ug/Kg					1 / 16	46.0	U	46.0	46.0		Yes	
Benzoic Acid	ug/Kg					3 / 16	73.0	U	73.0	73.0		No	F
Chrysene	ug/Kg					1 / 16	88.0	U	88.0	88.0		Yes	
Fluoranthene	ug/Kg					1 / 16	98.0	U	98.0	98.0		No	F
Phenol	ug/Kg					3 / 16	110.0	U	110.0	110.0		No	F
Pyrene	ug/Kg					2 / 16	130.0	U	130.0	130.0		No	F
Bis(2–Ethylhexyl) Phthalate	ug/Kg					8 / 16	1300.0	L	847.6	847.6		No	F
2–Butanone	ug/Kg					1 / 16	3.0	U	3.0	3.0		No	F
4–Methyl–2–Pentanone	ug/Kg					1 / 16	1.0	U	1.0	1.0		No	F
Acetone	ug/Kg					1 / 16	26.0	U	26.0	26.0		No	F
Methylene Chloride	ug/Kg					1 / 16	51.0	U	51.0	51.0		No	F
Toluene	ug/Kg					2 / 16	1.0	U	1.0	1.0		No	F
Cyanide	ug/Kg					4 / 17	7100.0	U	7100.0	7100.0		No	F

Notes:
1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 – The representative concentration for the CIS or RIFS data sets is the either the maximum value or 95% UCL value. If the distribution could not be determined but there were more than 7 detects, the non–parametric 95th percentile was used as the representative concentration.
3 – The representative concentration for surface soils is the maximum of the representative concentration from either the CIS or RIFS data.
4 – The 95th percentile background concentrations for surface soil are compared with maximum values.

TABLE E.II-8

SUMMARY OF ANALYTICAL RESULTS FOR BURN PIT

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify[4]
Aluminum	mg/Kg	7 / 7	11900.0	N	9343.5	4 / 4	8550.0	U	NA	8550.0	16064.0	No	A
Antimony	mg/Kg	1 / 7	0.6	U	NA	2 / 4	17.8	U	NA	17.8	NA	Yes	
Arsenic	mg/Kg	5 / 7	21.0	U	NA	4 / 4	39.2	U	NA	39.2	9.6	Yes	
Barium	mg/Kg	5 / 7	7100.0	U	NA	4 / 4	299.0	U	NA	299.0	119.2	No	F
Beryllium	mg/Kg	5 / 7	16.0	U	NA	4 / 4	1.9	U	NA	1.9	0.6	Yes	
Boron	mg/Kg					2 / 3	48.2	U	NA	48.2	43.0	No	F
Cadmium	mg/Kg	7 / 7	35.0	U	NA	4 / 4	5.4	U	NA	5.4	0.9	Yes	
Calcium	mg/Kg	7 / 7	116000.0	L	164991.3	4 / 4	88900.0	U	NA	88900.0	150000.0	No	A
Chromium	mg/Kg	7 / 7	88.0	U	NA	4 / 4	91.2	U	NA	91.2	20.7	Yes	
Cobalt	mg/Kg	6 / 7	104.0	U	NA	4 / 4	111.0	U	NA	111.0	15.8	No	F
Copper	mg/Kg	4 / 7	166.0	U	NA	4 / 4	259.0	U	NA	259.0	20.0	No	F
Iron	mg/Kg	7 / 7	17400.0	L	18269.5	4 / 4	31200.0	U	NA	31200.0	30700.0	No	B
Lead	mg/Kg	5 / 7	53.0	U	NA	4 / 4	279.0	U	NA	279.0	15.6	Yes	
Magnesium	mg/Kg	7 / 7	57100.0	L	68154.4	4 / 4	25700.0	U	NA	25700.0	42648.2	No	A
Manganese	mg/Kg	7 / 7	1720.0	L	1466.4	4 / 4	962.0	U	NA	962.0	1300.0	No	F
Mercury	mg/Kg	2 / 7	0.2	U	NA	3 / 4	1.2	U	NA	1.2	0.3	No	F
Molybdenum	mg/Kg					4 / 4	24.8	U	NA	24.8	2.7	No	F
Nickel	mg/Kg	6 / 7	60.0	U	NA	4 / 4	206.0	U	NA	206.0	34.4	No	F
Potassium	mg/Kg	7 / 7	1450.0	L	1184.4	4 / 4	1410.0	U	NA	1410.0	1980.0	No	A
Selenium	mg/Kg	1 / 5	0.5	U	NA	4 / 4	2.0	U	NA	2.0		No	F
Silicon	mg/Kg					3 / 3	1350.0	U	NA	1350.0	1593.1	No	A
Silver	mg/Kg	2 / 6	506.0	U	NA	4 / 4	21.6	U	NA	21.6	NA	Yes	
Sodium	mg/Kg	5 / 6	1270.0	U	NA	4 / 4	812.0	U	NA	812.0	285.0	No	B
Thallium	mg/Kg	2 / 6	0.5	U	NA					0.0	0.5	No	F
Vanadium	mg/Kg	3 / 6	290.0	U	NA	4 / 4	43.3	U	NA	43.3	37.8	Yes	
Zinc	mg/Kg	6 / 6	75.0	U	NA	4 / 4	505.0	U	NA	505.0	72.6	No	F
Aroclor 1242	ug/Kg	1 / 7	290.0	U	NA					290.0		Yes	
Aroclor 1248	ug/Kg	1 / 7	200.0	U	NA					200.0		Yes	
Aroclor 1254	ug/Kg	5 / 7	2700.0	U	NA	3 / 4	7700.0	U	NA	7700.0		Yes	
Neptunium-237	pCi/g	2 / 6	0.6	U	NA					0.6		Yes	
Plutonium-238	pCi/g	1 / 6	0.5	U	NA					0.5	NA	Yes	
Plutonium-239/240	pCi/g	1 / 6	0.4	U	NA					0.4	NA	Yes	
Radium-226	pCi/g				NA	4 / 4	39.2	U	NA	39.2	1.5	Yes	
Radium-228	pCi/g				NA	4 / 4	10.4	U	NA	10.4	1.3	Yes	

TABLE E.II-8
(Continued)

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %[5]	CPC?	Justify
Ruthenium-106	pCi/g				NA	2 / 4	1.5	U	NA	1.5	NA	Yes	
Strontium-90	pCi/g				NA	1 / 4	0.5	U	NA	0.5	0.6	No	A
Technetium-99	pCi/g	4 / 6	64.0	U	NA	4 / 4	3.3	U	NA	64.0	NA	Yes	
Thorium-228	pCi/g	6 / 6	19.0	U	NA	4 / 4	900.0	U	NA	900.0	1.3	Yes	
Thorium-230	pCi/g	6 / 6	218.0	U	NA	4 / 4	4530.0	U	NA	4530.0	1.9	Yes	
Thorium-232	pCi/g	6 / 6	21.0	U	NA	4 / 4	410.0	U	NA	410.0	1.3	Yes	
Thorium-Total	mg/Kg				NA	4 / 4	3700.0	U	NA	3.7	9.5	Yes	G
Uranium-234	pCi/g	6 / 6	415.0	U	NA	4 / 4	1711.0	U	NA	1711.0	1.0	Yes	
Uranium-235/236	pCi/g	6 / 6	27.0	U	NA	4 / 4	102.0	U	NA	102.0	0.2	Yes	
Uranium-238	pCi/g	6 / 6	454.0	U	NA	4 / 4	1996.0	U	NA	1996.0	1.1	Yes	
Uranium-Total	mg/Kg				NA	4 / 4	4458.0	U	NA	4.5	NA	Yes	
2-Methylnaphthalene	ug/Kg	1 / 7	50.0	U	NA	2 / 5	820.0	U	NA	820.0		Yes	G
Acenaphthene	ug/Kg				NA	1 / 5	1100.0	U	NA	1100.0		No	F
Anthracene	ug/Kg				NA	1 / 5	3100.0	U	NA	3100.0		No	F
Benzo(A)Anthracene	ug/Kg	4 / 7	170.0	U	NA	2 / 5	6300.0	U	NA	6300.0		Yes	
Benzo(A)Pyrene	ug/Kg	1 / 7	160.0	U	NA	2 / 5	3900.0	U	NA	3900.0		Yes	
Benzo(B)Fluoranthene	ug/Kg	4 / 7	170.0	U	NA	1 / 5	9600.0	U	NA	9600.0		Yes	
Benzo(G,H,I)Perylene	ug/Kg	1 / 7	85.0	U	NA	2 / 5	2900.0	U	NA	2900.0		Yes	
Benzo(K)Fluoranthene	ug/Kg	1 / 7	200.0	U	NA	1 / 5	340.0	U	NA	340.0		Yes	
Bis(2-Ethylhexyl) Phthalate	ug/Kg	5 / 7	2000.0	U	NA	3 / 5	9700.0	U	NA	9700.0		Yes	
Chrysene	ug/Kg	3 / 7	83.0	U	NA	2 / 5	7000.0	U	NA	7000.0		Yes	
Di-N-Butylphthalate	ug/Kg	4 / 7	210.0	U	NA					210.0		No	F
Di-N-Octylphthalate	ug/Kg	4 / 7	130.0	U	NA					130.0		No	F
Dibenzofuran	ug/Kg				NA	1 / 5	900.0	U	NA	900.0		Yes	
Diethyl Phthalate	ug/Kg				NA	1 / 5	80.0	U	NA	80.0		No	F
Fluoranthene	ug/Kg	3 / 7	210.0	U	NA	2 / 5	16000.0	U	NA	16000.0		No	F
Fluorene	ug/Kg				NA	2 / 5	1700.0	U	NA	1700.0		No	F
Indeno(1,2,3-Cd)Pyrene	ug/Kg	1 / 7	78.0	U	NA	2 / 5	2200.0	U	NA	2200.0		Yes	
Naphthalene	ug/Kg				NA	1 / 5	200.0	U	NA	200.0		No	F
Pentachlorophenol	ug/Kg	2 / 7	2600.0	U	NA					2600.0		Yes	
Phenanthrene	ug/Kg	4 / 7	190.0	U	NA	3 / 5	15000.0	U	NA	15000.0		Yes	G
Phenol	ug/Kg	3 / 7	650.0	U	NA					650.0		No	F
Pyrene	ug/Kg	3 / 7	140.0	U	NA	3 / 5	14000.0	U	NA	14000.0		No	F
1,1,1-Trichloroethane	ug/Kg				NA	1 / 4	2.0	U	NA	2.0		No	F

TABLE E.II-8
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %	CPC?	Justify
1,1-Dichloroethane	ug/Kg				NA	2 / 5	110.0	U	NA	NA		No	F
2-Butanone	ug/Kg	1 / 2	70.0	U	NA	1 / 4	41.0	U	NA	NA		No	F
2-Hexanone	ug/Kg				NA	1 / 4	2.0	U	NA	2.0		Yes	G
4-Methyl-2-Pentanone	ug/Kg				NA	1 / 4	6.0	U	NA	NA		No	F
Acetone	ug/Kg				NA	4 / 5	100.0	U	NA	NA		No	F
Carbon Disulfide	ug/Kg				NA	1 / 4	1.0	U	NA	NA		No	F
Chlorobenzene	ug/Kg				NA	1 / 4	2.0	U	NA	NA		No	F
Ethylbenzene	ug/Kg	1 / 6	270.0	U	NA	3 / 4	28.0	U	NA	NA		No	F
Methylene Chloride	ug/Kg				NA	1 / 5	56.0	U	NA	NA		No	F
Tetrachloroethene	ug/Kg	2 / 6	260.0	U	NA					NA		No	F
Toluene	ug/Kg	1 / 6	50.0	U	NA	1 / 4	3.0	U	NA	NA		No	F
Total Xylenes	ug/Kg	1 / 6	890.0	U	NA	3 / 4	190.0	U	NA	NA		No	F
Vinyl Chloride	ug/Kg				NA	1 / 4	3.0	U	NA	3.0		Yes	
1,2,3,4,6,7,8-HpCDD[4]	ug/Kg				NA	2 / 4	0.5	U	NA	0.5		Yes	
1,2,3,4,6,7,8-HpCDF[4]	ug/Kg				NA	2 / 4	0.3	U	NA	0.3		Yes	
1,2,3,4,7,8,9-HpCDD[4]	ug/Kg				NA	1 / 4	0.3	U	NA	0.3		Yes	
HpCDD[4]	ug/Kg				NA	2 / 4	1.0	U	NA	1.0		Yes	
HpCDF[4]	ug/Kg				NA	1 / 4	0.3	U	NA	0.3		Yes	
OCDD[4]	ug/Kg				NA	2 / 4	4.0	U	NA	4.0		Yes	
OCDF[4]	ug/Kg				NA	2 / 4	0.3	U	NA	0.3		Yes	
Chloride	ug/Kg				NA	1 / 1	192000.0	U	NA	NA		No	D
Cyanide	ug/Kg				NA	2 / 4	210.0	U	NA	NA		No	F
Fluoride	ug/Kg				NA	1 / 1	49100.0	U	NA	NA		No	F
Phosphorus	ug/Kg				NA	2 / 2	783000.0	U	NA	NA		No	C
Sulfate	ug/Kg				NA	1 / 1	172000.0	U	NA	NA		No	D
Sulfide	ug/Kg				NA	1 / 2	59200.0	U	NA	NA		No	D
Total Organic Carbon	ug/Kg				NA	1 / 1	152000000.0	U	NA	NA		No	E
Total Organic Nitrogen	ug/Kg				NA	2 / 2	642000.0	U	NA	NA		No	E

Notes:
1 - Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 - NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 - The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 - TCDD = Tetrachlorodibenzo-p-dioxin
PeCDD = Pentachlorodibenzo-p-dioxin
HxCDD = Hexachlorodibenzo-p-dioxin
HpCCD = Heptachlorodibenzo-p-dioxin
OCDD = Octachlorodibenzo-p-dioxin
TCDF = Tetrachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HxCDF = Hexachlorodibenzofuran
HpCDF = Heptachlodibenzofuran
OCDF = Octachlorodibenzofuran
5 - The 95[th]percentile background concentrations for subsurface soil are compared with maximum values.

TABLE E.II-9

SUMMARY OF ANALYTICAL RESULTS FOR CLEARWELL

		CIS Data				RIFS Data							
Parameter	Units	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Frequency of Detection	Maximum Value	Dist.[1]	95% UCL[2]	Representative Concentration[3]	Background 95 %[4]	Constituent is CPC?	
Aluminum	mg/Kg	4 / 4	23800.0	U	NA	7 / 7	20700.0	N	19460.5	23800.0	16064.0	No	D
Antimony	mg/Kg	2 / 4	32.0	U	NA	5 / 7	10.9	U	NA	32.0	NA	Yes	
Arsenic	mg/Kg	4 / 4	18.0	U	NA	6 / 7	59.1	U	NA	59.1	9.6	Yes	
Barium	mg/Kg	4 / 4	6910.0	U	NA	7 / 7	1790.0	N	1569.9	6910.0	119.2	Yes	
Beryllium	mg/Kg	4 / 4	9.1	U	NA	7 / 7	2.9	L	3.2	9.1	0.6	Yes	
Cadmium	mg/Kg	2 / 4	7.2	U	NA	7 / 7	2.9	L	7.0	7.2	0.9	Yes	
Calcium	mg/Kg	4 / 4	183000.0	U	NA	7 / 7	177000.0	N	165419.4	183000.0	150000.0	No	C
Chromium	mg/Kg	4 / 4	76.0	U	NA	7 / 7	196.0	N	148.4	148.4	20.7	Yes	
Cobalt	mg/Kg	2 / 4	23.0	U	NA	7 / 7	25.7	L	23.4	23.4	15.8	No	F
Copper	mg/Kg	4 / 4	1120.0	U	NA	7 / 7	3320.0	L	18483.3	3320.0	20.0	Yes	
Iron	mg/Kg	4 / 4	21100.0	U	NA	7 / 7	20300.0	N	19434.5	21100.0	30700.0	No	A
Lead	mg/Kg	4 / 4	83.0	U	NA	7 / 7	588.0	N	417.1	417.1	15.6	Yes	
Magnesium	mg/Kg	4 / 4	44600.0	U	NA	7 / 7	27200.0	N	24831.4	44600.0	42648.2	No	B
Manganese	mg/Kg	4 / 4	1660.0	U	NA	7 / 7	19800.0	N	12661.4	12661.4	1300.0	Yes	
Mercury	mg/Kg	4 / 4	4.4	U	NA	7 / 7	1.6	L	3.0	4.4	0.3	No	F
Molybdenum	mg/Kg					7 / 7	40.9	L	149.4	40.9	2.7	No	F
Nickel	mg/Kg	4 / 4	67.0	U	NA	7 / 7	228.0	N	160.5	160.5	34.4	No	F
Potassium	mg/Kg	4 / 4	3650.0	U	NA	7 / 7	4820.0	N	4622.8	4622.8	1980.0	No	B
Selenium	mg/Kg	1 / 4	3.7	U	NA	4 / 7	0.9	U	NA	3.7		No	F
Silver	mg/Kg	1 / 4	3.3	U	NA	6 / 7	12.7	U	NA	12.7	NA	No	F
Sodium	mg/Kg	4 / 4	3500.0	U	NA	7 / 7	1020.0	L	962.0	3500.0	285.0	No	B
Thallium	mg/Kg	1 / 4	2.1	U	NA	4 / 7	1.6	U	NA	2.1	0.5	Yes	
Tin	mg/Kg					6 / 7	24.1	U	NA	24.1		No	F
Vanadium	mg/Kg	4 / 4	2600.0	U	NA	7 / 7	285.0	L	351.5	2600.0	37.8	Yes	
Zinc	mg/Kg	4 / 4	194.0	U	NA	7 / 7	314.0	N	240.2	240.2	72.6	No	F
Aroclor 1242	ug/Kg	1 / 4	121.0	U	NA					121.0		Yes	
Aroclor 1248	ug/Kg	1 / 4	308.0	U	NA					308.0		Yes	
Aroclor 1254	ug/Kg	4 / 4	737.0	U	NA					737.0		Yes	
Cesium-137	pCi/g	4 / 4	450.0	U	NA	6 / 6	71.4	U	NA	450.0	NA	Yes	
Gross Alpha	pCi/g					6 / 6	2050.0	U	NA	2050.0		No	D
Gross Beta	pCi/g					6 / 6	1830.0	U	NA	1830.0		No	D
Neptunium-237	pCi/g	3 / 4	2.2	U	NA	4 / 6	1.8	U	NA	2.2		Yes	
Plutonium-238	pCi/g					5 / 6	0.5	U	NA	0.5	NA	Yes	
Plutonium-239/240	pCi/g					5 / 6	0.5	U	NA	0.5	NA	Yes	

TABLE E.II-9
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Background 95 %[4]	Constituent is CPC?	
Radium-226	pCi/g					6 / 6	170.0	U	NA	170.0	1.5	Yes	
Radium-228	pCi/g					6 / 6	26.4	U	NA	26.4	1.3	Yes	
Strontium-90	pCi/g	4 / 4	26.0	U	NA	2 / 6	12.8	U	NA	26.0	0.6	Yes	
Technetium-99	pCi/g	2 / 4	278.0	U	NA	6 / 6	695.0	U	NA	695.0	NA	Yes	
Thorium-228	pCi/g	4 / 4	56.0	U	NA	6 / 6	28.1	U	NA	56.0	1.3	Yes	
Thorium-230	pCi/g	4 / 4	5600.0	U	NA	6 / 6	314.0	U	NA	5600.0	1.9	Yes	
Thorium-232	pCi/g	4 / 4	39.0	U	NA	6 / 6	9.7	U	NA	39.0	1.3	Yes	
Thorium-Total	mg/Kg					6 / 6	88.9	U	NA	0.1	9.5	Yes	
Uranium-234	pCi/g	4 / 4	376.0	U	NA	6 / 6	1050.0	U	NA	1050.0	1.0	Yes	
Uranium-235/236	pCi/g	4 / 4	49.0	U	NA	6 / 6	373.0	U	NA	373.0	0.2	Yes	
Uranium-238	pCi/g	4 / 4	670.0	U	NA	6 / 6	1640.0	U	NA	1640.0	1.1	Yes	
Uranium-Total	mg/Kg					6 / 6	2780.0	U	NA	2780.0	NA	Yes	
2,4,5-Trichlorophenol	ug/Kg	1 / 4	6200.0	U	NA					6200.0		No	F
Anthracene	ug/Kg	1 / 4	450.0	U	NA					450.0		No	F
Benzo(A)Anthracene	ug/Kg	2 / 4	890.0	U	NA					890.0		Yes	
Benzo(A)Pyrene	ug/Kg	1 / 4	670.0	U	NA					670.0		Yes	
Benzo(B)Fluoranthene	ug/Kg	1 / 4	710.0	U	NA					710.0		Yes	
Benzo(G,H,I)Perylene	ug/Kg	1 / 4	230.0	U	NA					230.0		Yes	G
Benzo(K)Fluoranthene	ug/Kg	1 / 4	750.0	U	NA					750.0		Yes	
Bis(2-Ethylhexyl)Phthalate	ug/Kg	3 / 4	560.0	U	NA					560.0		No	F
Chrysene	ug/Kg	3 / 4	1000.0	U	NA					1000.0		Yes	
Di-N-Butylphthalate	ug/Kg	2 / 4	1700.0	U	NA					1700.0		No	F
Diethyl Phthalate	ug/Kg	1 / 4	410.0	U	NA					410.0		No	F
Fluoranthene	ug/Kg	1 / 4	3100.0	U	NA					3100.0		No	F
Fluorene	ug/Kg	1 / 4	280.0	U	NA					280.0		No	F
Indeno(1,2,3-Cd)Pyrene	ug/Kg	1 / 4	270.0	U	NA					270.0		Yes	
Phenanthrene	ug/Kg	4 / 4	2100.0	U	NA					2100.0		Yes	G
Pyrene	ug/Kg	3 / 4	1400.0	U	NA					1400.0		No	F
Acetone	ug/Kg	1 / 3	2000.0	U	NA					2000.0		No	F
Methylene Chloride	ug/Kg	1 / 3	870.0	U	NA					870.0		No	F
Ammonia, As Nitrogen	ug/Kg					5 / 5	151000.0	U	NA	151000.0		No	E
Cyanide	ug/Kg	1 / 4	9200.0	U	NA	4 / 7	1470.0	U	NA	9200.0		No	F

TABLE E.II-9
(Continued)

Parameter	Units	CIS Data Frequency of Detection	CIS Data Maximum Value	CIS Data Dist.[1]	CIS Data 95% UCL[2]	RIFS Data Frequency of Detection	RIFS Data Maximum Value	RIFS Data Dist.[1]	RIFS Data 95% UCL[2]	Representative Concentration[3]	Constituent is CPC?	
Nitrate/Nitrite	ug/Kg					5 / 7	69000.0	U	NA	69000.0	No	C
Oil & Grease	ug/Kg					6 / 6	288000.0	U	NA	288000.0	No	E
Sulfate	ug/Kg					4 / 4	572000.0	U	NA	572000.0	No	D
Total Kjeldahl Nitrogen	ug/Kg					7 / 7	1060000.0	N	1007147.4	1007147.4	No	E
Total Organic Carbon	ug/Kg					7 / 7	108000000.0	L	696196201.5	108000000.0	No	E
Total Organic Nitrogen	ug/Kg					4 / 4	909000.0	U	NA	909000.0	No	E

Notes:
1 – Distribution, N = Normal, L = Lognormal, U = Undetermined (normality is not assumed for data sets with less than 7 detects or more than 50% nondetects).
2 – NA is given if the distribution of the dataset can not be determined, if there are less than seven samples or if there are more than 50% nondetects.
3 – The representative concentration is the maximum of the UCL/Max value from either the CIS or RIFS data. The UCL/Max value from each data set is the lower of the maximum detected value or the 95% upper confidence limit.
4 – The 95th percentile background concentrations for subsurface soil are compared with maximum values.

TABLE E.II-10

SUMMARY OF SURFACE WATER DATA FOR PIT 5

Parameter	Units	CIS Data Frequency Detection	CIS Data Maximum Value	CIS Data Filtered/ Unfiltered	Representative Concentration[1]	Constituent is CPC? (yes/no)	
Cyanide	ug/L	2 / 2	87.0	Unfiltered	87.0	Yes	
Antimony	ug/L	2 / 2	4.5	Unfiltered	4.5	Yes	
Arsenic	ug/L	2 / 2	2.1	Unfiltered	2.1	Yes	
Barium	ug/L	2 / 2	108.0	Unfiltered	108.0	Yes	
Calcium	ug/L	2 / 2	184000.0	Unfiltered	NA	No	B
Copper	ug/L	2 / 2	21.0	Unfiltered	21.0	Yes	
Lead	ug/L	2 / 2	2.9	Unfiltered	2.9	Yes	G
Magnesium	ug/L	2 / 2	387000.0	Unfiltered	NA	No	B
Nickel	ug/L	2 / 2	21.0	Unfiltered	21.0	Yes	
Potassium	ug/L	2 / 2	92000.0	Unfiltered	NA	No	B
Selenium	ug/L	2 / 2	2.1	Unfiltered	2.1	Yes	
Sodium	ug/L	2 / 2	1320000.0	Unfiltered	NA	No	B
Vanadium	ug/L	2 / 2	47.0	Unfiltered	47.0	Yes	
Zinc	ug/L	2 / 2	94.0	Unfiltered	NA	No	F
Cesium-137	pCi/L	2 / 2	90.0	Unfiltered	90.0	Yes	
Strontium-90	pCi/L	2 / 2	41.0	Unfiltered	41.0	Yes	
Technetium-99	pCi/L	2 / 2	320.0	Unfiltered	320.0	Yes	
Thorium-230	pCi/L	2 / 2	0.1	Unfiltered	0.1	Yes	
Uranium-234	pCi/L	2 / 2	420.0	Unfiltered	420.0	Yes	
Uranium-235	pCi/L	2 / 2	19.0	Unfiltered	19.0	Yes	
Uranium-238	pCi/L	2 / 2	400.0	Unfiltered	400.0	Yes	
Benzene	ug/L	2 / 2	11.0	Unfiltered	11.0	Yes	
Methylene Chloride	ug/L	2 / 2	2.0	Unfiltered	2.0	Yes	
Toluene	ug/L	2 / 2	1.0	Unfiltered	1.0	Yes	

Notes:
1 – Representative concentration is assumed to equal the maximum concentration detected.

TABLE E.II–11

SUMMARY OF SURFACE WATER DATA FOR PIT 6

Parameter	Units	CIS Data: Frequency of Detection	CIS Data: Maximum Value	CIS Data: Filtered/ Unfiltered	Constituent is CPC? (yes/no)		Representative Concentration[1]
Aluminum	ug/L	4 / 5	492.0	Unfiltered	No	F	NA
Antimony	ug/L	1 / 5	1.7	Unfiltered	Yes		1.7
Calcium	ug/L	5 / 5	111000.0	Unfiltered	No	B	NA
Iron	ug/L	1 / 5	16.0	Unfiltered	No	C	NA
Lead	ug/L	1 / 5	2.9	Unfiltered	Yes	G	2.9
Magnesium	ug/L	5 / 5	2430.0	Unfiltered	No	B	NA
Potassium	ug/L	5 / 5	42000.0	Unfiltered	No	B	NA
Sodium	ug/L	5 / 5	103000.0	Unfiltered	No	B	NA
Zinc	ug/L	1 / 5	8.0	Unfiltered	No	F	NA
Radium–228	pCi/L	5 / 5	31.3	Unfiltered	Yes		31.3
Technetium–99	pCi/L	5 / 5	3500.0	Unfiltered	Yes		3500.0
Thorium–230	pCi/L	2 / 5	0.3	Unfiltered	Yes		0.3
Uranium–234	pCi/L	5 / 5	77.0	Unfiltered	Yes		77.0
Uranium–235	pCi/L	5 / 5	9.3	Unfiltered	Yes		9.3
Uranium–238	pCi/L	5 / 5	460.0	Unfiltered	Yes		460.0
Chloroform	ug/L	4 / 5	3.0	Unfiltered	Yes		3.0
Tetrachloroethene	ug/L	5 / 5	2.0	Unfiltered	Yes		2.0
Toluene	ug/L	4 / 5	6.0	Unfiltered	Yes		6.0

Notes:
1 – Representative concentration is assumed to equal the maximum concentration detected.

TABLE E.II-12

SUMMARY OF SURFACE WATER DATA FOR CLEARWELL

Parameter	Units	CIS Data: Frequency of Detection	CIS Data: Maximum Value	CIS Data: Filtered/ Unfiltered	Constituent is CPC? (yes/no)		Representative Concentration[1]
Cyanide	ug/L	1 / 2	87.0	Unfiltered	Yes		87.0
Arsenic	ug/L	2 / 2	4.2	Unfiltered	Yes		4.2
Calcium	ug/L	2 / 2	112000.0	Unfiltered	No	B	NA
Copper	ug/L	2 / 2	19.0	Unfiltered	Yes		19.0
Iron	ug/L	2 / 2	33.0	Unfiltered	No	C	NA
Magnesium	ug/L	2 / 2	155000.0	Unfiltered	No	B	NA
Manganese	ug/L	2 / 2	20.0	Unfiltered	Yes		20.0
Potassium	ug/L	2 / 2	28000.0	Unfiltered	No	B	NA
Selenium	ug/L	1 / 2	3.0	Unfiltered	Yes		3.0
Silver	ug/L	2 / 2	14.0	Unfiltered	Yes		14.0
Sodium	ug/L	2 / 2	504000.0	Unfiltered	No	B	NA
Vanadium	ug/L	2 / 2	513.0	Unfiltered	Yes		513.0
Zinc	ug/L	2 / 2	47.0	Unfiltered	No	F	NA
Radium-226	pCi/L	2 / 2	1.1	Unfiltered	Yes		1.1
Technetium-99	pCi/L	2 / 2	4030.0	Unfiltered	Yes		4030.0
Thorium-230	pCi/L	1 / 2	0.4	Unfiltered	Yes		0.4
Uranium-234	pCi/L	2 / 2	1900.0	Unfiltered	Yes		1900.0
Uranium-235	pCi/L	2 / 2	120.0	Unfiltered	Yes		120.0
Uranium-238	pCi/L	2 / 2	6200.0	Unfiltered	Yes		6200.0
2-Nitrophenol	ug/L	1 / 2	4.0	Unfiltered	Yes	G	4.0
Acetone	ug/L	1 / 2	520.0	Unfiltered	Yes		520.0

Notes:
1 - Representative concentration is assumed to equal the maximum concentration detected.

5511

TABLE E.II-13
TOXICITY SCREENING CRITERIA FOR CHEMICALS

Constituent	Dose-Response Oral CSF (mg/Kg/day)$^{-1}$	Inhalation CSF (mg/Kg/day)$^{-1}$	Oral RfD (mg/Kg/day)	Inhalation RfD (mg/Kg/day)	EPA Part B Soil Screening Value[a] (mg/Kg)	EPA Part B Surface Water Screening Value[a] (mg/L)
aluminum	ND	ND	ND	ND	ND	ND
antimony	ND	ND	4.00E-04	ND	1.08E+01	1.46E-03
arsenic	1.75E+00	1.50E+01	3.00E-04	ND	3.66E-02	4.86E-06
barium	ND	ND	7.00E-02	1.43E-04	1.89E+03	2.56E-01
beryllium	4.30E+00	8.40E+00	5.00E-03	ND	1.49E-02	1.98E-06
boron	ND	ND	9.00E-02	5.71E-03	2.43E+03	3.28E-01
cadmium	ND	6.30E+00	1.00E-03	ND	2.70E+01	3.65E-03
chromium vi	ND	4.20E+01	5.00E-03	ND	1.35E+02	1.82E-02
cobalt	ND	ND	6.00E-02	3.00E-07	1.62E+03	2.19E-01
copper	ND	ND	3.70E-02	ND	9.99E+02	1.35E-01
cyanide	ND	ND	2.00E-02	ND	5.40E+02	7.30E-02
lead	ND	ND	ND	ND	ND	ND
magnesium	ND	ND	9.70E+00	ND	2.62E+05	3.54E+01
manganese	ND	ND	1.40E-01	1.14E-04	3.78E+03	5.11E-01
mercury	ND	ND	3.00E-04	8.57E-05	8.10E+00	1.09E-03
molybdenum	ND	ND	5.00E-03	ND	1.35E+02	1.82E-02
nickel	ND	8.40E-01	2.00E-02	ND	5.40E+02	7.30E-02
selenium	ND	ND	5.00E-03	ND	1.35E+02	1.82E-02
silver	ND	ND	5.00E-03	ND	1.35E+02	1.82E-02
thallium	ND	ND	7.00E-05	ND	1.89E+00	2.55E-04
uranium-total	ND	ND	3.00E-03	ND	8.10E+01	1.09E-02
vanadium	ND	ND	7.00E-03	ND	1.89E+02	2.55E-02
zinc	ND	ND	3.00E-01	ND	8.10E+03	1.09E+00
1,1,1-trichloroethane	ND	ND	ND	2.86E-01	ND	2.78E-01
1,1,2,2-tetrachloroethane	2.00E-01	2.03E-01	ND	ND	3.20E-01	8.84E-06
1,1,2-trichloroethane	5.70E-02	5.70E-02	4.00E-03	ND	1.12E+00	3.14E-05
1,1-dichloroethane	ND	ND	ND	1.43E-01	ND	1.39E-01
1,1-dichloroethene	6.10E-01	1.80E-01	9.00E-03	ND	1.05E-01	6.61E-06
1,2,4-trichlorobenzene	ND	ND	1.00E-02	2.57E-03	2.70E+02	2.34E-03
1,2-dichloroethane	9.10E-02	9.10E-02	ND	ND	7.03E-01	1.97E-05
1,2-dichloroethene	ND	ND	9.00E-03	ND	2.43E+02	3.28E-02
1,2-dichloropropane	ND	6.80E-02	ND	1.14E-03	ND	3.33E-05
1,4-dichlorobenzene	2.40E-02	ND	ND	2.29E-01	2.67E+00	3.54E-04
2,4,6-trichlorophenol	1.10E-02	1.10E-02	ND	ND	5.82E+00	1.63E-04
2,4-dichlorophenol	ND	ND	3.00E-03	ND	8.10E+01	1.09E-02
2,4-dinitrophenol	ND	ND	2.00E-03	ND	5.40E+01	7.30E-03
2,4-dinitrotoluene	6.80E-01	ND	2.00E-03	ND	9.41E-02	1.25E-05
2,6-dinitrotoluene	6.80E-01	ND	1.00E-03	ND	9.41E-02	1.25E-05
2-chlorophenol	ND	ND	5.00E-03	ND	1.35E+02	1.82E-02
2-hexanone	ND	ND	4.00E-02	ND	1.08E+03	1.46E-01
2-methylnaphthalene	ND	ND	ND	ND	ND	ND
2-nitroanaline	ND	ND	ND	5.71E-05	ND	5.56E-05
2-nitrophenol	ND	ND	ND	ND	ND	ND
3,3-dichlorobenzidene	4.50E-01	ND	ND	ND	1.42E-01	1.89E-05
3-chloropropene	ND	ND	ND	ND	ND	ND

5511

TABLE E.II-13 (con't)

Constituent	Dose-Response Oral CSF (mg/Kg/day)$^{-1}$	Inhalation CSF (mg/Kg/day)$^{-1}$	Oral RfD (mg/Kg/day)	Inhalation RfD (mg/Kg/day)	EPA Part B Soil Screening Value[a] (mg/Kg)	EPA Part B Surface Water Screening Value[a] (mg/L)
3-nitroanaline	ND	ND	3.00E-03	ND	8.10E+01	1.09E-02
4-chloro-3-methylphenol	ND	ND	ND	ND	ND	ND
4-nitrophenol	ND	ND	6.00E-02	ND	1.62E+03	2.19E-01
acetone	ND	ND	1.00E-01	ND	2.70E+03	3.65E-01
benzene	2.90E-02	2.92E-02	ND	ND	2.21E+00	6.14E-05
bis(2-ethylhexyl)phthalate	1.40E-02	ND	2.00E-02	ND	4.57E+00	6.07E-04
bromodichloromethane	6.20E-02	ND	2.00E-02	ND	1.03E+00	1.37E-04
bromoform	7.90E-03	3.90E-03	2.00E-02	ND	8.10E+00	1.08E-03
carbazole	2.00E-02	ND	ND	ND	3.20E+00	4.25E-04
carbon disulfide	ND	ND	1.00E-01	2.86E-03	2.70E+03	2.76E-03
carbon tetrachloride	1.31E-01	5.30E-02	7.00E-04	ND	4.89E-01	2.58E-05
chlorobenzene	ND	ND	2.00E-02	5.71E-03	5.40E+02	5.17E-03
chloroform	6.10E-03	8.10E-02	1.00E-02	ND	1.05E+01	2.74E-05
chloromethane	1.30E-02	6.30E-03	ND	ND	4.92E+00	2.32E-04
dibromochloromethane	8.40E-02	ND	2.00E-02	ND	7.62E-01	1.01E-04
hexachlorobenzene	1.60E+00	1.60E+00	8.00E-04	ND	4.00E-02	5.31E-06
hexachloroethane	1.40E-02	1.40E-02	1.00E-03	ND	4.57E+00	6.07E-04
methylene chloride	7.50E-03	1.60E-03	6.10E-02	8.57E-01	8.53E+00	6.30E-04
n-nitrosodiphenylamine	4.90E-03	ND	ND	ND	1.31E+01	1.73E-03
n-nitrosodipropylamine	7.00E+00	ND	ND	ND	9.14E-03	1.21E-06
pentachlorophenol	1.20E-01	ND	3.00E-02	ND	5.33E-01	7.08E-05
styrene	3.00E-02	ND	2.00E-01	2.86E-01	2.13E+00	2.83E-04
tetrachloroethene	5.20E-02	2.00E-03	1.00E-02	ND	1.23E+00	1.43E-04
toluene	ND	ND	2.00E-01	1.14E-01	5.40E+03	9.65E-02
tributyl phosphate	ND	ND	5.00E-03	ND	1.35E+02	1.82E-02
trichloroethene	1.10E-02	6.00E-03	ND	ND	5.82E+00	2.54E-04
vinyl chloride	1.90E+00	3.00E-01	ND	ND	3.37E-02	2.81E-06
acenaphthylene	ND	ND	ND	ND	ND	ND
benzo(g,h,i)perylene	ND	ND	ND	ND	ND	ND
fluoranthene	ND	ND	4.00E-02	ND	1.08E+03	1.46E-01
phenanthrene	ND	ND	ND	ND	ND	ND
benzo(a)anthracene	7.30E-01	6.10E-01	ND	ND	8.77E-02	1.16E-05
benzo(a)pyrene	7.30E+00	6.10E+00	ND	ND	8.77E-03	1.16E-06
benzo(b)fluoranthene	7.30E-01	6.10E-01	ND	ND	8.77E-02	1.16E-05
benzo(k)fluoranthene	7.30E-02	6.10E-02	ND	ND	8.77E-01	1.16E-04
chrysene	7.30E-03	6.10E-03	ND	ND	8.77E+00	1.16E-03
dibenzo(a,h)anthracene	7.30E+00	6.10E+00	ND	ND	8.77E-03	1.16E-06
indeno(1,2,3-cd)pyrene	7.30E-01	6.10E-01	ND	ND	8.77E-02	1.16E-05
4,4-ddd	2.40E-01	ND	ND	ND	2.67E-01	3.54E-05
4,4-dde	3.40E-01	ND	ND	ND	1.88E-01	2.50E-05
4,4-ddt	3.40E-01	3.40E-01	5.00E-04	ND	1.88E-01	2.50E-05
aldrin	1.70E+01	1.70E+01	3.00E-05	ND	3.76E-03	5.00E-07
alpha bhc	6.30E+00	6.30E+00	ND	ND	1.02E-02	1.35E-06
aroclor-1248	7.70E+00	ND	ND	ND	8.31E-03	1.10E-06

5511

TABLE E.II-13
(con't)

Constituent	Dose-Response Oral CSF (mg/Kg/day)$^{-1}$	Inhalation CSF (mg/Kg/day)$^{-1}$	Oral RfD (mg/Kg/day)	Inhalation RfD (mg/Kg/day)	EPA Part B Soil Screening Value[a] (mg/Kg)	EPA Part B Surface Water Screening Value[a] (mg/L)
aroclor-1254	7.70E+00	ND	ND	ND	8.31E-03	1.10E-06
aroclor-1260	7.70E+00	ND	ND	ND	8.31E-03	1.10E-06
beta bhc	1.80E+00	1.90E+00	ND	ND	3.56E-02	4.72E-06
chlorodane	1.30E+00	1.30E+00	6.00E-05	ND	4.92E-02	6.54E-06
delta bhc	ND	ND	ND	ND	ND	ND
diazinon	ND	ND	9.00E-04	ND	2.43E+01	3.28E-03
dieldrin	1.60E+01	1.60E+01	5.00E-05	ND	4.00E-03	5.31E-07
endosulfan I	ND	ND	ND	ND	ND	ND
endosulfan II	ND	ND	ND	ND	ND	ND
endrin	ND	ND	3.00E-04	ND	8.10E+00	1.09E-03
gamma chlorodane	ND	ND	ND	ND	ND	ND
heptachlor	4.50E+00	4.50E+00	5.00E-04	ND	1.42E-02	1.89E-06
heptachlor epoxide	9.10E+00	9.10E+00	1.30E-05	ND	7.03E-03	9.34E-07
lindane	ND	ND	3.00E-04	ND	8.10E+00	1.09E-03
malathion	ND	ND	2.00E-02	ND	5.40E+02	7.30E-02
methoxychlor	ND	ND	5.00E-03	ND	1.35E+02	1.82E-02
toxaphene	1.10E+00	1.10E+00	ND	ND	5.82E-02	7.73E-06
heptachlorodibenzofuran	1.50E+03	1.50E+03	ND	ND	4.27E-05	5.67E-09
heptachlorodibenzo-p-dioxin	1.50E+03	1.50E+03	ND	ND	4.27E-05	5.67E-09
hexachlorodibenzofuran	1.50E+04	1.50E+04	ND	ND	4.27E-06	5.67E-10
hexachlorodibenzo-p-dioxin	1.50E+04	1.50E+04	ND	ND	4.27E-06	5.67E-10
octachlorodibenzofuran	1.50E+02	1.50E+02	ND	ND	4.27E-04	5.67E-08
octachlorodibenzo-p-dioxin	1.50E+02	1.50E+02	ND	ND	4.27E-04	5.67E-08
pentachlorodibenzofuran	7.50E+03	7.50E+03	ND	ND	8.53E-06	1.13E-09
tetrachlorodibenzofuran	1.50E+04	1.50E+04	ND	ND	4.27E-06	5.67E-10
tetrachlorodibenzo-p-dioxin	1.50E+05	1.50E+05	ND	ND	4.27E-07	5.67E-11

Note:

[a] Screening value selected is lower of values based on cancer risk level of 10^{-7} or HQ of 0.1.

ND - No data.

where

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$ILCR_v$ = Incremental lifetime cancer risk from volatilization (unitless)
I_{wa} = Intake from drinking water (mg/kg-d)
SF_i = Slope factor (0.3 r-kg-d/mg-lifetime)

The risk for this receptor, pathway, and chemical is determined by substituting the lifetime intake calculated by Equation E.III-74 and the inhalation slope factor of vinyl chloride for SF_i into Equation E.III-75. This yields:

$$ILCR_v = (0.3 \text{ r-kg-d/mg-lifetime})(0.10 \text{ mg/d-kg}) \qquad \text{(E.III-76)}$$
$$ILCR_v = 0.030 \text{ r/lifetime}$$

Thus, each additional mg/L of vinyl chloride in water will yield a calculated excess risk of 3 x 10^{-2} r/lifetime for this receptor and pathway.

Dermal Contact:

32-U ~~Intake from dermal contact with household water containing vinyl chloride is calculated using the E{A's dermal guidance (EPA 1989a, 1992b, 1992c):~~

The following sample calculation shows the method used to quantify exposure via dermal contact with water (i.e. from swimming, showering, bathing, etc.) (EPA 1989a, 1992b, 1992c). In the example given below, dermal contact with household water containing vinyl chloride is calculated.

$$I_{ws} = (DA_{event})(EV)(EF)(ED)(CF)(SA)/(BW)(AT) \qquad \text{(E.III-77)}$$

where

I_{ws} = Intake though skin from showering or bathing (mg/kg-d)
DA_{event} = Absorbed dose per event (mg/cm^2-event)
EV = Event frequency (event/d)
SA = Surface area (cm^2)
EF = Exposure frequency (d/y)
ED = Exposure duration (y)
CF = Conversion factor (0.001 L/cm^3)
BW = Body weight (kg)
AT = Averaging time (for carcinogens, AT = 25,550 d)

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DA_{event} can be calculated as:

$$DA_{event} = (C_w)(2)(K_p)[(6)(TAO)(t_{event})/\pi]^{0.5} \text{ if } t_{event} < t^*, \text{ or}$$
$$DA_{event} = (C_w)(K_p)\{[(t_{event})+(2)(TAO)(1+3B)]/(1+B)\} \text{ if } t_{event} > t^*$$

where

C_w	= Concentration in water (mg/L)
K_p	= Permeability constant (0.0073 cm/h)
TAO	= Lag time (0.21 h)
B	= Partitioning coefficient (unitless)
t_{event}	= Time of event (0.25 h)
π	= Pi (3.14)

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E.III

Tables

TABLE E.III-2
INTAKES FOR CARCINOGENS FOR ON-PROPERTY GROUNDSKEEPER CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil			Buried Pit Material
Exposure Pathways:		Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Contaminants of Concern	Inhalation				
Radionuclides	pCi/life	pCi/life		pCi/life	mRem/life
Cs_{137+1d}	9.8E-02	7.0E+01	NA	6.4E-01	
Np_{237+1d}	6.1E-02	4.4E+01	NA	4.0E-01	
Pu_{238}	1.2E-02	8.8E+00	NA	8.0E-02	
$Pu_{239/240}$	2.4E-02	1.8E+01	NA	1.6E-01	
Ra_{226+8d}	1.7E-01	1.2E+02	NA	1.1E+00	
Ra_{228+1d}	2.7E-01	1.9E+02	NA	1.8E+00	
Sr_{90+1d}	1.9E-01	1.3E+02	NA	1.2E+00	
Tc_{99}	6.9E-01	4.9E+02	NA	4.5E+00	
Th_{228+7d}	9.6E-01	6.8E+02	NA	6.2E+00	
Th_{230}	1.8E+01	1.3E+04	NA	1.2E+02	
Th_{232}	6.7E-01	4.8E+02	NA	4.4E+00	
U_{234}	1.5E+01	1.0E+04	NA	9.4E+01	
U_{235+1D}	1.7E-01	1.6E+03	NA	1.5E+01	
U_{238+2d}	9.6E+01	6.9E+04	NA	6.3E+02	7.5E+01
Rn_{222+4d}	5.3E-01	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day		
arsenic	5.6E-10	4.0E-07	2.3E-08	NA	NA
beryllium	5.3E-11	3.8E-08	2.2E-08	NA	NA
cadmium	4.0E-10	2.9E-07	1.6E-07	NA	NA
lead	NA	NA	NA	NA	NA
nickel	NA	NA	NA	NA	NA
pcbs	9.7E-11	6.8E-08	1.2E-07	NA	NA
benzo(a)anthracene	6.8E-12	4.8E-09	NA	NA	NA
benzo(a)pyrene	2.9E-12	2.1E-09	NA	NA	NA
benzo(b)fluoranthene	4.1E-12	2.9E-09	NA	NA	NA
benzo(k)fluoranthene	3.5E-12	2.3E-09	NA	NA	NA
chrysene	NA	4.3E-09	NA	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
[a] Calculation of dose from penetrating radiation for groundskeeper is provided in Table E.IV-35.

TABLE E.III-3
INTAKES FOR TOXICANTS FOR ON-PROPERTY GROUNDSKEEPER CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	
cyanide	NA	NA	NA	NA
antimony	5.5E-09	3.8E-06	2.2E-06	NA
arsenic	1.6E-09	1.1E-06	6.5E-08	NA
barium	NA	NA	NA	NA
beryllium	1.5E-10	1.1E-07	6.1E-08	NA
cadmium	1.1E-09	8.0E-07	4.6E-07	NA
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
thallium	1.3E-10	9.6E-08	5.5E-08	NA
vanadium	NA	NA	NA	NA
thorium-total	1.1E-09	7.9E-07	1.4E-06	NA
uranium-total	7.9E-08	5.7E-05	3.3E-05	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

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TABLE E.III–4
INTAKES FOR CARCINOGENS FOR RME OFF–PROPERTY FARMER, CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life
Cs_{137+1d}	5.0E−02	8.1E−01	1.4E+00	2.0E+00
Np_{237+1d}	3.1E−02	4.2E−01	2.4E−03	8.7E−04
Pu_{238}	6.3E−03	7.9E−02	2.9E−06	2.3E−06
$Pu_{239/240}$	1.2E−02	1.6E−01	1.2E−05	9.8E−06
Ra_{226+8d}	8.8E−02	1.2E+00	5.1E−02	3.6E−01
Ra_{228+1d}	1.4E−01	1.7E+00	2.4E−02	1.8E−01
Sr_{90+1d}	9.3E−02	1.5E+00	9.1E−02	1.8E+00
Tc_{99}	3.5E−01	4.6E+00	2.8E+00	1.3E+01
Th_{228+7d}	4.9E−01	6.1E+00	1.9E−03	6.4E−03
Th_{230}	9.3E+00	1.2E+02	1.4E−01	4.7E−01
Th_{232}	3.4E−01	4.4E+00	5.3E−03	1.8E−02
U_{234}	7.3E+00	9.3E+01	1.0E+00	1.2E+01
U_{235+1D}	1.1E+00	1.4E+01	1.6E−01	1.9E+00
U_{238+2d}	5.0E+01	6.3E+02	7.0E+00	8.4E+01
Rn_{222+4d}	2.6E−01	1.8E+00	NA	NA
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
arsenic	2.8E−10	4.1E−09	1.0E−09	1.3E−10
beryllium	2.7E−11	4.0E−10	7.7E−11	2.8E−13
cadmium	2.1E−10	2.8E−08	3.7E−09	2.7E−08
lead	NA	NA	NA	NA
nickel	NA	NA	NA	NA
pcbs	4.9E−11	2.3E−09	6.6E−09	8.3E−09
benzo(a)anthracene	3.4E−12	4.6E−11	2.6E−11	3.3E−11
benzo(a)pyrene	1.5E−12	1.9E−11	2.6E−11	3.3E−11
benzo(b)fluoranthene	2.1E−12	2.6E−11	1.3E−10	1.7E−10
benzo(k)fluoranthene	1.6E−12	2.1E−11	2.2E−10	2.8E−10
chrysene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
benzene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

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TABLE E.III-5
INTAKES FOR TOXICANTS FOR RME OFF-PROPERTY FARMER, CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA
antimony	9.7E-10	2.4E-08	6.6E-09	2.6E-09
arsenic	2.8E-10	4.1E-09	1.0E-09	1.3E-10
barium	NA	NA	NA	NA
beryllium	2.7E-11	4.0E-10	7.7E-11	2.8E-13
cadmium	2.1E-10	2.8E-08	3.7E-09	2.7E-08
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
thallium	2.4E-11	3.2E-10	2.3E-09	4.5E-10
vanadium	NA	NA	NA	NA
thorium-total	2.0E-10	2.6E-09	3.1E-12	1.0E-11
uranium-total	1.4E-08	1.8E-07	2.0E-09	2.4E-08
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

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TABLE E.III-6
INTAKES FOR CARCINOGENS FOR RME OFF-PROPERTY CHILD, CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life
Cs_{137+1d}	2.6E-03	6.0E-02	4.7E-02	3.9E-01
Np_{237+1d}	1.6E-03	3.1E-02	7.9E-05	1.7E-04
Pu_{238}	3.2E-04	5.9E-03	9.5E-08	4.5E-07
$Pu_{239/240}$	6.4E-04	1.2E-02	4.1E-07	1.9E-06
Ra_{226+8d}	4.5E-03	9.1E-02	1.7E-03	7.1E-02
Ra_{228+1d}	7.1E-03	1.3E-01	8.0E-04	3.4E-02
Sr_{90+1d}	4.8E-03	1.1E-01	3.0E-03	3.5E-01
Tc_{99}	1.8E-02	3.4E-01	9.3E-02	2.6E+00
Th_{228+7d}	2.5E-02	4.5E-01	6.2E-05	1.2E-03
Th_{230}	4.8E-01	8.9E+00	4.7E-03	9.2E-02
Th_{232}	1.8E-02	3.3E-01	1.8E-04	3.4E-03
U_{234}	3.8E-01	6.9E+00	3.4E-02	2.4E+00
U_{235+1D}	5.8E-02	1.1E+00	5.3E-03	3.7E-01
U_{238+2d}	2.6E+00	4.7E+01	2.3E-01	1.6E+01
Rn_{222+4d}	1.3E-02	1.2E-01	NA	NA
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
arsenic	6.8E-11	1.4E-09	1.6E-10	1.1E-10
beryllium	6.4E-12	1.4E-10	1.2E-11	2.5E-13
cadmium	5.0E-11	9.6E-09	5.8E-10	2.5E-08
lead	NA	NA	NA	NA
nickel	NA	NA	NA	NA
pcbs	1.2E-11	7.9E-10	1.0E-09	7.5E-09
benzo(a)anthracene	8.3E-13	1.6E-11	4.0E-12	2.9E-11
benzo(a)pyrene	3.6E-13	6.7E-12	4.0E-12	3.0E-11
benzo(b)fluoranthene	5.0E-13	9.2E-12	2.1E-11	1.6E-10
benzo(k)fluoranthene	3.9E-13	7.3E-12	3.4E-11	2.5E-10
chrysene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
benzene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

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TABLE E.III-7·
INTAKES FOR TOXICANTS FOR RME OFF-PROPERTY CHILD, CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA
antimony	2.7E-09	9.8E-08	1.2E-08	2.8E-08
arsenic	NA	NA	NA	NA
barium	NA	NA	NA	NA
beryllium	7.5E-11	1.6E-09	1.4E-10	2.9E-12
cadmium	5.8E-10	1.1E-07	6.8E-09	2.9E-07
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
vanadium	NA	NA	NA	NA
thorium-total	5.6E-10	1.0E-08	5.6E-12	1.1E-10
uranium-total	4.0E-08	7.3E-07	3.6E-09	2.6E-07
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

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TABLE E.III-8
INTAKES FOR CARCINOGENS FOR TRESPASSING YOUTH
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil			Buried Pit Material
Exposure Pathways: Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure*
Radionuclides	pCi/life	pCi/life		pCi/life	mRem/life
Cs_{137+1d}	1.2E−02	1.2E+01	NA	2.3E−01	
Np_{237+1d}	7.3E−03	7.8E+00	NA	1.4E−01	
Pu_{238}	1.5E−03	1.6E+00	NA	2.8E−02	
$Pu_{239/240}$	2.9E−03	3.1E+00	NA	5.7E−02	
Ra_{226+8d}	2.0E−02	2.2E+01	NA	4.0E−01	
Ra_{228+1d}	3.2E−02	3.4E+01	NA	6.3E−01	
Sr_{90+1d}	2.3E−02	2.3E+01	NA	4.3E−01	
Tc_{99}	8.1E−02	8.7E+01	NA	1.6E+00	
Th_{228+7d}	1.1E−01	1.2E+02	NA	2.2E+00	
Th_{230}	2.1E+00	2.3E+03	NA	4.2E+01	
Th_{232}	8.0E−02	8.6E+01	NA	1.6E+00	
U_{234}	1.7E+00	1.8E+03	NA	3.3E+01	
U_{235+1D}	2.0E−02	2.9E+02	NA	5.3E+00	
U_{238+2d}	1.1E+01	1.2E+04	NA	2.2E+02	2.8E+01
Rn_{222+4d}	6.2E−02	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day		
arsenic	1.1E−10	1.2E−07	2.0E−08	NA	NA
beryllium	1.0E−11	1.1E−08	1.8E−08	NA	NA
cadmium	7.7E−11	8.3E−08	1.4E−07	NA	NA
lead	NA	NA	NA	NA	NA
nickel	NA	NA	NA	NA	NA
pcbs	1.9E−11	2.0E−08	1.0E−07	NA	NA
benzo(a)anthracene	1.3E−12	1.4E−09	NA	NA	NA
benzo(a)pyrene	5.7E−13	6.0E−10	NA	NA	NA
benzo(b)fluoranthene	7.9E−13	8.4E−10	NA	NA	NA
benzo(k)fluoranthene	6.8E−13	6.5E−10	NA	NA	NA
chrysene	NA	1.2E−09	NA	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
* Calculation of dose from penetrating radiation for trespassing youth is provided in Table E.IV−36.

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TABLE E.III-9
INTAKES FOR TOXICANTS FOR TRESPASSING YOUTH
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	
cyanide	NA	NA	NA	NA
antimony	2.2E-09	2.3E-06	3.9E-06	NA
arsenic	6.3E-10	6.8E-07	1.1E-07	NA
barium	NA	NA	NA	NA
beryllium	5.9E-11	6.4E-08	1.1E-07	NA
cadmium	4.5E-10	4.9E-07	8.2E-07	NA
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
thallium	5.4E-11	5.8E-08	9.7E-08	NA
vanadium	NA	NA	NA	NA
thorium-total	4.5E-10	4.8E-07	2.4E-06	NA
uranium-total	3.2E-08	3.4E-05	5.8E-05	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

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TABLE E.III-10
INTAKES FOR CARCINOGENS FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Soil		Surface Water	
Exposure Pathways: / Contaminants of Concern	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life
Cs_{137+1d}	1.3E+05	1.8E+05	1.3E+06	1.9E+06
Np_{237+1d}	2.8E+02	1.0E+02	NA	NA
Pu_{238}	4.8E-02	3.8E-02	NA	NA
$Pu_{239/240}$	9.6E-02	7.7E-02	NA	NA
Ra_{226+8d}	8.0E+02	5.8E+03	4.7E+01	3.4E+02
Ra_{228+1d}	1.2E+03	9.0E+03	6.1E+02	4.6E+03
Sr_{90+1d}	1.0E+05	2.1E+06	2.1E+04	4.3E+05
Tc_{99}	4.2E+07	2.0E+08	7.8E+06	3.8E+07
Th_{228+7d}	4.6E+01	1.5E+02	NA	NA
Th_{230}	8.7E+02	2.9E+03	6.5E-01	2.2E+00
Th_{232}	3.3E+01	1.1E+02	NA	NA
U_{234}	4.0E+04	4.8E+05	6.1E+04	7.6E+05
U_{235+1D}	6.4E+03	7.6E+04	3.4E+03	4.2E+04
U_{238+2d}	2.7E+05	3.2E+06	1.3E+05	1.6E+06
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
arsenic	4.2E-05	5.1E-06	2.8E-06	3.5E-07
beryllium	7.9E-07	2.9E-09	NA	NA
cadmium	9.3E-05	6.7E-04	NA	NA
lead	NA	NA	1.9E-06	6.5E-06
nickel	NA	NA	1.8E-04	1.2E-04
pcbs	4.4E-05	5.5E-05	NA	NA
benzo(a)anthracene	1.6E-06	2.1E-06	NA	NA
benzo(a)pyrene	1.2E-06	1.5E-06	NA	NA
benzo(b)fluoranthene	4.5E-06	5.8E-06	NA	NA
benzo(k)fluoranthene	5.9E-06	7.4E-06	NA	NA
chrysene	1.5E-06	1.9E-06	NA	NA
chloroform	NA	NA	2.6E-10	3.6E-10
tetrachloroethene	NA	NA	1.4E-09	1.8E-09
benzene	NA	NA	1.2E-08	1.6E-08
methylene chloride	NA	NA	3.2E-11	7.2E-11

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

5511

TABLE E.III-11
INTAKES FOR TOXICANTS FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Soil		Surface Water	
Exposure Pathways:	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	2.0E-09	2.6E-09
antimony	3.0E-04	1.2E-04	9.3E-06	3.7E-06
arsenic	4.2E-05	5.1E-06	2.8E-06	3.5E-07
barium	NA	NA	7.7E-05	7.2E-04
beryllium	7.9E-07	2.9E-09	NA	NA
cadmium	9.3E-05	6.7E-04	NA	NA
copper	NA	NA	4.7E-04	2.8E-04
lead	NA	NA	2.3E-06	7.7E-06
manganese	NA	NA	2.5E-06	8.9E-06
nickel	NA	NA	1.8E-04	1.2E-04
selenium	NA	NA	3.1E-05	3.3E-05
silver	NA	NA	2.0E-05	5.4E-04
thallium	2.0E-05	4.0E-06	NA	NA
vanadium	NA	NA	1.3E-04	4.2E-06
thorium-total	1.9E-08	6.5E-08	NA	NA
uranium-total	7.9E-05	9.4E-04	NA	NA
chloroform	NA	NA	2.6E-10	3.6E-10
tetrachloroethene	NA	NA	1.4E-09	1.8E-09
methylene chloride	NA	NA	3.2E-11	7.2E-11
toluene	NA	NA	5.2E-09	7.3E-09
2-nitrophenol	NA	NA	4.0E-10	5.2E-10
acetone	NA	NA	5.9E-11	1.3E-10

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

TABLE E.III-12
INTAKES FOR CARCINOGENS FOR TRESPASSING YOUTH
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure*
Radionuclides	pCi/life	pCi/life		pCi/life	pCi/life		pCi/life		pCi/life	mRem/life
Cs_{137+1d}	6.6E+00	7.8E+01	NA	1.4E+00	5.1E-02	NA	3.7E+00	NA	7.1E-02	
Np_{237+1d}	5.2E+00	5.8E+01	NA	1.0E+00	8.4E-01	NA	1.9E+00	NA	3.6E-02	
Pu_{238}	2.9E-01	4.5E+00	NA	8.1E-02	2.2E-02	NA	1.5E+00	NA	2.8E-02	
$Pu_{239/240}$	1.3E+00	2.0E+01	NA	3.5E-01	5.4E-03	NA	3.7E-01	NA	7.1E-03	
Ra_{226+8d}	3.9E+01	3.6E+02	NA	6.5E+00	NA	NA	NA	NA	NA	
Ru_{106}	3.7E-01	5.7E+01	NA	1.0E+00	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.9E+00	3.8E+01	NA	6.9E-01	1.6E+01	NA	6.4E+00	NA	1.2E-01	
Tc_{99}	1.9E+03	2.5E+03	NA	4.6E+01	3.7E+03	NA	1.8E+01	NA	3.3E-01	
Th_{230}	1.0E+03	1.1E+04	NA	2.1E+02	1.2E+00	NA	2.8E+02	NA	5.3E+00	
$Th_{232+10d}$	3.5E+01	4.2E+02	NA	7.5E+00	6.9E-02	NA	1.6E+01	NA	3.1E-01	
U_{234}	2.3E+02	3.2E+03	NA	5.8E+01	4.6E+02	NA	2.2E+02	NA	4.3E+00	
U_{235+1D}	6.2E+01	5.1E+02	NA	9.3E+00	5.2E+01	NA	2.5E+01	NA	4.8E-01	
U_{238+2d}	8.3E+02	1.3E+04	NA	2.4E+02	1.9E+03	NA	9.0E+02	NA	1.7E+01	1.2E+01
Rn_{222+4d}	7.5E+00	NA	NA	NA	NA	NA	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		
arsenic	2.8E-06	2.0E-05	4.5E-06	NA	2.1E-09	3.0E-10	1.7E-08	1.2E-08	NA	NA
beryllium	2.3E-09	3.0E-08	6.7E-08	NA	5.2E-11	7.6E-12	2.7E-09	1.9E-08	NA	NA
cadmium	3.2E-09	8.6E-08	1.9E-07	NA	9.7E-10	1.4E-10	2.0E-08	1.4E-07	NA	NA
chromium vi	1.9E-08	4.0E-07	8.8E-07	NA	8.0E-10	2.3E-10	4.9E-08	3.4E-07	NA	NA
lead	2.8E-06	7.2E-07	1.6E-06	NA	4.5E-10	2.6E-13	5.4E-08	3.8E-07	NA	NA
nickel	4.1E-08	6.9E-07	7.6E-08	NA	3.8E-09	5.6E-11	1.0E-07	3.5E-08	NA	NA
pcbs	6.6E-10	1.8E-08	1.2E-07	NA	4.5E-12	4.8E-09	5.5E-09	1.1E-07	NA	NA
benzo(a)anthracene	2.8E-11	1.1E-09	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	2.3E-11	5.4E-10	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	4.3E-11	8.5E-10	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	4.9E-13	4.4E-10	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	2.8E-11	1.0E-09	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.0E-11	6.5E-11	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	3.6E-11	2.3E-10	1.5E-09	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	1.0E-10	6.5E-10	4.3E-08	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	9.2E-13	6.1E-12	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	3.8E-15	2.2E-13	1.5E-12	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	1.6E-12	1.1E-11	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	1.3E-13	7.8E-12	5.2E-11	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	1.6E-14	9.7E-13	6.4E-12	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	1.5E-12	8.9E-11	5.9E-10	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	8.5E-14	5.1E-12	3.4E-11	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	9.1E-10	3.3E-09	2.9E-07	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
* Calculation of dose from penetrating radiation for trespassing youth is provided in Table E.IV-37.

TABLE E.III-13
INTAKES FOR TOXICANTS FOR TRESPASSING YOUTH
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	
cyanide	NA	NA	NA	NA	1.0E-06	1.5E-07	NA	NA	NA
antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA
arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA
barium	NA	NA	NA	NA	NA	NA	NA	NA	NA
beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA
chromium vi	1.1E-07	2.3E-06	5.1E-06	NA	4.7E-09	6.8E-10	2.8E-07	2.0E-06	NA
cobalt	2.4E-08	9.2E-07	2.0E-06	NA	9.3E-09	1.4E-09	2.1E-07	1.4E-06	NA
copper	5.9E-06	6.7E-05	1.5E-05	NA	6.7E-08	9.8E-09	3.4E-07	2.4E-07	NA
lead	1.6E-05	4.2E-06	9.2E-06	NA	2.6E-09	3.8E-10	3.2E-07	2.2E-06	NA
manganese	9.3E-06	1.1E-04	2.4E-04	NA	1.6E-06	2.3E-07	1.1E-05	8.0E-05	NA
mercury	2.3E-09	2.2E-08	4.8E-08	NA	4.9E-09	7.1E-10	NA	NA	NA
molybdenum	4.5E-07	5.5E-06	1.2E-05	NA	2.3E-08	3.4E-09	8.5E-08	6.0E-07	NA
nickel	2.4E-07	4.0E-06	8.9E-06	NA	2.2E-08	6.5E-09	5.8E-07	4.1E-06	NA
selenium	4.1E-08	3.6E-07	7.9E-07	NA	4.0E-10	2.3E-11	NA	NA	NA
silver	3.1E-08	8.1E-07	1.8E-07	NA	2.4E-08	3.6E-09	1.8E-07	1.2E-07	NA
thallium	2.9E-08	3.1E-07	6.8E-07	NA	2.3E-10	1.3E-13	1.4E-08	9.7E-08	NA
vanadium	2.7E-06	3.6E-05	7.9E-05	NA	9.6E-09	1.4E-09	3.9E-07	2.7E-06	NA
thorium-total	3.0E-08	1.1E-05	1.2E-04	NA	NA	NA	1.5E-05	5.1E-04	NA
uranium-total	5.7E-06	5.0E-05	1.1E-04	NA	3.0E-05	4.4E-06	NA	NA	NA
fluoride	1.1E-06	1.5E-04	1.6E-05	NA	NA	NA	NA	NA	NA
acenaphthylene	4.4E-11	2.8E-10	6.2E-10	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	7.3E-11	4.7E-10	1.0E-10	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	5.9E-10	3.8E-09	8.4E-09	NA	NA	NA	NA	NA	NA
phenanthrene	2.6E-10	1.7E-09	1.1E-08	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	7.7E-12	5.0E-11	3.3E-09	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	5.3E-09	1.9E-08	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

TABLE E.III-14
INTAKES FOR CARCINOGENS FOR GREAT MIAMI RIVER USER
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Surface Water								
Exposure Pathways: / Contaminants of Concern	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	Dermal Contact while Swimming	Incidental Ingestion while Swimming	Ingestion of Fish
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life				pCi/life	pCi/life
Cs_{137+1d}	1.4E-01	5.5E-02	5.7E-02	8.1E-02	NA	NA	NA	7.6E-05	3.2E+00
Np_{237+1d}	2.3E+00	7.3E-01	2.5E-03	9.4E-04	NA	NA	NA	1.3E-03	2.6E-01
Pu_{238}	5.9E-02	1.8E-02	3.2E-07	2.7E-07	NA	NA	NA	3.3E-05	1.7E-02
$Pu_{239/240}$	1.5E-02	4.4E-03	8.6E-08	7.1E-08	NA	NA	NA	8.2E-06	4.2E-03
Ra_{226+8d}	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ru_{106}	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sr_{90+1d}	4.3E+01	1.7E+01	6.2E-01	1.3E+01	NA	NA	NA	2.4E-02	1.5E+01
Tc_{99}	9.9E+03	3.1E+03	1.2E+03	6.0E+03	NA	NA	NA	5.5E+00	1.7E+03
Th_{230}	3.2E+00	9.8E-01	2.5E-04	8.7E-04	NA	NA	NA	1.8E-03	1.1E+00
$Th_{232+10d}$	1.9E-01	5.7E-02	1.5E-05	5.0E-05	NA	NA	NA	1.0E-04	6.4E-02
U_{234}	1.2E+03	3.7E+02	2.7E+00	3.4E+01	NA	NA	NA	6.9E-01	2.9E+01
U_{235+1D}	1.4E+02	4.2E+01	3.1E-01	3.9E+00	NA	NA	NA	7.8E-02	3.2E+00
U_{238+2d}	5.0E+03	1.5E+03	1.1E+01	1.4E+02	NA	NA	NA	2.8E+00	1.2E+02
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
arsenic	2.7E-09	9.8E-10	1.4E-10	1.6E-11	NA	7.9E-12	1.7E-12	1.5E-12	1.4E-09
beryllium	8.5E-11	3.1E-11	2.3E-12	8.5E-15	NA	2.4E-13	5.2E-14	4.7E-14	1.9E-11
cadmium	1.6E-09	6.2E-09	4.3E-10	3.1E-09	NA	4.6E-12	9.9E-13	9.0E-13	1.5E-09
chromium vi	1.3E-09	7.0E-10	1.8E-10	2.0E-10	NA	7.7E-12	1.6E-12	7.5E-13	2.5E-10
lead	7.4E-10	6.4E-10	2.5E-11	8.3E-11	NA	8.5E-15	1.8E-15	4.1E-13	4.2E-10
nickel	6.3E-09	1.3E-08	2.8E-09	1.9E-09	NA	1.8E-12	3.9E-13	3.5E-12	3.4E-09
pcbs	7.4E-12	9.6E-12	9.3E-12	1.2E-11	NA	3.1E-10	2.0E-11	4.1E-15	1.9E-09
benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

TABLE E.III-15
INTAKES FOR TOXICANTS FOR GREAT MIAMI RIVER USER
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Surface Water								
Exposure Pathways:	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	Dermal Contact while Swimming	Incidental Ingestion while Swimming	Ingestion of Fish
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA
antimony	1.9E-08	1.2E-08	1.8E-09	7.4E-10	NA	5.4E-11	1.2E-11	1.1E-11	2.2E-10
arsenic	2.7E-09	9.8E-10	1.4E-10	1.6E-11	NA	7.9E-12	1.7E-12	1.5E-12	1.4E-09
barium	6.8E-09	6.4E-09	2.5E-10	2.3E-09	NA	2.0E-11	4.2E-12	3.8E-12	NA
beryllium	8.5E-11	3.1E-11	2.3E-12	8.5E-15	NA	2.4E-13	5.2E-14	4.7E-14	1.9E-11
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	1.6E-09	6.2E-09	4.3E-10	3.1E-09	NA	4.6E-12	9.9E-13	9.0E-13	1.5E-09
chromium vi	1.3E-09	7.0E-10	1.8E-10	2.0E-10	NA	7.7E-12	1.6E-12	7.5E-13	2.5E-10
cobalt	2.6E-09	1.3E-09	1.5E-09	6.2E-10	NA	3.0E-12	6.5E-13	1.5E-12	NA
copper	1.9E-08	3.4E-08	1.8E-08	1.1E-08	NA	5.4E-11	1.2E-11	1.1E-11	4.4E-08
lead	7.4E-10	6.4E-10	2.5E-11	8.3E-11	NA	8.5E-15	1.8E-15	4.1E-13	4.2E-10
manganese	4.4E-07	3.2E-07	1.6E-08	5.5E-08	NA	1.3E-09	2.7E-10	2.4E-10	NA
mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA
molybdenum	6.6E-09	3.7E-09	2.0E-09	2.0E-09	NA	1.9E-11	4.0E-12	3.7E-12	NA
nickel	6.3E-09	1.3E-08	2.8E-09	1.9E-09	NA	1.8E-12	3.9E-13	3.5E-12	3.4E-09
selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA
silver	6.8E-09	8.0E-09	2.8E-09	7.4E-08	NA	1.2E-11	2.5E-12	3.8E-12	2.5E-07
thallium	6.6E-11	2.1E-11	4.7E-11	9.6E-12	NA	1.9E-13	4.0E-14	3.7E-14	NA
vanadium	2.7E-09	1.1E-09	1.3E-10	4.2E-12	NA	7.9E-12	1.7E-12	1.5E-12	NA
thorium-total	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	8.5E-06	2.6E-06	1.9E-08	2.3E-07	NA	2.4E-08	5.2E-09	4.7E-09	2.0E-10
fluoride	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

TABLE E.III-16
INTAKES FOR CARCINOGENS FOR EXPANDED TRESPASSER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Radionuclides	pCi/life	pCi/life		pCi/life	pCi/life		pCi/life		pCi/life	mRem/life
Cs_{137+1d}	1.0E+01	1.3E+02	NA	3.2E+00	5.1E-02	NA	3.7E+00	NA	7.1E-02	
Np_{237+1d}	8.2E+00	9.6E+01	NA	2.4E+00	8.4E-01	NA	1.9E+00	NA	3.6E-02	
Pu_{238}	4.6E-01	7.4E+00	NA	1.9E-01	2.2E-02	NA	1.5E+00	NA	2.8E-02	
$Pu_{239/240}$	2.0E+00	3.3E+01	NA	8.2E-01	5.4E-03	NA	3.7E-01	NA	7.1E-03	
Ra_{226+8d}	6.2E+01	6.0E+02	NA	1.5E+01	NA	NA	NA	NA	NA	
Ru_{106}	5.9E-01	9.4E+01	NA	2.4E+00	NA	NA	NA	NA	NA	
Sr_{90+1d}	3.0E+00	6.4E+01	NA	1.6E+00	1.6E+01	NA	6.4E+00	NA	1.2E-01	
Tc_{99}	3.0E+03	4.2E+03	NA	1.1E+02	3.7E+03	NA	1.8E+01	NA	3.3E-01	
Th_{230}	1.6E+03	1.9E+04	NA	4.8E+02	1.2E+00	NA	2.8E+02	NA	5.3E+00	
$Th_{232+10d}$	5.6E+01	6.9E+02	NA	1.7E+01	6.9E-02	NA	1.6E+01	NA	3.1E-01	
U_{234}	3.6E+02	5.4E+03	NA	1.3E+02	4.6E+02	NA	2.2E+02	NA	4.3E+00	
U_{235+1D}	9.8E+01	8.5E+02	NA	2.1E+01	5.2E+01	NA	2.5E+01	NA	4.8E-01	
U_{238+2d}	1.3E+03	2.2E+04	NA	5.4E+02	1.9E+03	NA	9.0E+02	NA	1.7E+01	4.2E+01
Rn_{222+4d}	1.2E+01	NA	NA	NA	NA	NA	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		
arsenic	3.9E-06	2.9E-05	1.7E-05	NA	2.1E-09	3.0E-10	1.7E-08	1.2E-08	NA	NA
beryllium	3.1E-09	4.4E-08	2.6E-07	NA	5.2E-11	7.6E-12	2.7E-09	1.9E-08	NA	NA
cadmium	4.4E-09	1.2E-07	7.3E-07	NA	9.7E-10	1.4E-10	2.0E-08	1.4E-07	NA	NA
chromium vi	2.6E-08	5.7E-07	3.4E-06	NA	8.0E-10	2.3E-10	4.9E-08	3.4E-07	NA	NA
lead	3.9E-06	1.0E-06	6.1E-06	NA	4.5E-10	2.6E-13	5.4E-08	3.8E-07	NA	NA
nickel	5.7E-08	9.9E-07	2.9E-07	NA	3.8E-09	5.6E-11	1.0E-07	3.5E-08	NA	NA
pcbs	9.1E-10	2.6E-08	4.7E-07	NA	4.5E-12	4.8E-09	5.5E-09	1.1E-07	NA	NA
benzo(a)anthracene	3.9E-11	1.6E-09	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	3.1E-11	7.9E-10	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	6.0E-11	1.2E-09	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	6.8E-13	6.4E-10	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	3.9E-11	1.5E-09	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.4E-11	9.4E-11	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	4.9E-11	3.3E-10	5.9E-09	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	1.4E-10	9.4E-10	1.7E-07	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	1.3E-12	2.3E-11	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	5.2E-15	3.2E-13	5.6E-12	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	2.3E-12	4.1E-11	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	1.8E-13	1.1E-11	2.0E-10	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	2.3E-14	1.4E-12	2.5E-11	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	2.1E-12	1.3E-10	2.3E-09	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	1.2E-13	7.3E-12	1.3E-10	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	1.2E-09	4.7E-09	1.1E-06	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
[a] Calculation of dose from penetrating radiation for expanded trespasser is provided in Table E.IV-33.

TABLE E.III-17
INTAKES FOR TOXICANTS FOR EXPANDED TRESPASSER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	
cyanide	NA	NA	NA	NA	1.0E-06	1.5E-07	NA	NA	NA
antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA
arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA
barium	NA	NA	NA	NA	NA	NA	NA	NA	NA
beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA
chromium vi	1.3E-07	2.9E-06	1.4E-05	NA	4.7E-09	6.8E-10	2.8E-07	2.0E-06	NA
cobalt	2.9E-08	1.1E-06	5.6E-06	NA	9.3E-09	1.4E-09	2.1E-07	1.4E-06	NA
copper	7.0E-06	8.3E-05	4.1E-05	NA	6.7E-08	9.8E-09	3.4E-07	2.4E-07	NA
lead	1.9E-05	5.2E-06	2.6E-05	NA	2.6E-09	3.8E-10	3.2E-07	2.2E-06	NA
manganese	1.1E-05	1.3E-04	6.6E-04	NA	1.6E-06	2.3E-07	1.1E-05	8.0E-05	NA
mercury	2.7E-09	2.7E-08	1.3E-07	NA	4.9E-09	7.1E-10	NA	NA	NA
molybdenum	5.3E-07	6.8E-06	3.4E-05	NA	2.3E-08	3.4E-09	8.5E-08	6.0E-07	NA
nickel	2.9E-07	5.0E-06	2.4E-05	NA	2.2E-08	6.5E-09	5.8E-07	4.1E-06	NA
selenium	4.8E-08	4.4E-07	2.2E-06	NA	4.0E-10	2.3E-11	NA	NA	NA
silver	3.6E-08	1.0E-06	4.9E-07	NA	2.4E-08	3.6E-09	1.8E-07	1.2E-07	NA
thallium	3.4E-08	3.8E-07	1.9E-06	NA	2.3E-10	1.3E-13	1.4E-08	9.7E-08	NA
vanadium	3.2E-06	4.4E-05	2.2E-04	NA	9.6E-09	1.4E-09	3.9E-07	2.7E-06	NA
thorium-total	3.5E-08	1.4E-05	3.4E-04	NA	NA	NA	1.5E-05	5.1E-04	NA
uranium-total	6.8E-06	6.2E-05	3.1E-04	NA	3.0E-05	4.4E-06	NA	NA	NA
fluoride	1.3E-06	1.8E-04	4.5E-05	NA	NA	NA	NA	NA	NA
acenaphthylene	5.2E-11	3.5E-10	1.7E-09	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	8.6E-11	5.8E-10	2.9E-10	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	7.0E-10	4.7E-09	2.3E-08	NA	NA	NA	NA	NA	NA
phenanthrene	3.1E-10	2.1E-09	3.1E-08	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	9.1E-12	6.2E-11	9.1E-09	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	6.2E-09	2.4E-08	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

5511

TABLE E.III-18
INTAKES FOR CARCINOGENS FOR ON-PROPERTY GROUNDSKEEPER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material			Buried Pit Material
Exposure Pathways:		Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Contaminants of Concern	Inhalation				
Radionuclides	pCi/life	pCi/life		pCi/life	mRem/life
Cs_{137+1d}	5.6E+01	5.7E+02	NA	5.2E+00	
Np_{237+1d}	4.4E+01	4.3E+02	NA	3.9E+00	
Pu_{238}	2.4E+00	3.3E+01	NA	3.0E-01	
$Pu_{239/240}$	1.1E+01	1.5E+02	NA	1.3E+00	
Ra_{226+8d}	3.3E+02	2.7E+03	NA	2.4E+01	
Ru_{106}	3.2E+00	4.2E+02	NA	3.8E+00	
Sr_{90+1d}	1.6E+01	2.8E+02	NA	2.6E+00	
Tc_{99}	1.6E+04	1.9E+04	NA	1.7E+02	
Th_{230}	8.8E+03	8.5E+04	NA	7.7E+02	
$Th_{232+10d}$	3.0E+02	3.1E+03	NA	2.8E+01	
U_{234}	1.9E+03	2.4E+04	NA	2.2E+02	
U_{235+1D}	5.3E+02	3.8E+03	NA	3.5E+01	
U_{238+2d}	7.0E+03	9.6E+04	NA	8.8E+02	7.5E+01
Rn_{222+4d}	6.3E+01	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day		
arsenic	1.5E-05	9.2E-05	5.3E-06	NA	NA
beryllium	1.2E-08	1.4E-07	7.9E-08	NA	NA
cadmium	1.7E-08	3.9E-07	2.2E-07	NA	NA
chromium vi	9.8E-08	1.8E-06	1.0E-06	NA	NA
lead	1.5E-05	3.2E-06	1.9E-06	NA	NA
nickel	2.2E-07	3.1E-06	8.9E-08	NA	NA
pcbs	3.4E-09	8.3E-08	1.4E-07	NA	NA
benzo(a)anthracene	1.5E-10	5.1E-09	NA	NA	NA
benzo(a)pyrene	1.2E-10	2.5E-09	NA	NA	NA
benzo(b)fluoranthene	2.3E-10	3.8E-09	NA	NA	NA
benzo(k)fluoranthene	2.5E-12	2.0E-09	NA	NA	NA
chrysene	1.5E-10	4.7E-09	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	5.3E-11	3.0E-10	NA	NA	NA
n-nitrosodipropylamine	1.9E-10	1.0E-09	1.8E-09	NA	NA
pentachlorophenol	5.3E-10	3.0E-09	5.1E-08	NA	NA
vinyl chloride	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	4.2E-12	7.2E-12	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	2.0E-14	1.0E-12	1.7E-12	NA	NA
hexachlorodibenzofuran	NA	7.3E-12	1.3E-11	NA	NA
heptachlorodibenzo-p-dioxin	6.8E-13	3.6E-11	6.1E-11	NA	NA
heptachlorodibenzofuran	8.5E-14	4.4E-12	7.6E-12	NA	NA
octachlorodibenzo-p-dioxin	7.8E-12	4.1E-10	7.0E-10	NA	NA
octachlorodibenzofuran	4.4E-13	2.3E-11	4.0E-11	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	4.7E-09	1.5E-08	3.4E-07	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
[a] Calculation of dose from penetrating radiation for groundskeeper is provided in Table E.IV-35.

5511

TABLE E.III-19
INTAKES FOR TOXICANTS FOR ON-PROPERTY GROUNDSKEEPER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	
cyanide	NA	NA	NA	NA
antimony	8.2E-08	4.4E-06	2.5E-06	NA
arsenic	4.1E-05	2.6E-04	1.5E-05	NA
barium	3.0E-05	3.6E-04	2.1E-04	NA
beryllium	3.3E-08	3.8E-07	2.2E-07	NA
boron	NA	NA	NA	NA
cadmium	4.7E-08	1.1E-06	6.3E-07	NA
chromium vi	2.7E-07	5.0E-06	2.9E-06	NA
cobalt	6.0E-08	2.0E-06	1.1E-06	NA
copper	1.5E-05	1.5E-04	8.4E-06	NA
lead	4.1E-05	9.1E-06	5.2E-06	NA
manganese	2.3E-05	2.4E-04	1.4E-04	NA
mercury	5.8E-09	4.8E-08	1.4E-07	NA
molybdenum	1.1E-06	1.2E-05	6.9E-06	NA
nickel	6.0E-07	8.7E-06	2.5E-07	NA
selenium	1.0E-07	7.7E-07	4.5E-07	NA
silver	7.7E-08	1.8E-06	1.0E-06	NA
thallium	7.1E-08	6.7E-07	3.9E-07	NA
vanadium	6.8E-06	7.8E-05	4.5E-06	NA
thorium-total	7.4E-08	2.4E-05	4.2E-05	NA
uranium-total	1.4E-05	1.1E-04	6.3E-05	NA
fluoride	2.7E-06	3.2E-04	5.6E-04	NA
acenaphthylene	1.1E-10	6.1E-10	1.1E-08	NA
2-methylnaphthalene	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA
benzo(g,h,i)perylene	1.8E-10	1.0E-09	NA	NA
dibenzofuran	NA	NA	NA	NA
pentachlorophenol	1.5E-09	8.3E-09	1.4E-07	NA
phenanthrene	6.6E-10	3.7E-09	6.4E-08	NA
tributyl phosphate	NA	NA	NA	NA
2-hexanone	1.9E-11	1.1E-10	NA	NA
3-chloropropene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	1.3E-08	4.1E-08	9.5E-07	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

TABLE E.III–20
INTAKES FOR CARCINOGENS FOR RME ON–PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater						Buried Pit Material
Exposure Pathways:		Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	External Exposure*
Contaminants of Concern	Inhalation																		
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life		pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life			mRem/life
Cs_{137+1d}	3.6E+02	5.8E+03	1.0E+04	1.4E+04	3.1E+04	1.3E+05	1.8E+05	2.9E+04	NA	2.7E+02	1.2E+06	1.7E+06	NA	NA	NA	NA	NA	NA	
Np_{237+1d}	2.8E+02	3.8E+03	2.1E+01	7.7E+00	6.4E+03	2.8E+02	1.0E+02	2.2E+04	NA	2.0E+02	NA	NA	5.7E+00	1.8E+00	6.4E−03	2.4E−03	NA	NA	
Pu_{238}	1.6E+01	2.0E+02	7.4E−03	5.9E−03	5.8E+00	4.8E−02	3.8E−02	1.7E+03	NA	1.6E+01	NA	NA	6.5E+03	1.9E+03	3.6E−02	3.0E−02	NA	NA	
$Pu_{239/240}$	7.2E+01	9.1E+02	7.1E−02	5.7E−02	1.2E+01	9.6E−02	7.7E−02	7.3E+03	NA	6.9E+01	NA	NA	NA	NA	NA	NA	NA	NA	
Ra_{226+8d}	2.2E+03	3.1E+04	1.3E+03	9.2E+03	2.7E+03	8.0E+02	5.8E+03	1.3E+05	NA	1.3E+03	8.1E+01	5.9E+02	8.7E+04	3.0E+04	5.5E+02	4.0E+03	NA	NA	
Ru_{106}	2.1E+01	2.6E+02	2.6E+01	3.2E−02	NA	NA	NA	2.1E+04	NA	2.0E+02	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.0E+02	1.7E+03	1.0E+02	2.0E+03	4.8E+05	1.0E+05	2.1E+06	1.4E+04	NA	1.3E+02	1.9E+04	3.8E+05	2.3E+02	9.3E+01	3.4E+00	6.8E+01	NA	NA	
Tc_{99}	1.0E+04	1.4E+05	8.2E+04	3.9E+05	1.1E+07	4.2E+07	2.0E+08	9.4E+05	NA	8.8E+03	9.8E+06	4.7E+07	8.1E+05	2.5E+05	1.0E+05	4.9E+05	NA	NA	
Th_{230}	5.7E+04	7.3E+05	8.7E+02	2.9E+03	1.6E+04	8.7E+02	2.9E+03	4.3E+06	NA	4.0E+04	7.7E−01	2.6E+00	5.1E+04	1.6E+04	4.0E+00	1.4E+01	NA	NA	
$Th_{232+10d}$	1.9E+03	2.4E+04	2.8E+01	9.5E+01	6.0E+02	3.3E+01	1.1E+02	1.6E+05	NA	1.5E+03	1.5E+01	5.3E+01	NA	NA	NA	NA	NA	NA	
U_{234}	1.3E+04	1.6E+05	1.8E+03	2.2E+04	6.0E+05	4.0E+04	4.8E+05	1.2E+06	NA	1.1E+04	7.8E+04	9.7E+05	1.1E+08	3.4E+07	2.5E+05	3.1E+06	NA	NA	
U_{235+1D}	3.5E+03	4.4E+04	4.9E+02	5.9E+03	9.6E+04	6.4E+03	7.6E+04	1.9E+05	NA	1.8E+03	4.5E+03	5.6E+04	2.6E+07	7.7E+06	5.7E+04	7.1E+05	NA	NA	
U_{238+2d}	4.6E+04	5.9E+05	6.5E+03	7.9E+04	4.0E+06	2.7E+05	3.2E+06	4.9E+06	NA	4.6E+04	1.9E+05	2.4E+06	5.3E+08	1.6E+08	1.2E+06	1.5E+07	NA	NA	1.9E+03
Rn_{222+4d}	4.3E+02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	
arsenic	9.7E−05	1.4E−03	3.6E−04	4.3E−05	3.5E−05	4.2E−05	5.1E−06	4.6E−03	1.5E−04	NA	3.1E−06	3.8E−07	1.6E−02	5.7E−03	7.9E−04	9.6E−05	NA	4.6E−05	NA
beryllium	6.5E−08	9.7E−07	1.9E−07	6.8E−10	8.3E−07	7.9E−07	2.9E−09	6.9E−06	2.2E−06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	1.1E−07	1.5E−05	2.0E−06	1.4E−05	6.3E−04	9.3E−05	6.7E−04	2.0E−05	6.3E−06	NA	NA	NA	1.7E−14	6.6E−14	4.5E−15	3.3E−14	NA	5.0E−17	NA
chromium vi	6.5E−07	1.3E−05	9.9E−06	1.1E−05	NA	NA	NA	9.0E−05	2.9E−05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
lead	9.7E−05	3.1E−03	2.6E−04	8.8E−04	NA	NA	NA	1.6E−04	5.2E−05	NA	2.0E−06	6.8E−06	1.6E−03	1.4E−03	5.4E−05	1.8E−04	NA	1.8E−08	NA
nickel	1.4E−06	9.7E−05	4.6E−05	3.1E−05	NA	NA	NA	1.6E−04	2.5E−06	NA	1.6E−04	1.1E−04	NA	NA	NA	NA	NA	NA	NA
pcbs	2.3E−08	1.1E−06	3.2E−06	4.0E−06	1.3E−05	4.4E−05	5.5E−05	4.2E−06	4.0E−06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	1.0E−09	1.4E−08	7.7E−09	9.8E−09	1.6E−06	1.6E−06	2.1E−06	2.6E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	7.8E−10	1.0E−08	1.3E−08	1.7E−08	4.1E−07	1.2E−06	1.5E−06	1.2E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	1.6E−09	2.0E−08	1.0E−07	1.3E−07	2.6E−07	4.5E−06	5.8E−06	1.9E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	6.5E−11	8.4E−10	8.7E−09	1.1E−08	1.4E−07	5.9E−06	7.4E−06	1.0E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	9.7E−10	1.3E−08	7.6E−09	9.6E−09	1.4E−06	1.5E−06	1.9E−06	2.4E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3−cd)pyrene	3.4E−10	4.3E−09	2.7E−07	3.5E−07	NA	NA	NA	1.5E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n−nitrosodipropylamine	1.2E−09	1.9E−08	5.5E−13	7.0E−13	NA	NA	NA	5.3E−08	5.0E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	3.4E−09	4.6E−08	6.4E−09	8.2E−09	NA	NA	NA	1.5E−07	1.4E−06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo−p−dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	2.1E−10	2.0E−10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo−p−dioxin	1.3E−13	1.5E−12	1.6E−11	2.2E−11	NA	NA	NA	5.1E−11	4.8E−11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	3.7E−10	3.5E−10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo−p−dioxin	4.5E−12	5.3E−11	5.4E−10	7.6E−10	NA	NA	NA	1.8E−09	1.7E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	5.6E−13	6.6E−12	4.2E−12	6.0E−12	NA	NA	NA	2.2E−10	2.1E−10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo−p−dioxin	5.1E−11	6.1E−10	6.1E−09	8.7E−09	NA	NA	NA	2.0E−08	2.0E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	2.9E−12	3.5E−11	2.2E−11	3.1E−11	NA	NA	NA	1.2E−09	1.1E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6E−10	3.6E−10	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	3.0E−08	6.5E−07	3.3E−10	4.3E−10	NA	NA	NA	7.4E−07	9.5E−06	NA	1.4E−09	1.8E−09	1.7E−11	9.7E−12	2.9E−15	3.7E−15	6.5E−11	1.3E−11	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E−08	1.4E−08	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9E−11	6.7E−11	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
* Calculation of dose from penetrating radiation for on–property RME farmer is provided in Table E.IV–39.

TABLE E.III-21
INTAKES FOR TOXICANTS FOR RME ON-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Ground Water					
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0E-09	2.6E-09	1.2E-07	5.6E-08	1.1E-13	1.5E-13	NA	3.3E-10
antimony	2.0E-07	5.0E-06	1.4E-06	5.5E-07	6.0E-04	3.0E-04	1.2E-04	8.0E-05	2.5E-05	NA	8.0E-06	3.2E-06	4.8E-03	3.2E-03	4.7E-04	1.9E-04	NA	1.4E-05
arsenic	9.7E-05	1.4E-03	3.6E-04	4.3E-05	3.5E-05	4.2E-05	5.1E-06	4.6E-03	1.5E-04	NA	3.1E-06	3.8E-07	1.6E-02	5.7E-03	7.9E-04	9.6E-05	NA	4.6E-05
barium	7.1E-05	2.4E-03	1.8E-04	1.7E-03	NA	NA	NA	6.5E-03	2.1E-03	NA	6.8E-05	6.4E-04	1.8E-02	1.7E-02	6.4E-04	6.0E-03	NA	5.1E-05
beryllium	6.5E-08	9.7E-07	1.9E-07	6.8E-10	8.3E-07	7.9E-07	2.9E-09	6.9E-06	2.2E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.8E-03	1.7E-03	7.2E-05	5.5E-04	NA	8.0E-06
cadmium	1.1E-07	1.5E-05	2.0E-06	1.4E-05	6.3E-04	9.3E-05	6.7E-04	2.0E-05	6.3E-06	NA	NA	NA	1.7E-14	6.6E-14	4.5E-15	3.3E-14	NA	5.0E-17
chromium vi	6.5E-07	1.3E-05	9.9E-06	1.1E-05	NA	NA	NA	9.0E-05	2.9E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
cobalt	1.4E-07	2.7E-06	7.2E-06	2.9E-06	NA	NA	NA	3.6E-05	1.1E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper	3.4E-05	2.2E-03	2.3E-03	1.4E-03	NA	NA	NA	2.6E-03	8.4E-05	NA	4.7E-04	2.9E-04	NA	NA	NA	NA	NA	NA
lead	9.7E-05	3.1E-03	2.6E-04	8.8E-04	NA	NA	NA	1.6E-04	5.2E-05	NA	2.0E-06	6.8E-06	1.6E-03	1.4E-03	5.4E-05	1.8E-04	NA	1.8E-08
manganese	5.4E-05	1.5E-03	1.3E-04	4.7E-04	NA	NA	NA	4.3E-03	1.4E-03	NA	4.6E-06	1.6E-05	5.7E-02	4.2E-02	2.0E-03	7.1E-03	NA	1.6E-04
mercury	1.4E-08	2.2E-07	6.0E-06	4.3E-08	NA	NA	NA	8.6E-07	1.4E-06	NA	NA	NA	9.8E-06	3.9E-06	6.5E-05	4.8E-07	NA	2.8E-08
molybdenum	2.5E-06	5.4E-05	5.2E-05	5.2E-05	NA	NA	NA	2.2E-04	6.9E-05	NA	NA	NA	4.6E-04	2.6E-04	1.4E-04	1.4E-04	NA	1.3E-06
nickel	1.4E-06	9.7E-05	4.6E-05	3.1E-05	NA	NA	NA	1.6E-04	2.5E-06	NA	1.6E-04	1.1E-04	NA	NA	NA	NA	NA	NA
selenium	2.4E-07	9.5E-06	1.2E-05	1.3E-05	NA	NA	NA	1.4E-05	4.5E-06	NA	3.3E-05	3.5E-05	NA	NA	NA	NA	NA	NA
silver	1.7E-07	7.3E-06	4.9E-06	1.3E-04	NA	NA	NA	3.2E-05	1.0E-05	NA	3.7E-05	9.8E-04	NA	NA	NA	NA	NA	NA
thallium	1.6E-07	2.2E-06	1.5E-05	3.0E-06	2.0E-07	2.0E-05	4.0E-06	1.2E-05	3.9E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
vanadium	1.6E-05	2.7E-04	8.8E-05	2.8E-06	NA	NA	NA	1.4E-03	4.5E-05	NA	1.9E-04	6.3E-06	NA	NA	NA	NA	NA	NA
thorium-total	1.7E-07	2.2E-06	2.6E-09	8.6E-09	3.5E-07	1.9E-08	6.5E-08	4.4E-04	4.2E-04	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	3.3E-05	4.2E-04	4.7E-06	5.6E-05	1.2E-03	7.9E-05	9.4E-04	2.0E-03	6.3E-04	NA	NA	NA	8.8E-01	2.6E-01	1.9E-03	2.4E-02	NA	2.5E-03
fluoride	6.2E-06	7.9E-05	NA	NA	NA	NA	NA	5.8E-03	5.6E-03	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	2.5E-10	3.2E-09	4.4E-11	5.9E-11	NA	NA	NA	1.1E-08	1.1E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	4.2E-10	5.3E-09	1.2E-07	1.6E-07	NA	NA	NA	1.8E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	3.4E-09	4.6E-08	6.4E-09	8.2E-09	NA	NA	NA	1.5E-07	1.4E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	1.6E-09	2.1E-08	8.0E-10	1.0E-09	NA	NA	NA	6.6E-08	6.4E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	4.5E-11	8.2E-10	2.9E-14	3.7E-14	NA	NA	NA	1.9E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6E-10	3.6E-10	NA	NA	NA	NA	NA	NA
tetrachloroethene	3.0E-08	6.5E-07	3.3E-10	4.3E-10	NA	NA	NA	7.4E-07	9.5E-06	NA	1.4E-09	1.8E-09	1.7E-11	9.7E-12	2.9E-15	3.7E-15	6.5E-11	1.3E-11
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9E-11	6.7E-11	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.6E-09	6.4E-09	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.1E-10	9.3E-10	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E-10	2.3E-10	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

TABLE E.III–22
INTAKES FOR CARCINOGENS FOR RME ON–PROPERTY CHILD
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater						Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	External Exposure[a]
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life		pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life			mRem/life
Cs_{137+1d}	6.5E+00	4.3E+02	3.4E+02	2.8E+03	2.3E+03	4.4E+03	3.6E+04	2.8E+03	NA	2.0E+01	3.9E+04	3.2E+05	NA	NA	NA	NA	NA	NA	
Np_{237+1d}	5.0E+00	2.8E+02	7.0E−01	1.5E+00	4.8E+02	9.2E+00	2.0E+01	2.1E+03	NA	1.5E+01	NA	NA	2.4E−01	1.4E−01	2.1E−04	4.6E−04	NA	NA	
Pu_{238}	2.9E−01	1.5E+01	2.5E−04	1.2E−03	4.3E−01	1.6E−03	7.5E−03	1.6E+02	NA	1.2E+00	NA	NA	2.8E+02	1.5E+02	1.2E−03	5.8E−03	NA	NA	
$Pu_{239/240}$	1.3E+00	6.8E+01	2.4E−03	1.1E−02	8.6E−01	3.2E−03	1.5E−02	7.0E+02	NA	5.2E+00	NA	NA	NA	NA	NA	NA	NA	NA	
Ra_{226+8d}	4.0E+01	2.3E+03	4.2E+01	1.8E+03	2.0E+02	2.7E+01	1.1E+03	1.3E+04	NA	9.5E+01	2.7E+00	1.1E+02	3.7E+03	2.2E+03	1.8E+01	7.9E+02	NA	NA	
Ru_{106}	3.8E−01	1.9E+01	8.6E−01	6.2E−03	NA	NA	NA	2.0E+03	NA	1.5E+01	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.9E+00	1.3E+02	3.4E+00	4.0E+02	3.6E+04	3.4E+03	4.0E+05	1.4E+03	NA	1.0E+01	6.2E+02	7.3E+04	9.8E+00	6.9E+00	1.1E−01	1.3E+01	NA	NA	
Tc_{99}	1.9E+02	1.0E+04	2.7E+03	7.5E+04	8.0E+05	1.4E+06	3.8E+07	8.9E+04	NA	6.6E+02	3.2E+05	9.1E+06	3.5E+04	1.9E+04	3.3E+03	9.5E+04	NA	NA	
Th_{230}	1.0E+03	5.4E+04	2.9E+01	5.6E+02	1.2E+03	2.9E+01	5.7E+02	4.1E+05	NA	3.0E+03	2.5E−02	5.1E−01	2.2E+03	1.2E+03	1.3E−01	2.7E+00	NA	NA	
$Th_{232+10d}$	3.4E+01	1.8E+03	9.4E−01	1.8E+01	4.5E+01	1.1E+00	2.1E+01	1.5E+04	NA	1.1E+02	5.1E−01	1.0E+01	NA	NA	NA	NA	NA	NA	
U_{234}	2.3E+02	1.2E+04	6.0E+01	4.2E+03	4.5E+04	1.3E+03	9.3E+04	1.1E+05	NA	8.5E+02	2.6E+03	1.9E+05	4.8E+06	2.5E+06	8.2E+03	6.0E+05	NA	NA	
U_{235+1D}	6.3E+01	3.3E+03	1.6E+01	1.1E+03	7.1E+03	2.1E+02	1.5E+04	1.8E+04	NA	1.3E+02	1.5E+02	1.1E+04	1.1E+06	5.8E+05	1.9E+03	1.4E+05	NA	NA	
U_{238+2d}	8.4E+02	4.4E+04	2.2E+02	1.5E+04	3.0E+05	8.9E+03	6.2E+05	4.6E+05	NA	3.4E+03	6.3E+03	4.6E+05	2.3E+07	1.2E+07	3.9E+04	2.8E+06	NA	NA	4.0E−01
Rn_{222+4d}	7.8E+00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	
arsenic	8.2E−06	4.9E−04	5.6E−05	3.9E−05	1.2E−05	6.5E−06	4.6E−06	2.1E−03	2.1E−05	NA	4.8E−07	3.4E−07	3.2E−03	2.0E−03	1.2E−04	8.7E−05	NA	6.4E−06	NA
beryllium	5.5E−09	3.4E−07	2.9E−08	6.1E−10	2.9E−07	1.2E−07	2.6E−09	3.1E−06	3.1E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	9.3E−09	5.1E−06	3.1E−07	1.3E−05	2.2E−04	1.4E−05	6.1E−04	8.7E−06	8.7E−07	NA	NA	NA	3.5E−15	2.3E−14	7.0E−16	3.0E−14	NA	6.9E−18	NA
chromium vi	5.5E−08	4.5E−06	1.5E−06	9.8E−06	NA	NA	NA	4.0E−05	4.0E−06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
lead	8.2E−06	1.1E−03	4.1E−05	8.0E−04	NA	NA	NA	7.3E−05	7.3E−06	NA	3.1E−07	6.2E−06	3.2E−04	4.8E−04	8.3E−06	1.6E−04	NA	2.5E−09	NA
nickel	1.2E−07	3.4E−05	7.1E−06	2.8E−05	NA	NA	NA	7.0E−05	3.5E−07	NA	2.5E−05	9.8E−05	NA	NA	NA	NA	NA	NA	NA
pcbs	2.0E−09	3.8E−07	4.9E−07	3.6E−06	4.4E−06	6.8E−06	5.0E−05	1.9E−06	5.6E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	8.8E−11	4.8E−09	1.2E−09	8.9E−09	5.4E−07	2.5E−07	1.9E−06	1.1E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	6.6E−11	3.5E−09	2.1E−09	1.6E−08	1.4E−07	1.9E−07	1.4E−06	5.5E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	1.3E−10	6.9E−09	1.6E−08	1.2E−07	9.0E−08	7.0E−07	5.2E−06	8.6E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	5.5E−12	2.9E−10	1.3E−09	1.0E−08	4.9E−08	9.1E−07	6.7E−06	4.5E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	8.2E−11	4.6E−09	1.2E−09	8.7E−09	4.9E−07	2.3E−07	1.7E−06	1.0E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3−cd)pyrene	2.9E−11	1.5E−09	4.2E−08	3.2E−07	NA	NA	NA	6.6E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n−nitrosodipropylamine	1.0E−10	6.5E−09	8.5E−14	6.3E−13	NA	NA	NA	2.3E−08	7.0E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	2.9E−10	1.6E−08	9.9E−10	7.4E−09	NA	NA	NA	6.6E−08	2.0E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo−p−dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	9.4E−11	2.8E−11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo−p−dioxin	1.1E−14	5.3E−13	2.4E−12	2.0E−11	NA	NA	NA	2.2E−11	6.7E−12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	1.6E−10	4.9E−11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo−p−dioxin	3.8E−13	1.8E−11	8.3E−11	6.9E−10	NA	NA	NA	8.0E−10	2.4E−10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	4.7E−14	2.3E−12	6.5E−13	5.5E−12	NA	NA	NA	9.8E−11	3.0E−11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo−p−dioxin	4.3E−12	2.1E−10	9.5E−10	7.9E−09	NA	NA	NA	9.1E−09	2.7E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	2.5E−13	1.2E−11	3.4E−12	2.9E−11	NA	NA	NA	5.2E−10	1.5E−10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.0E−11	3.3E−10	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.6E−09	2.3E−07	5.2E−11	3.9E−10	NA	NA	NA	3.3E−07	1.3E−06	NA	2.1E−10	1.6E−09	3.5E−12	3.4E−12	4.4E−16	3.4E−15	2.6E−11	1.7E−12	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6E−09	1.3E−08	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.5E−12	6.1E−11	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
[a] Calculation of dose from penetrating radiation for on–property young child is provided in Table E.IV–40.

TABLE E.III-23
INTAKES FOR TOXICANTS FOR RME ON-PROPERTY CHILD
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Ground Water					
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.7E-09	2.8E-08	2.7E-07	2.3E-07	2.0E-13	1.6E-12	NA	5.4E-10
antimony	2.0E-07	2.0E-05	2.5E-06	5.8E-06	2.4E-03	5.4E-04	1.3E-03	4.1E-04	4.1E-05	NA	1.4E-05	3.4E-05	1.1E-02	1.3E-02	8.4E-04	2.0E-03	NA	2.2E-05
arsenic	9.6E-05	5.7E-03	6.5E-04	4.6E-04	1.4E-04	7.6E-05	5.3E-05	2.4E-02	2.4E-04	NA	5.6E-06	4.0E-06	3.7E-02	2.3E-02	1.4E-03	1.0E-03	NA	7.4E-05
barium	7.0E-05	9.9E-03	3.3E-04	1.8E-02	NA	NA	NA	3.4E-02	3.4E-03	NA	1.2E-04	6.7E-03	4.2E-02	6.8E-02	1.2E-03	6.4E-02	NA	8.3E-05
beryllium	6.4E-08	3.9E-06	3.4E-07	7.2E-09	3.4E-06	1.4E-06	3.0E-08	3.6E-05	3.6E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6.5E-03	6.8E-03	1.3E-04	5.8E-03	NA	1.3E-05
cadmium	1.1E-07	5.9E-05	3.6E-06	1.5E-04	2.5E-03	1.7E-04	7.1E-03	1.0E-04	1.0E-05	NA	NA	NA	4.0E-14	2.7E-13	8.2E-15	3.5E-13	NA	8.1E-17
chromium vi	6.4E-07	5.3E-05	1.8E-05	1.1E-04	NA	NA	NA	4.7E-04	4.7E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
cobalt	1.4E-07	1.1E-05	1.3E-05	3.0E-05	NA	NA	NA	1.9E-04	1.9E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper	3.4E-05	8.8E-03	4.1E-03	1.5E-02	NA	NA	NA	1.4E-02	1.4E-04	NA	8.6E-04	3.0E-03	NA	NA	NA	NA	NA	NA
lead	9.6E-05	1.2E-02	4.8E-04	9.3E-03	NA	NA	NA	8.5E-04	8.5E-05	NA	3.7E-06	7.2E-05	3.7E-03	5.6E-03	9.7E-05	1.9E-03	NA	3.0E-08
manganese	5.4E-05	6.0E-03	2.4E-04	5.0E-03	NA	NA	NA	2.2E-02	2.2E-03	NA	8.2E-06	1.7E-04	1.3E-01	1.7E-01	3.6E-03	7.5E-02	NA	2.6E-04
mercury	1.3E-08	8.8E-07	1.1E-05	4.5E-07	NA	NA	NA	4.4E-06	2.2E-06	NA	NA	NA	2.3E-05	1.6E-05	1.2E-04	5.1E-06	NA	4.6E-08
molybdenum	2.5E-06	2.2E-04	9.3E-05	5.5E-04	NA	NA	NA	1.1E-03	1.1E-04	NA	NA	NA	1.1E-03	1.1E-03	2.5E-04	1.5E-03	NA	2.2E-06
nickel	1.3E-06	3.9E-04	8.3E-05	3.2E-04	NA	NA	NA	8.1E-04	4.1E-06	NA	2.9E-04	1.1E-03	NA	NA	NA	NA	NA	NA
selenium	2.4E-07	3.9E-05	2.2E-05	1.4E-04	NA	NA	NA	7.2E-05	7.2E-06	NA	5.9E-05	3.7E-04	NA	NA	NA	NA	NA	NA
silver	1.7E-07	3.0E-05	8.8E-06	1.4E-03	NA	NA	NA	1.6E-04	1.6E-05	NA	6.6E-05	1.0E-02	NA	NA	NA	NA	NA	NA
thallium	1.6E-07	8.7E-06	2.7E-05	3.2E-05	8.1E-07	3.6E-05	4.3E-05	6.3E-05	6.3E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
vanadium	1.6E-05	1.1E-03	1.6E-04	3.0E-05	NA	NA	NA	7.2E-03	7.2E-05	NA	3.5E-04	6.6E-05	NA	NA	NA	NA	NA	NA
thorium-total	1.7E-07	8.8E-06	4.7E-09	9.1E-08	1.4E-06	3.5E-08	6.8E-07	2.3E-03	6.8E-04	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	3.3E-05	1.7E-03	8.4E-06	5.9E-04	4.8E-03	1.4E-04	1.0E-02	1.0E-02	1.0E-03	NA	NA	NA	2.0E+00	1.1E+00	3.5E-03	2.6E-01	NA	4.1E-03
fluoride	6.1E-06	3.2E-04	NA	NA	NA	NA	NA	3.0E-02	9.0E-03	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	2.5E-10	1.3E-08	7.9E-11	6.2E-10	NA	NA	NA	5.7E-08	1.7E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	4.2E-10	2.2E-08	2.2E-07	1.7E-06	NA	NA	NA	9.5E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	3.4E-09	1.9E-07	1.2E-08	8.6E-08	NA	NA	NA	7.7E-07	2.3E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	1.5E-09	8.4E-08	1.4E-09	1.1E-08	NA	NA	NA	3.4E-07	1.0E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	4.4E-11	3.3E-09	5.3E-14	3.9E-13	NA	NA	NA	1.0E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.7E-10	3.9E-09	NA	NA	NA	NA	NA	NA
tetrachloroethene	3.0E-08	2.6E-06	6.0E-10	4.5E-09	NA	NA	NA	3.9E-06	1.5E-05	NA	2.5E-09	1.9E-08	4.0E-11	3.9E-11	5.2E-15	3.9E-14	3.0E-10	2.0E-11
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.3E-11	7.1E-10	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.2E-09	6.7E-08	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.3E-09	9.8E-09	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.9E-10	2.5E-09	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

TABLE E.III–24
INTAKES FOR CARCINOGENS FOR CT ON–PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater						Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	External Exposure[a]
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life		pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life			mRem/life
Cs_{137+1d}	2.7E+01	3.7E+02	6.9E+02	7.7E+02	2.0E+03	8.9E+03	1.0E+04	2.0E+03	NA	2.6E+01	7.8E+04	8.9E+04	NA	NA	NA	NA	NA	NA	
Np_{237+1d}	2.1E+01	2.4E+02	1.4E+00	4.2E−01	4.1E+02	1.9E+01	5.4E+00	1.5E+03	NA	1.9E+01	NA	NA	4.0E−01	1.2E−01	4.3E−04	1.3E−04	NA	NA	
Pu_{238}	1.2E+00	1.3E+01	5.0E−04	3.2E−04	3.7E−01	3.2E−03	2.1E−03	1.1E+02	NA	1.5E+00	NA	NA	4.6E+02	1.3E+02	2.4E−03	1.6E−03	NA	NA	
$Pu_{239/240}$	5.3E+00	5.9E+01	4.8E−03	3.1E−03	7.4E−01	6.5E−03	4.1E−03	5.0E+02	NA	6.6E+00	NA	NA	NA	NA	NA	NA	NA	NA	
Ra_{226+8d}	1.6E+02	2.0E+03	8.6E+01	4.9E+02	1.7E+02	5.4E+01	3.1E+02	9.2E+03	NA	1.2E+02	5.4E+00	3.2E+01	6.2E+03	1.9E+03	3.7E+01	2.2E+02	NA	NA	
Ru_{106}	1.6E+00	1.7E+01	1.7E+00	1.7E−03	NA	NA	NA	1.4E+03	NA	1.9E+01	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	7.8E+00	1.1E+02	6.9E+00	1.1E+02	3.1E+04	7.0E+03	1.1E+05	9.8E+02	NA	1.3E+01	1.3E+03	2.0E+04	1.6E+01	6.0E+00	2.3E−01	3.7E+00	NA	NA	
Tc_{99}	7.7E+02	8.8E+03	5.5E+03	2.1E+04	6.9E+05	2.8E+06	1.1E+07	6.4E+04	NA	8.5E+02	6.6E+05	2.5E+06	5.7E+04	1.6E+04	6.5E+03	2.6E+04	NA	NA	
Th_{230}	4.2E+03	4.7E+04	5.9E+01	1.6E+02	1.0E+03	5.9E+01	1.6E+02	2.9E+05	NA	3.9E+03	5.2E−02	1.4E−01	3.6E+03	1.0E+03	2.7E−01	7.4E−01	NA	NA	
$Th_{232+10d}$	1.4E+02	1.5E+03	1.9E+00	5.1E+00	3.9E+01	2.2E+00	5.9E+00	1.1E+04	NA	1.4E+02	1.0E+00	2.9E+00	NA	NA	NA	NA	NA	NA	
U_{234}	9.5E+02	1.0E+04	1.2E+02	1.2E+03	3.9E+04	2.7E+03	2.6E+04	8.2E+04	NA	1.1E+03	5.3E+03	5.2E+04	7.9E+06	2.2E+06	1.7E+04	1.7E+05	NA	NA	
U_{235+1D}	2.6E+02	2.9E+03	3.3E+01	3.2E+02	6.2E+03	4.3E+02	4.1E+03	1.3E+04	NA	1.7E+02	3.0E+02	3.0E+03	1.8E+06	5.0E+05	3.8E+03	3.8E+04	NA	NA	
U_{238+2d}	3.5E+03	3.8E+04	4.4E+02	4.2E+03	2.6E+05	1.8E+04	1.7E+05	3.3E+05	NA	4.4E+03	1.3E+04	1.3E+05	3.7E+07	1.0E+07	7.9E+04	7.8E+05	NA	NA	2.6E+02
Rn_{222+6d}	3.2E+01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	
arsenic	7.2E−06	9.1E−05	2.4E−05	2.3E−06	2.3E−06	2.8E−06	2.7E−07	3.2E−04	2.6E−06	NA	2.1E−07	2.0E−08	1.1E−03	3.7E−04	5.3E−05	5.2E−06	NA	2.7E−06	NA
beryllium	4.8E−09	6.3E−08	1.3E−08	3.6E−11	5.3E−08	5.3E−08	1.5E−10	4.7E−07	3.9E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	8.2E−09	9.4E−07	1.3E−07	7.8E−07	4.1E−05	6.2E−06	3.6E−05	1.3E−06	1.1E−07	NA	NA	NA	1.2E−15	4.3E−15	3.1E−16	1.8E−15	NA	3.0E−18	NA
chromium vi	4.8E−08	8.4E−07	6.6E−07	5.8E−07	NA	NA	NA	6.2E−06	5.1E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
lead	7.2E−06	2.0E−04	1.8E−05	4.7E−05	NA	NA	NA	1.1E−05	9.2E−07	NA	1.4E−07	3.7E−07	1.1E−04	8.9E−05	3.6E−06	9.6E−06	NA	1.1E−09	NA
nickel	1.0E−07	6.3E−06	3.1E−06	1.6E−06	NA	NA	NA	1.1E−05	4.4E−08	NA	1.1E−05	5.8E−06	NA	NA	NA	NA	NA	NA	NA
pcbs	1.7E−09	7.0E−08	2.1E−07	2.1E−07	8.2E−07	3.0E−06	3.0E−06	2.9E−07	7.0E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	7.7E−11	8.9E−10	5.2E−10	5.3E−10	1.0E−07	1.1E−07	1.1E−07	1.8E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	5.8E−11	6.5E−10	9.1E−10	9.2E−10	2.6E−08	8.1E−08	8.2E−08	8.5E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	1.2E−10	1.3E−09	6.8E−09	6.9E−09	1.7E−08	3.1E−07	3.1E−07	1.3E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	4.8E−12	5.5E−11	5.9E−10	6.0E−10	9.2E−09	3.9E−07	4.0E−07	6.9E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	7.2E−11	8.5E−10	5.1E−10	5.2E−10	9.1E−08	9.8E−08	1.0E−07	1.6E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3−cd)pyrene	2.6E−11	2.8E−10	1.8E−08	1.9E−08	NA	NA	NA	1.0E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n−nitrosodipropylamine	9.2E−11	1.2E−09	3.7E−14	3.7E−14	NA	NA	NA	3.6E−09	8.9E−10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	2.6E−10	3.0E−09	4.3E−10	4.4E−10	NA	NA	NA	1.0E−08	2.5E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo−p−dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	1.4E−11	3.5E−12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo−p−dioxin	9.6E−15	9.9E−14	1.0E−12	1.2E−12	NA	NA	NA	3.5E−12	8.5E−13	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	2.5E−11	6.2E−12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo−p−dioxin	3.3E−13	3.4E−12	3.6E−11	4.1E−11	NA	NA	NA	1.2E−10	3.0E−11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	4.1E−14	4.3E−13	2.8E−13	3.2E−13	NA	NA	NA	1.5E−11	3.7E−12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo−p−dioxin	3.8E−12	3.9E−11	4.1E−10	4.7E−10	NA	NA	NA	1.4E−09	3.4E−10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	2.2E−13	2.2E−12	1.5E−12	1.7E−12	NA	NA	NA	7.9E−11	2.0E−11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.7E−11	2.0E−11	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.3E−09	4.2E−08	2.2E−11	2.3E−11	NA	NA	NA	5.1E−08	1.7E−07	NA	9.2E−11	9.6E−11	1.2E−12	6.2E−13	1.9E−16	2.0E−16	6.5E−12	9.1E−13	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.1E−10	7.4E−10	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0E−12	3.6E−12	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
[a] Calculation of dose from penetrating radiation for on–property CT farmer is provided in Table E.IV–41.

TABLE E.III–25
INTAKES FOR TOXICANTS FOR CT ON–PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Ground Water					
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1E−09	1.1E−09	6.4E−08	2.8E−08	5.9E−14	6.1E−14	NA	1.5E−10
antimony	1.2E−07	2.5E−06	7.2E−07	2.3E−07	3.0E−04	1.6E−04	5.0E−05	4.2E−05	3.5E−06	NA	4.2E−06	1.3E−06	2.6E−03	1.6E−03	2.4E−04	7.8E−05	NA	6.4E−06
arsenic	5.6E−05	7.1E−04	1.9E−04	1.8E−05	1.8E−05	2.2E−05	2.1E−06	2.5E−03	2.0E−05	NA	1.6E−06	1.6E−07	8.8E−03	2.9E−03	4.1E−04	4.0E−05	NA	2.1E−05
barium	4.1E−05	1.2E−03	9.7E−05	7.2E−04	NA	NA	NA	3.5E−03	2.8E−04	NA	3.6E−05	2.7E−04	9.8E−03	8.4E−03	3.4E−04	2.5E−03	NA	2.4E−05
beryllium	3.8E−08	4.9E−07	9.9E−08	2.8E−10	4.2E−07	4.1E−07	1.2E−09	3.7E−06	3.0E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5E−03	8.4E−04	3.8E−05	2.3E−04	NA	3.7E−06
cadmium	6.4E−08	7.3E−06	1.0E−06	6.1E−06	3.2E−04	4.9E−05	2.8E−04	1.0E−05	8.6E−07	NA	NA	NA	9.5E−15	3.3E−14	2.4E−15	1.4E−14	NA	2.3E−17
chromium vi	3.8E−07	6.5E−06	5.2E−06	4.5E−06	NA	NA	NA	4.8E−05	4.0E−06	NA	NA	NA	NA	NA	NA	NA	NA	NA
cobalt	8.3E−08	1.3E−06	3.8E−06	1.2E−06	NA	NA	NA	1.9E−05	1.6E−06	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper	2.0E−05	1.1E−03	1.2E−03	5.8E−04	NA	NA	NA	1.4E−03	1.2E−05	NA	2.5E−04	1.2E−04	NA	NA	NA	NA	NA	NA
lead	5.6E−05	1.5E−03	1.4E−04	3.7E−04	NA	NA	NA	8.7E−05	7.1E−06	NA	1.1E−06	2.8E−06	8.7E−04	6.9E−04	2.8E−05	7.5E−05	NA	8.5E−09
manganese	3.2E−05	7.5E−04	7.0E−05	2.0E−04	NA	NA	NA	2.3E−03	1.9E−04	NA	2.4E−06	6.7E−06	3.1E−02	2.1E−02	1.1E−03	3.0E−03	NA	7.6E−05
mercury	7.9E−09	1.1E−07	3.1E−06	1.8E−08	NA	NA	NA	4.6E−07	1.9E−07	NA	NA	NA	5.4E−06	2.0E−06	3.4E−05	2.0E−07	NA	1.3E−08
molybdenum	1.5E−06	2.7E−05	2.7E−05	2.2E−05	NA	NA	NA	1.1E−04	9.4E−06	NA	NA	NA	2.6E−04	1.3E−04	7.3E−05	5.9E−05	NA	6.2E−07
nickel	7.9E−07	4.9E−05	2.4E−05	1.3E−05	NA	NA	NA	8.4E−05	3.4E−07	NA	8.5E−05	4.5E−05	NA	NA	NA	NA	NA	NA
selenium	1.4E−07	4.8E−06	6.4E−06	5.5E−06	NA	NA	NA	7.4E−06	6.1E−07	NA	1.7E−05	1.5E−05	NA	NA	NA	NA	NA	NA
silver	1.0E−07	3.7E−06	2.6E−06	5.5E−05	NA	NA	NA	1.7E−05	1.4E−06	NA	1.9E−05	4.1E−04	NA	NA	NA	NA	NA	NA
thallium	9.4E−08	1.1E−06	8.0E−06	1.3E−06	1.0E−07	1.1E−05	1.7E−06	6.4E−06	5.3E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA
vanadium	9.4E−06	1.4E−04	4.6E−05	1.2E−06	NA	NA	NA	7.4E−04	6.1E−06	NA	1.0E−04	2.6E−06	NA	NA	NA	NA	NA	NA
thorium−total	9.8E−08	1.1E−06	1.4E−09	3.6E−09	1.8E−07	1.0E−08	2.7E−08	2.3E−04	5.7E−05	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium−total	1.9E−05	2.1E−04	2.4E−06	2.3E−05	5.9E−04	4.1E−05	4.0E−04	1.0E−03	8.6E−05	NA	NA	NA	4.8E−01	1.3E−01	1.0E−03	1.0E−02	NA	1.2E−03
fluoride	3.6E−06	3.9E−05	NA	NA	NA	NA	NA	3.1E−03	7.6E−04	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	1.5E−10	1.6E−09	2.3E−11	2.5E−11	NA	NA	NA	5.9E−09	1.4E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA
2−methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4−chloro−3−methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	2.4E−10	2.7E−09	6.5E−08	6.6E−08	NA	NA	NA	9.8E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	2.0E−09	2.3E−08	3.4E−09	3.4E−09	NA	NA	NA	7.9E−08	1.9E−07	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	9.0E−10	1.0E−08	4.2E−10	4.3E−10	NA	NA	NA	3.5E−08	8.7E−08	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2−hexanone	2.6E−11	4.1E−10	1.5E−14	1.6E−14	NA	NA	NA	1.0E−09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3−chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.4E−10	1.5E−10	NA	NA	NA	NA	NA	NA
tetrachloroethene	1.8E−08	3.3E−07	1.7E−10	1.8E−10	NA	NA	NA	4.0E−07	1.3E−06	NA	7.1E−10	7.4E−10	9.5E−12	4.9E−12	1.5E−15	1.6E−15	5.1E−11	7.0E−12
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5E−11	2.8E−11	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4E−09	2.7E−09	NA	NA	NA	NA	NA	NA
2−nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.7E−10	3.9E−10	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.4E−11	9.8E−11	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

TABLE E.III-26
INTAKES FOR CARCINOGENS FOR RME ON-PROPERTY FARMER, USE OF PERCHED GROUNDWATER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Perched Groundwater			Great Miami Aquifer			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk	Ingestion of Drinking Water	Inhalation of VOC's	Dermal Contact while Bathing	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	External Exposure[a]
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life		pCi/life	pCi/life	pCi/life	pCi/life			pCi/life	pCi/life	pCi/life	mRem/life
Cs_{137+1d}	3.6E+02	5.8E+03	1.0E+04	1.4E+04	3.1E+04	1.3E+05	1.8E+05	2.9E+04	NA	2.7E+02	1.2E+06	1.7E+06	4.4E+04	NA	NA	NA	NA	NA	
Np_{237+1d}	2.8E+02	3.8E+03	2.1E+01	7.7E+00	6.4E+03	2.8E+02	1.0E+02	2.2E+04	NA	2.0E+02	NA	NA	3.7E+05	NA	NA	1.8E+00	6.4E-03	2.4E-03	
Pu_{239}	1.6E+01	2.0E+02	7.4E-03	5.9E-03	5.8E+00	4.8E-02	3.8E-02	1.7E+03	NA	1.6E+01	NA	NA	2.4E+04	NA	NA	1.9E+03	3.6E-02	3.0E-02	
$Pu_{238/240}$	7.2E+01	9.1E+02	7.1E-02	5.7E-02	1.2E+01	9.6E-02	7.7E-02	7.3E+03	NA	6.9E+01	NA	NA	2.4E+03	NA	NA	NA	NA	NA	
Ra_{226+Rd}	2.2E+03	3.1E+04	1.3E+03	9.2E+03	2.7E+03	8.0E+02	5.8E+03	1.3E+05	NA	1.3E+03	8.1E+01	5.9E+02	3.6E+06	NA	NA	3.0E+04	5.5E+02	4.0E+03	
Ru_{106}	2.1E+01	2.6E+02	2.6E+01	3.2E-02	NA	NA	NA	2.1E+04	NA	2.0E+02	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.0E+02	1.7E+03	1.0E+02	2.0E+03	4.8E+05	1.0E+05	2.1E+06	1.4E+04	NA	1.3E+02	1.9E+04	3.8E+05	2.0E+06	NA	NA	9.3E+01	3.4E+00	6.8E+01	
Tc_{99}	1.0E+04	1.4E+05	8.2E+04	3.9E+05	1.1E+07	4.2E+07	2.0E+08	9.4E+05	NA	8.8E+03	9.8E+06	4.7E+07	1.3E+08	NA	NA	2.5E+05	1.0E+05	4.9E+05	
Th_{230}	5.7E+04	7.3E+05	8.7E+02	2.9E+03	1.6E+04	8.7E+02	2.9E+03	4.3E+06	NA	4.0E+04	7.7E-01	2.6E+00	1.5E+04	NA	NA	1.6E+04	4.0E+00	1.4E+01	
$Th_{232+10d}$	1.9E+03	2.4E+04	2.8E+01	9.5E+01	6.0E+02	3.3E+01	1.1E+02	1.6E+05	NA	1.5E+03	1.5E+01	5.3E+01	2.5E+03	NA	NA	NA	NA	NA	
U_{234}	1.3E+04	1.6E+05	1.8E+03	2.2E+04	6.0E+05	4.0E+04	4.8E+05	1.2E+06	NA	1.1E+04	7.8E+04	9.7E+05	7.3E+09	NA	NA	3.4E+07	2.5E+05	3.1E+06	
U_{235+1D}	3.5E+03	4.4E+04	4.9E+02	5.9E+03	9.6E+04	6.4E+03	7.6E+04	1.9E+05	NA	1.8E+03	4.5E+03	5.6E+04	1.4E+09	NA	NA	7.7E+06	5.7E+04	7.1E+05	
U_{238+2d}	4.6E+04	5.9E+05	6.5E+03	7.9E+04	4.0E+06	2.7E+05	3.2E+06	4.9E+06	NA	4.6E+04	1.9E+05	2.4E+06	2.1E+10	NA	NA	1.6E+08	1.2E+06	1.5E+07	1.9E+03
Rn_{222+4d}	4.3E+02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	
arsenic	9.7E-05	1.4E-03	3.6E-04	4.3E-05	3.5E-05	4.2E-05	5.1E-06	4.6E-03	1.5E-04	NA	3.1E-06	3.8E-07	1.7E-02	NA	5.0E-05	5.7E-03	7.9E-04	9.6E-05	NA
beryllium	6.5E-08	9.7E-07	1.9E-07	6.8E-10	8.3E-07	7.9E-07	2.9E-09	6.9E-06	2.2E-06	NA	NA	NA	5.6E-04	NA	1.6E-06	NA	NA	NA	NA
cadmium	1.1E-07	1.5E-05	2.0E-06	1.4E-05	6.3E-04	9.3E-05	6.7E-04	2.0E-05	6.3E-06	NA	NA	NA	3.2E-03	NA	9.3E-06	6.6E-14	4.5E-15	3.3E-14	NA
chromium vi	6.5E-07	1.3E-05	9.9E-06	1.1E-05	NA	NA	NA	9.0E-05	2.9E-05	NA	NA	NA	3.5E-03	NA	2.0E-05	NA	NA	NA	NA
lead	9.7E-05	3.1E-03	2.6E-04	8.8E-04	NA	NA	NA	1.6E-04	5.2E-05	NA	2.0E-06	6.8E-06	1.9E-02	NA	2.2E-07	1.4E-03	5.4E-05	1.8E-04	NA
nickel	1.4E-06	9.7E-05	4.6E-05	3.1E-05	NA	NA	NA	1.6E-04	2.5E-06	NA	1.6E-04	1.1E-04	5.8E-02	NA	1.7E-05	NA	NA	NA	NA
pcbs	2.3E-08	1.1E-06	3.2E-06	4.0E-06	1.3E-05	4.4E-05	5.5E-05	4.2E-06	4.0E-06	NA	NA	NA	4.1E-03	NA	1.7E-01	NA	NA	NA	NA
benzo(a)anthracene	1.0E-09	1.4E-08	7.7E-09	9.8E-09	1.6E-06	1.6E-06	2.1E-06	2.6E-07	NA	NA	NA	NA	1.1E-03	NA	2.1E-02	NA	NA	NA	NA
benzo(a)pyrene	7.8E-10	1.0E-08	1.3E-08	1.7E-08	4.1E-07	1.2E-06	1.5E-06	1.2E-07	NA	NA	NA	NA	1.1E-03	NA	3.6E-02	NA	NA	NA	NA
benzo(b)fluoranthene	1.6E-09	2.0E-08	1.0E-07	1.3E-07	2.6E-07	4.5E-06	5.8E-06	1.9E-07	NA	NA	NA	NA	1.1E-03	NA	3.6E-02	NA	NA	NA	NA
benzo(k)fluoranthene	6.5E-11	8.4E-10	8.7E-09	1.1E-08	1.4E-07	5.9E-06	7.4E-06	1.0E-07	NA	NA	NA	NA	1.1E-03	NA	3.6E-02	NA	NA	NA	NA
chrysene	9.7E-10	1.3E-08	7.6E-09	9.6E-09	1.4E-06	1.5E-06	1.9E-06	2.4E-07	NA	NA	NA	NA	1.1E-03	NA	2.1E-02	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.7E-04	NA	2.5E-02	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	3.4E-10	4.3E-09	2.7E-07	3.5E-07	NA	NA	NA	1.5E-08	NA	NA	NA	NA	1.1E-03	NA	6.8E-02	NA	NA	NA	NA
n-nitrosodipropylamine	1.2E-09	1.9E-08	5.5E-13	7.0E-13	NA	NA	NA	5.3E-08	5.0E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	3.4E-09	4.6E-08	6.4E-09	8.2E-09	NA	NA	NA	1.5E-07	1.4E-06	NA	NA	NA	5.5E-03	NA	1.1E-01	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.7E-02	1.0E-01	1.5E-03	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	2.1E-10	2.0E-10	NA	NA	NA	1.5E-07	NA	9.2E-06	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.8E-08	NA	3.6E-06	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	1.3E-13	1.5E-12	1.6E-11	2.2E-11	NA	NA	NA	5.1E-11	4.8E-11	NA	NA	NA	2.1E-08	NA	1.3E-06	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	3.7E-10	3.5E-10	NA	NA	NA	3.3E-08	NA	2.1E-06	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	4.5E-12	5.3E-11	5.4E-10	7.6E-10	NA	NA	NA	1.8E-09	1.7E-09	NA	NA	NA	2.6E-08	NA	1.6E-06	NA	NA	NA	NA
heptachlorodibenzofuran	5.6E-13	6.6E-12	4.2E-12	6.0E-12	NA	NA	NA	2.2E-10	2.1E-10	NA	NA	NA	5.5E-08	NA	3.5E-06	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	5.1E-11	6.1E-10	6.1E-09	8.7E-09	NA	NA	NA	2.0E-08	2.0E-08	NA	NA	NA	4.9E-08	NA	3.1E-06	NA	NA	NA	NA
octachlorodibenzofuran	2.9E-12	3.5E-11	2.2E-11	3.1E-11	NA	NA	NA	1.2E-09	1.1E-09	NA	NA	NA	3.0E-08	NA	1.9E-06	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6E-10	3.6E-10	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	3.0E-08	6.5E-07	3.3E-10	4.3E-10	NA	NA	NA	7.4E-07	9.5E-06	NA	1.4E-09	1.8E-09	3.8E-03	1.4E-02	2.8E-03	9.7E-12	2.9E-15	3.7E-15	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E-08	1.4E-08	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9E-11	6.7E-11	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
[a] Calculation of dose from penetrating radiation for on-property RME farmer is provided in Table E.IV-39.

TABLE E.III-27
INTAKES FOR TOXICANTS FOR RME ON-PROPERTY FARMER, USE OF PERCHED GROUNDWATER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Perched Groundwater			Great Miami Aquifer		
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk	Ingestion of Drinking Water	Inhalation of VOC's	Dermal Contact while Bathing	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day		mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0E-09	2.6E-09	9.9E-02	NA	2.8E-04	5.6E-08	1.1E-13	1.5E-13
antimony	2.0E-07	5.0E-06	1.4E-06	5.5E-07	6.0E-04	3.0E-04	1.2E-04	8.0E-05	2.5E-05	NA	8.0E-06	3.2E-06	2.6E-02	NA	7.5E-05	3.2E-03	4.7E-04	1.9E-04
arsenic	9.7E-05	1.4E-03	3.6E-04	4.3E-05	3.5E-05	4.2E-05	5.1E-06	4.6E-03	1.5E-04	NA	3.1E-06	3.8E-07	1.7E-02	NA	5.0E-05	5.7E-03	7.9E-04	9.6E-05
barium	7.1E-05	2.4E-03	1.8E-04	1.7E-03	NA	NA	NA	6.5E-03	2.1E-03	NA	6.8E-05	6.4E-04	5.4E-02	NA	1.5E-04	1.7E-02	6.4E-04	6.0E-03
beryllium	6.5E-08	9.7E-07	1.9E-07	6.8E-10	8.3E-07	7.9E-07	2.9E-09	6.9E-06	2.2E-06	NA	NA	NA	5.6E-04	NA	1.6E-06	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.0E-02	NA	2.3E-04	1.7E-03	7.2E-05	5.5E-04
cadmium	1.1E-07	1.5E-05	2.0E-06	1.4E-05	6.3E-04	9.3E-05	6.7E-04	2.0E-05	6.3E-06	NA	NA	NA	3.2E-03	NA	9.3E-06	6.6E-14	4.5E-15	3.3E-14
chromium vi	6.5E-07	1.3E-05	9.9E-06	1.1E-05	NA	NA	NA	9.0E-05	2.9E-05	NA	NA	NA	3.5E-03	NA	2.0E-05	NA	NA	NA
cobalt	1.4E-07	2.7E-06	7.2E-06	2.9E-06	NA	NA	NA	3.6E-05	1.1E-05	NA	NA	NA	9.3E-03	NA	1.1E-05	NA	NA	NA
copper	3.4E-05	2.2E-03	2.3E-03	1.4E-03	NA	NA	NA	2.6E-03	8.4E-05	NA	4.7E-04	2.9E-04	2.6E-02	NA	7.5E-05	NA	NA	NA
lead	9.7E-05	3.1E-03	2.6E-04	8.8E-04	NA	NA	NA	1.6E-04	5.2E-05	NA	2.0E-06	6.8E-06	1.9E-02	NA	2.2E-07	1.4E-03	5.4E-05	1.8E-04
manganese	5.4E-05	1.5E-03	1.3E-04	4.7E-04	NA	NA	NA	4.3E-03	1.4E-03	NA	4.6E-06	1.6E-05	6.6E-02	NA	1.9E-04	4.2E-02	2.0E-03	7.1E-03
mercury	1.4E-08	2.2E-07	6.0E-06	4.3E-08	NA	NA	NA	8.6E-07	1.4E-06	NA	NA	NA	6.0E-04	NA	1.7E-06	3.9E-06	6.5E-05	4.8E-07
molybdenum	2.5E-06	5.4E-05	5.2E-05	5.2E-05	NA	NA	NA	2.2E-04	6.9E-05	NA	NA	NA	3.2E+00	NA	9.1E-03	2.6E-04	1.4E-04	1.4E-04
nickel	1.4E-06	9.7E-05	4.6E-05	3.1E-05	NA	NA	NA	1.6E-04	2.5E-06	NA	1.6E-04	1.1E-04	5.8E-02	NA	1.7E-05	NA	NA	NA
selenium	2.4E-07	9.5E-06	1.2E-05	1.3E-05	NA	NA	NA	1.4E-05	4.5E-06	NA	3.3E-05	3.5E-05	1.0E-04	NA	3.0E-07	NA	NA	NA
silver	1.7E-07	7.3E-06	4.9E-06	1.3E-04	NA	NA	NA	3.2E-05	1.0E-05	NA	3.7E-05	9.8E-04	1.8E-03	NA	3.2E-06	NA	NA	NA
thallium	1.6E-07	2.2E-06	1.5E-05	3.0E-06	2.0E-07	2.0E-05	4.0E-06	1.2E-05	3.9E-06	NA	NA	NA	2.1E-02	NA	5.9E-05	NA	NA	NA
vanadium	1.6E-05	2.7E-04	8.8E-05	2.8E-06	NA	NA	NA	1.4E-03	4.5E-05	NA	1.9E-04	6.3E-06	3.9E-02	NA	1.1E-04	NA	NA	NA
thorium-total	1.7E-07	2.2E-06	2.6E-09	8.6E-09	3.5E-07	1.9E-08	6.5E-08	4.4E-04	4.2E-04	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	3.3E-05	4.2E-04	4.7E-06	5.6E-05	1.2E-03	7.9E-05	9.4E-04	2.0E-03	6.3E-04	NA	NA	NA	1.4E+01	NA	3.9E-02	2.6E-01	1.9E-03	2.4E-02
fluoride	6.2E-06	7.9E-05	NA	NA	NA	NA	NA	5.8E-03	5.6E-03	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	2.5E-10	3.2E-09	4.4E-11	5.9E-11	NA	NA	NA	1.1E-08	1.1E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	4.2E-10	5.3E-09	1.2E-07	1.6E-07	NA	NA	NA	1.8E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	3.4E-09	4.6E-08	6.4E-09	8.2E-09	NA	NA	NA	1.5E-07	1.4E-06	NA	NA	NA	5.5E-03	NA	1.1E-01	NA	NA	NA
phenanthrene	1.6E-09	2.1E-08	8.0E-10	1.0E-09	NA	NA	NA	6.6E-08	6.4E-07	NA	NA	NA	1.1E-03	4.1E-03	4.2E-03	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	4.5E-11	8.2E-10	2.9E-14	3.7E-14	NA	NA	NA	1.9E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6E-10	3.6E-10	NA	NA	NA	NA	NA	NA
tetrachloroethene	3.0E-08	6.5E-07	3.3E-10	4.3E-10	NA	NA	NA	7.4E-07	9.5E-06	NA	1.4E-09	1.8E-09	3.8E-03	1.4E-02	2.8E-03	9.7E-12	2.9E-15	3.7E-15
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.9E-11	6.7E-11	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.6E-09	6.4E-09	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.1E-10	9.3E-10	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E-10	2.3E-10	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

TABLE E.III-28
INTAKES FOR CARCINOGENS FOR RME OFF-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Off-property Groundwater					
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life		
Cs_{137+1d}	1.5E+01	2.4E+02	4.3E+02	6.0E+02	NA	NA	NA	NA	NA	NA
Np_{237+1d}	1.3E+01	1.7E+02	9.7E-01	3.5E-01	6.1E-07	2.0E-07	6.8E-10	2.5E-10	NA	NA
Pu_{238}	9.9E-01	1.2E+01	4.5E-04	3.6E-04	NA	NA	NA	NA	NA	NA
$Pu_{239/240}$	5.9E+00	7.5E+01	5.9E-03	4.7E-03	NA	NA	NA	NA	NA	NA
Ra_{226+8d}	1.5E+02	2.1E+03	8.7E+01	6.3E+02	NA	NA	NA	NA	NA	NA
Ru_{106}	1.4E+00	1.7E+01	1.7E+00	2.1E-03	NA	NA	NA	NA	NA	NA
Sr_{90+1d}	4.6E+00	7.5E+01	4.5E+00	9.1E+01	2.9E-01	1.2E-01	4.2E-03	8.5E-02	NA	NA
Tc_{99}	7.1E+02	9.3E+03	5.6E+03	2.6E+04	1.5E+05	4.8E+04	1.9E+04	9.2E+04	NA	NA
Th_{230}	4.3E+03	5.5E+04	6.6E+01	2.2E+02	NA	NA	NA	NA	NA	NA
$Th_{232+10d}$	1.2E+02	1.5E+03	1.8E+00	5.9E+00	NA	NA	NA	NA	NA	NA
U_{234}	5.3E+02	6.8E+03	7.5E+01	9.0E+02	8.4E+06	2.5E+06	1.9E+04	2.3E+05	NA	NA
U_{235+1D}	5.3E+01	6.8E+02	7.5E+00	9.0E+01	2.0E+06	5.9E+05	4.4E+03	5.4E+04	NA	NA
U_{238+2d}	1.1E+03	1.4E+04	1.6E+02	1.9E+03	4.0E+07	1.2E+07	8.9E+04	1.1E+06	NA	NA
Rn_{222+4d}	2.9E+01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
arsenic	6.0E-06	8.8E-05	2.2E-05	2.7E-06	NA	NA	NA	NA	NA	NA
beryllium	5.2E-09	7.7E-08	1.5E-08	5.4E-11	NA	NA	NA	NA	NA	NA
cadmium	7.8E-09	1.0E-06	1.4E-07	1.0E-06	NA	NA	NA	NA	NA	NA
chromium vi	5.3E-08	1.1E-06	8.1E-07	8.8E-07	NA	NA	NA	NA	NA	NA
lead	9.1E-07	2.9E-05	2.5E-06	8.2E-06	NA	NA	NA	NA	NA	NA
nickel	9.7E-08	6.9E-06	3.3E-06	2.2E-06	NA	NA	NA	NA	NA	NA
pcbs	1.5E-09	6.9E-08	2.0E-07	2.5E-07	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	6.5E-11	8.6E-10	4.8E-10	6.1E-10	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	4.8E-11	6.2E-10	8.3E-10	1.1E-09	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	9.1E-11	1.2E-09	5.9E-09	7.5E-09	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	4.3E-12	5.6E-11	5.8E-10	7.3E-10	NA	NA	NA	NA	NA	NA
chrysene	5.8E-11	7.9E-10	4.5E-10	5.8E-10	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	2.1E-11	2.6E-10	1.7E-08	2.1E-08	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	7.1E-11	1.1E-09	3.2E-14	4.0E-14	NA	NA	NA	NA	NA	NA
pentachlorophenol	2.1E-10	2.8E-09	3.9E-10	4.9E-10	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	7.8E-15	9.2E-14	9.3E-13	1.3E-12	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	2.7E-13	3.1E-12	3.2E-11	4.5E-11	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	3.3E-14	3.9E-13	2.5E-13	3.6E-13	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	3.0E-12	3.6E-11	3.7E-10	5.2E-10	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	1.7E-13	2.1E-12	1.3E-12	1.9E-12	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.3E-10	5.0E-09	2.6E-12	3.3E-12	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

TABLE E.III-29
INTAKES FOR TOXICANTS FOR RME OFF-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Ground Water					
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	3.4E-10	1.6E-10	3.3E-16	4.3E-16	NA	9.8E-13
antimony	1.9E-08	4.7E-07	1.3E-07	5.1E-08	NA	NA	NA	NA	NA	NA
arsenic	6.0E-06	8.8E-05	2.2E-05	2.7E-06	NA	NA	NA	NA	NA	NA
barium	4.9E-06	1.7E-04	1.3E-05	1.2E-04	1.3E-08	1.2E-08	4.7E-10	4.4E-09	NA	3.8E-11
beryllium	5.2E-09	7.7E-08	1.5E-08	5.4E-11	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	7.2E-05	4.3E-05	1.9E-06	1.4E-05	NA	2.1E-07
cadmium	7.8E-09	1.0E-06	1.4E-07	1.0E-06	NA	NA	NA	NA	NA	NA
chromium vi	5.3E-08	1.1E-06	8.1E-07	8.8E-07	NA	NA	NA	NA	NA	NA
cobalt	1.2E-08	2.2E-07	5.9E-07	2.4E-07	NA	NA	NA	NA	NA	NA
copper	1.7E-06	1.1E-04	1.2E-04	7.0E-05	NA	NA	NA	NA	NA	NA
lead	9.1E-07	2.9E-05	2.5E-06	8.2E-06	NA	NA	NA	NA	NA	NA
manganese	3.5E-06	9.5E-05	8.6E-06	3.0E-05	NA	NA	NA	NA	NA	NA
mercury	7.8E-10	1.2E-08	3.4E-07	2.5E-09	1.0E-11	4.1E-12	6.9E-11	5.1E-13	NA	3.0E-14
molybdenum	1.5E-07	3.2E-06	3.1E-06	3.1E-06	5.1E-09	2.8E-09	1.5E-09	1.5E-09	NA	1.5E-11
nickel	9.7E-08	6.9E-06	3.3E-06	2.2E-06	NA	NA	NA	NA	NA	NA
selenium	1.4E-08	5.7E-07	7.3E-07	7.8E-07	NA	NA	NA	NA	NA	NA
silver	7.8E-09	3.3E-07	2.2E-07	5.8E-06	NA	NA	NA	NA	NA	NA
thallium	6.5E-09	8.6E-08	6.1E-07	1.2E-07	NA	NA	NA	NA	NA	NA
vanadium	1.3E-06	2.2E-05	7.0E-06	2.2E-07	NA	NA	NA	NA	NA	NA
thorium-total	7.8E-09	1.0E-07	1.2E-10	4.0E-10	NA	NA	NA	NA	NA	NA
uranium-total	1.4E-06	1.7E-05	1.9E-07	2.3E-06	6.7E-02	2.0E-02	1.5E-04	1.8E-03	NA	1.9E-04
fluoride	3.7E-07	4.7E-06	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	1.5E-11	1.9E-10	2.6E-12	3.5E-12	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	2.5E-11	3.2E-10	7.5E-09	9.5E-09	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	2.1E-10	2.8E-09	3.9E-10	4.9E-10	NA	NA	NA	NA	NA	NA
phenanthrene	9.1E-11	1.2E-09	4.7E-11	6.0E-11	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.3E-10	5.0E-09	2.6E-12	3.3E-12	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

TABLE E.III-30
INTAKES FOR CARCINOGENS FOR RME OFF-PROPERTY CHILD
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Off-property Groundwater					
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life		
Cs_{137+1d}	2.7E-01	1.8E+01	1.4E+01	1.2E+02	NA	NA	NA	NA	NA	NA
Np_{237+1d}	2.3E-01	1.3E+01	3.2E-02	6.9E-02	2.6E-08	1.5E-08	2.3E-11	4.9E-11	NA	NA
Pu_{238}	1.8E-02	9.3E-01	1.5E-05	7.0E-05	NA	NA	NA	NA	NA	NA
$Pu_{239/240}$	1.1E-01	5.6E+00	1.9E-04	9.1E-04	NA	NA	NA	NA	NA	NA
Ra_{226+8d}	2.7E+00	1.6E+02	2.9E+00	1.2E+02	NA	NA	NA	NA	NA	NA
Ru_{106}	2.5E-02	1.3E+00	5.7E-02	4.2E-04	NA	NA	NA	NA	NA	NA
Sr_{90+1d}	8.4E-02	5.6E+00	1.5E-01	1.8E+01	1.2E-02	8.7E-03	1.4E-04	1.7E-02	NA	NA
Tc_{99}	1.3E+01	6.9E+02	1.9E+02	5.1E+03	6.6E+03	3.6E+03	6.4E+02	1.8E+04	NA	NA
Th_{230}	7.8E+01	4.1E+03	2.2E+00	4.3E+01	NA	NA	NA	NA	NA	NA
$Th_{232+10d}$	2.1E+00	1.1E+02	5.9E-02	1.2E+00	NA	NA	NA	NA	NA	NA
U_{234}	9.7E+00	5.0E+02	2.5E+00	1.8E+02	3.6E+05	1.9E+05	6.2E+02	4.5E+04	NA	NA
U_{235+1D}	9.7E-01	5.0E+01	2.5E-01	1.8E+01	8.4E+04	4.4E+04	1.4E+02	1.0E+04	NA	NA
U_{238+2d}	2.0E+01	1.1E+03	5.3E+00	3.7E+02	1.7E+06	9.0E+05	3.0E+03	2.2E+05	NA	NA
Rn_{222+4d}	5.3E-01	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
arsenic	5.1E-07	3.1E-05	3.4E-06	2.4E-06	NA	NA	NA	NA	NA	NA
beryllium	4.4E-10	2.7E-08	2.3E-09	4.9E-11	NA	NA	NA	NA	NA	NA
cadmium	6.6E-10	3.6E-07	2.2E-08	9.3E-07	NA	NA	NA	NA	NA	NA
chromium vi	4.5E-09	3.7E-07	1.3E-07	8.0E-07	NA	NA	NA	NA	NA	NA
lead	7.7E-08	1.0E-05	3.8E-07	7.5E-06	NA	NA	NA	NA	NA	NA
nickel	8.2E-09	2.4E-06	5.1E-07	2.0E-06	NA	NA	NA	NA	NA	NA
pcbs	1.3E-10	2.4E-08	3.1E-08	2.3E-07	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	5.5E-12	3.0E-10	7.5E-11	5.6E-10	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	4.1E-12	2.2E-10	1.3E-10	9.6E-10	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	7.7E-12	4.0E-10	9.1E-10	6.8E-09	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	3.6E-13	1.9E-11	8.9E-11	6.6E-10	NA	NA	NA	NA	NA	NA
chrysene	4.9E-12	2.8E-10	7.0E-11	5.2E-10	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.8E-12	9.1E-11	2.6E-09	1.9E-08	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	6.0E-12	3.8E-10	4.9E-15	3.7E-14	NA	NA	NA	NA	NA	NA
pentachlorophenol	1.8E-11	9.6E-10	6.0E-11	4.5E-10	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	6.6E-16	3.2E-14	1.4E-13	1.2E-12	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	2.2E-14	1.1E-12	4.9E-12	4.1E-11	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	2.8E-15	1.4E-13	3.9E-14	3.2E-13	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	2.6E-13	1.3E-11	5.7E-11	4.7E-10	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	1.5E-14	7.2E-13	2.1E-13	1.7E-12	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.0E-11	1.7E-09	4.0E-13	3.0E-12	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

TABLE E.III-31
INTAKES FOR TOXICANTS FOR RME OFF-PROPERTY CHILD
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Ground Water					
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	7.9E-10	6.6E-10	6.0E-16	4.6E-15	NA	1.6E-12
antimony	1.9E-08	1.9E-06	2.3E-07	5.4E-07	NA	NA	NA	NA	NA	NA
arsenic	5.9E-06	3.6E-04	4.0E-05	2.8E-05	NA	NA	NA	NA	NA	NA
barium	4.9E-06	6.8E-04	2.3E-05	1.3E-03	3.0E-08	5.0E-08	8.5E-10	4.7E-08	NA	6.1E-11
beryllium	5.1E-09	3.1E-07	2.7E-08	5.7E-10	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	1.7E-04	1.7E-04	3.4E-06	1.5E-04	NA	3.4E-07
cadmium	7.7E-09	4.2E-06	2.5E-07	1.1E-05	NA	NA	NA	NA	NA	NA
chromium vi	5.2E-08	4.3E-06	1.5E-06	9.3E-06	NA	NA	NA	NA	NA	NA
cobalt	1.2E-08	8.8E-07	1.1E-06	2.5E-06	NA	NA	NA	NA	NA	NA
copper	1.7E-06	4.5E-04	2.1E-04	7.4E-04	NA	NA	NA	NA	NA	NA
lead	8.9E-07	1.2E-04	4.4E-06	8.7E-05	NA	NA	NA	NA	NA	NA
manganese	3.5E-06	3.9E-04	1.6E-05	3.2E-04	NA	NA	NA	NA	NA	NA
mercury	7.7E-10	5.0E-08	6.2E-07	2.6E-08	2.4E-11	1.7E-11	1.2E-10	5.3E-12	NA	4.9E-14
molybdenum	1.5E-07	1.3E-05	5.5E-06	3.2E-05	1.2E-08	1.1E-08	2.7E-09	1.6E-08	NA	2.4E-11
nickel	9.6E-08	2.8E-05	5.9E-06	2.3E-05	NA	NA	NA	NA	NA	NA
selenium	1.4E-08	2.3E-06	1.3E-06	8.2E-06	NA	NA	NA	NA	NA	NA
silver	7.7E-09	1.3E-06	3.9E-07	6.1E-05	NA	NA	NA	NA	NA	NA
thallium	6.4E-09	3.5E-07	1.1E-06	1.3E-06	NA	NA	NA	NA	NA	NA
vanadium	1.3E-06	8.7E-05	1.3E-05	2.4E-06	NA	NA	NA	NA	NA	NA
thorium-total	7.7E-09	4.0E-07	2.2E-10	4.2E-09	NA	NA	NA	NA	NA	NA
uranium-total	1.3E-06	7.0E-05	3.5E-07	2.4E-05	1.6E-01	8.2E-02	2.7E-04	1.9E-02	NA	3.1E-04
fluoride	3.6E-07	1.9E-05	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	1.5E-11	7.7E-10	4.7E-12	3.7E-11	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	2.5E-11	1.3E-09	1.3E-08	1.0E-07	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	2.0E-10	1.1E-08	7.0E-10	5.2E-09	NA	NA	NA	NA	NA	NA
phenanthrene	8.9E-11	4.9E-09	8.4E-11	6.4E-10	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.3E-10	2.0E-08	4.6E-12	3.4E-11	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

5511

TABLE E.III-32
INTAKES FOR CARCINOGENS FOR ON-PROPERTY HOME BUILDER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material			Buried Pit Material
Exposure Pathways: Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	mRem/life
Cs_{137+1d}	1.1E+01	5.5E+02	NA	7.9E-01	
Np_{237+1d}	8.4E+00	4.1E+02	NA	5.9E-01	
Pu_{238}	4.9E-01	3.2E+01	NA	4.5E-02	
$Pu_{239/240}$	2.2E+00	1.4E+02	NA	2.0E-01	
Ra_{226+8d}	6.7E+01	2.6E+03	NA	3.7E+00	
Ru_{106}	6.3E-01	4.0E+02	NA	5.7E-01	
Sr_{90+1d}	3.1E+00	2.7E+02	NA	3.9E-01	
Tc_{99}	3.1E+02	1.8E+04	NA	2.6E+01	
Th_{230}	1.7E+03	8.1E+04	NA	1.2E+02	
$Th_{232+10d}$	5.6E+01	3.0E+03	NA	4.2E+00	
U_{234}	3.8E+02	2.3E+04	NA	3.3E+01	
U_{235+1D}	1.1E+02	3.6E+03	NA	5.2E+00	
U_{238+2d}	1.4E+03	9.2E+04	NA	1.3E+02	1.1E-02
Rn_{222+4d}	1.3E+01	NA	NA	NA	
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day		
arsenic	2.9E-06	8.8E-05	1.1E-06	NA	NA
beryllium	2.0E-09	1.3E-07	1.6E-08	NA	NA
cadmium	3.3E-09	3.7E-07	4.5E-08	NA	NA
chromium vi	2.0E-08	1.7E-06	2.1E-07	NA	NA
lead	2.9E-06	3.1E-06	3.7E-07	NA	NA
nickel	4.1E-08	3.0E-06	1.8E-08	NA	NA
pcbs	7.0E-10	8.0E-08	2.9E-08	NA	NA
benzo(a)anthracene	3.1E-11	4.9E-09	NA	NA	NA
benzo(a)pyrene	2.3E-11	2.4E-09	NA	NA	NA
benzo(b)fluoranthene	4.7E-11	3.7E-09	NA	NA	NA
benzo(k)fluoranthene	2.0E-12	1.9E-09	NA	NA	NA
chrysene	2.9E-11	4.5E-09	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.0E-11	2.8E-10	NA	NA	NA
n-nitrosodipropylamine	3.7E-11	1.0E-09	3.6E-10	NA	NA
pentachlorophenol	1.0E-10	2.8E-09	1.0E-08	NA	NA
vinyl chloride	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	4.0E-12	1.4E-12	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	3.9E-15	9.6E-13	3.5E-13	NA	NA
hexachlorodibenzofuran	NA	7.0E-12	2.5E-12	NA	NA
heptachlorodibenzo-p-dioxin	1.4E-13	3.4E-11	1.2E-11	NA	NA
heptachlorodibenzofuran	1.7E-14	4.2E-12	1.5E-12	NA	NA
octachlorodibenzo-p-dioxin	1.5E-12	3.9E-10	1.4E-10	NA	NA
octachlorodibenzofuran	8.8E-14	2.2E-11	7.9E-12	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	9.2E-10	1.4E-08	6.8E-08	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
[a] Calculation of dose from penetrating radiation for homebuilder is provided in Table E.IV-42.

5511

TABLE E.III-33
INTAKES FOR TOXICANTS FOR ON-PROPERTY HOME BUILDER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	
cyanide	NA	NA	NA	NA
antimony	8.9E-07	2.2E-04	2.7E-05	NA
arsenic	4.3E-04	1.3E-02	1.5E-04	NA
barium	3.1E-04	1.8E-02	2.2E-03	NA
beryllium	2.9E-07	1.9E-05	2.3E-06	NA
boron	NA	NA	NA	NA
cadmium	4.9E-07	5.5E-05	6.5E-06	NA
chromium vi	2.9E-06	2.5E-04	3.0E-05	NA
cobalt	6.3E-07	1.0E-04	1.2E-05	NA
copper	1.5E-04	7.3E-03	8.8E-05	NA
lead	4.3E-04	4.6E-04	5.5E-05	NA
manganese	2.4E-04	1.2E-02	1.4E-03	NA
mercury	6.0E-08	2.4E-06	1.4E-06	NA
molybdenum	1.1E-05	6.0E-04	7.2E-05	NA
nickel	6.0E-06	4.4E-04	2.6E-06	NA
selenium	1.1E-06	3.9E-05	4.6E-06	NA
silver	7.7E-07	8.8E-05	1.1E-05	NA
thallium	7.1E-07	3.4E-05	4.0E-06	NA
vanadium	7.1E-05	3.9E-03	4.6E-05	NA
thorium-total	7.4E-07	1.2E-03	4.4E-04	NA
uranium-total	1.5E-04	5.5E-03	6.6E-04	NA
fluoride	2.7E-05	1.6E-02	5.8E-03	NA
acenaphthylene	1.1E-09	3.1E-08	1.1E-07	NA
2-methylnaphthalene	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA
benzo(g,h,i)perylene	1.9E-09	5.1E-08	NA	NA
dibenzofuran	NA	NA	NA	NA
pentachlorophenol	1.5E-08	4.1E-07	1.5E-06	NA
phenanthrene	6.9E-09	1.8E-07	6.6E-07	NA
tributyl phosphate	NA	NA	NA	NA
2-hexanone	2.0E-10	5.4E-09	NA	NA
3-chloropropene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	1.3E-07	2.1E-06	9.9E-06	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

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TABLE E.III-34
INTAKES FOR CARCINOGENS FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS, FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air		Surface Soil		Surface Water	
Exposure Pathways: / Contaminants of Concern	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Radionuclides	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life	pCi/life
Cs_{137+1d}	1.0E+04	1.4E+04	1.3E+05	1.8E+05	1.2E+06	1.7E+06
Np_{237+1d}	2.1E+01	7.7E+00	2.8E+02	1.0E+02	NA	NA
Pu_{238}	7.4E-03	5.9E-03	4.8E-02	3.8E-02	NA	NA
$Pu_{239/240}$	7.1E-02	5.7E-02	9.6E-02	7.7E-02	NA	NA
Ra_{226+8d}	1.3E+03	9.2E+03	8.0E+02	5.8E+03	8.1E+01	5.9E+02
Ru_{106}	2.6E+01	3.2E-02	NA	NA	NA	NA
Sr_{90+1d}	1.0E+02	2.0E+03	1.0E+05	2.1E+06	1.9E+04	3.8E+05
Tc_{99}	8.2E+04	3.9E+05	4.2E+07	2.0E+08	9.8E+06	4.7E+07
Th_{230}	8.7E+02	2.9E+03	8.7E+02	2.9E+03	7.7E-01	2.6E+00
$Th_{232+10d}$	2.8E+01	9.5E+01	3.3E+01	1.1E+02	1.5E+01	5.3E+01
U_{234}	1.8E+03	2.2E+04	4.0E+04	4.8E+05	7.8E+04	9.7E+05
U_{235+1D}	4.9E+02	5.9E+03	6.4E+03	7.6E+04	4.5E+03	5.6E+04
U_{238+2d}	6.5E+03	7.9E+04	2.7E+05	3.2E+06	1.9E+05	2.4E+06
Chemicals	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
arsenic	3.6E-04	4.3E-05	4.2E-05	5.1E-06	3.1E-06	3.8E-07
beryllium	1.9E-07	6.8E-10	7.9E-07	2.9E-09	NA	NA
cadmium	2.0E-06	1.4E-05	9.3E-05	6.7E-04	NA	NA
chromium vi	9.9E-06	1.1E-05	NA	NA	NA	NA
lead	2.6E-04	8.8E-04	NA	NA	2.0E-06	6.8E-06
nickel	4.6E-05	3.1E-05	NA	NA	1.6E-04	1.1E-04
pcbs	3.2E-06	4.0E-06	4.4E-05	5.5E-05	NA	NA
benzo(a)anthracene	7.7E-09	9.8E-09	1.6E-06	2.1E-06	NA	NA
benzo(a)pyrene	1.3E-08	1.7E-08	1.2E-06	1.5E-06	NA	NA
benzo(b)fluoranthene	1.0E-07	1.3E-07	4.5E-06	5.8E-06	NA	NA
benzo(k)fluoranthene	8.7E-09	1.1E-08	5.9E-06	7.4E-06	NA	NA
chrysene	7.6E-09	9.6E-09	1.5E-06	1.9E-06	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	2.7E-07	3.5E-07	NA	NA	NA	NA
n-nitrosodipropylamine	5.5E-13	7.0E-13	NA	NA	NA	NA
pentachlorophenol	6.4E-09	8.2E-09	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	1.6E-11	2.2E-11	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	5.4E-10	7.6E-10	NA	NA	NA	NA
heptachlorodibenzofuran	4.2E-12	6.0E-12	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	6.1E-09	8.7E-09	NA	NA	NA	NA
octachlorodibenzofuran	2.2E-11	3.1E-11	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	2.6E-10	3.6E-10
tetrachloroethene	3.3E-10	4.3E-10	NA	NA	1.4E-09	1.8E-09
benzene	NA	NA	NA	NA	1.0E-08	1.4E-08
methylene chloride	NA	NA	NA	NA	2.9E-11	6.7E-11

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

TABLE E.III-35
INTAKES FOR TOXICANTS FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS, FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air		Surface Soil		Surface Water	
Exposure Pathways:	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Toxicants	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day	mg/Kg/day
cyanide	NA	NA	NA	NA	2.0E-09	2.6E-09
antimony	1.4E-06	5.5E-07	3.0E-04	1.2E-04	8.0E-06	3.2E-06
arsenic	3.6E-04	4.3E-05	4.2E-05	5.1E-06	3.1E-06	3.8E-07
barium	1.8E-04	1.7E-03	NA	NA	6.8E-05	6.4E-04
beryllium	1.9E-07	6.8E-10	7.9E-07	2.9E-09	NA	NA
boron	NA	NA	NA	NA	NA	NA
cadmium	2.0E-06	1.4E-05	9.3E-05	6.7E-04	NA	NA
chromium vi	9.9E-06	1.1E-05	NA	NA	NA	NA
cobalt	7.2E-06	2.9E-06	NA	NA	NA	NA
copper	2.3E-03	1.4E-03	NA	NA	4.7E-04	2.9E-04
lead	2.6E-04	8.8E-04	NA	NA	2.0E-06	6.8E-06
manganese	1.3E-04	4.7E-04	NA	NA	4.6E-06	1.6E-05
mercury	6.0E-06	4.3E-08	NA	NA	NA	NA
molybdenum	5.2E-05	5.2E-05	NA	NA	NA	NA
nickel	4.6E-05	3.1E-05	NA	NA	1.6E-04	1.1E-04
selenium	1.2E-05	1.3E-05	NA	NA	3.3E-05	3.5E-05
silver	4.9E-06	1.3E-04	NA	NA	3.7E-05	9.8E-04
thallium	1.5E-05	3.0E-06	2.0E-05	4.0E-06	NA	NA
vanadium	8.8E-05	2.8E-06	NA	NA	1.9E-04	6.3E-06
thorium-total	2.6E-09	8.6E-09	1.9E-08	6.5E-08	NA	NA
uranium-total	4.7E-06	5.6E-05	7.9E-05	9.4E-04	NA	NA
fluoride	NA	NA	NA	NA	NA	NA
acenaphthylene	4.4E-11	5.9E-11	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	1.2E-07	1.6E-07	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA
pentachlorophenol	6.4E-09	8.2E-09	NA	NA	NA	NA
phenanthrene	8.0E-10	1.0E-09	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA
2-hexanone	2.9E-14	3.7E-14	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	2.6E-10	3.6E-10
tetrachloroethene	3.3E-10	4.3E-10	NA	NA	1.4E-09	1.8E-09
methylene chloride	NA	NA	NA	NA	2.9E-11	6.7E-11
toluene	NA	NA	NA	NA	4.6E-09	6.4E-09
2-nitrophenol	NA	NA	NA	NA	7.1E-10	9.3E-10
acetone	NA	NA	NA	NA	1.0E-10	2.3E-10

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

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E.IV

Tables

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TABLE E.IV-1
ILCRs FOR ON-PROPERTY GROUNDSKEEPER CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	External Exposure[a]
Radionuclides					
Cs_{137+1d}	1.9E-12	2.0E-09	NA	1.3E-06	
Np_{237+1d}	1.8E-09	9.6E-09	NA	1.7E-07	
Pu_{238}	4.8E-10	1.9E-09	NA	2.2E-12	
$Pu_{239/240}$	9.3E-10	4.0E-09	NA	4.3E-12	
Ra_{226+8d}	1.2E-09	9.6E-08	NA	6.7E-06	
Ra_{228+1d}	1.9E-10	1.9E-08	NA	5.1E-06	
Sr_{90+1d}	1.2E-11	4.7E-09	NA	ND	
Tc_{99}	5.7E-12	6.4E-10	NA	2.7E-12	
Th_{228+7d}	7.5E-08	3.8E-08	NA	3.5E-05	
Th_{230}	5.1E-07	1.7E-07	NA	6.3E-09	
Th_{232}	1.9E-08	5.8E-09	NA	1.1E-10	
U_{234}	3.8E-07	1.6E-07	NA	2.8E-09	
U_{235+1D}	4.3E-09	2.6E-08	NA	3.6E-06	
U_{238+2d}	5.0E-06	1.9E-06	NA	2.3E-05	
Rn_{222+4d}	4.0E-12	NA	NA	NA	
Total Radionuclides	6.0E-06	2.5E-06		7.4E-05	4.6E-05
Chemicals					
arsenic	8.4E-09	7.0E-07	4.2E-08	NA	NA
beryllium	4.4E-10	1.6E-07	9.3E-06	NA	NA
cadmium	2.5E-09	ND	ND	NA	NA
lead	NA	NA	NA	NA	NA
nickel	NA	NA	NA	NA	NA
pcbs	ND	5.3E-07	1.2E-06	NA	NA
benzo(a)anthracene	4.1E-12	3.5E-09	3.5E-09	NA	NA
benzo(a)pyrene	1.8E-11	1.5E-08	1.5E-08	NA	NA
benzo(b)fluoranthene	2.5E-12	2.1E-09	2.1E-09	NA	NA
benzo(k)fluoranthene	2.1E-13	1.6E-10	1.6E-10	NA	NA
chrysene	NA	1.4E-10	1.4E-10	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA
Sum Chem. (TEF for PAHs):	1.1E-08	1.4E-06	1.1E-05		
Sum Chem. (BaP for PAHs):	1.1E-08	1.5E-06	1.1E-05		
TOTAL ALL (TEF):	6.0E-06	3.9E-06	1.1E-05	7.4E-05	4.6E-05
TOTAL ALL (BaP):	6.0E-06	4.0E-06	1.1E-05	7.4E-05	4.6E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from to exposure to buried gamma radiation sources.
[b] Risk from dermal contact with PAHs is assumed to equal the risk from oral ingestion of PAHs.

5511

TABLE E.IV-2
HAZARD QUOTIENTS FOR ON-PROPERTY GROUNDKEEPER CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants				
cyanide	NA	NA	NA	NA
antimony	ND	9.6E-03	3.7E-02	NA
arsenic	ND	3.7E-03	2.3E-04	NA
barium	NA	NA	NA	NA
beryllium	ND	2.1E-05	1.2E-03	NA
cadmium	ND	8.0E-04	9.2E-03	NA
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
thallium	ND	1.4E-03	7.9E-04	NA
vanadium	NA	NA	NA	NA
thorium-total	ND	ND	ND	NA
uranium-total	ND	1.9E-02	2.2E-01	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA
TOTAL:	0.0E+00	3.4E-02	2.7E-01	

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

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TABLE E.IV-3
ILCRs FOR RME OFF-PROPERTY FARMER
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Radionuclides				
Cs_{137+1d}	9.5E−13	2.3E−11	4.0E−11	5.6E−11
Np_{237+1d}	9.1E−10	9.3E−11	5.3E−13	1.9E−13
Pu_{238}	2.5E−10	1.7E−11	6.3E−16	5.1E−16
$Pu_{239/240}$	4.7E−10	3.6E−11	2.8E−15	2.3E−15
Ra_{226+8d}	6.1E−10	9.6E−10	4.0E−11	2.8E−10
Ra_{228+1d}	9.5E−11	1.7E−10	2.4E−12	1.8E−11
Sr_{90+1d}	5.8E−12	5.4E−11	3.3E−12	6.6E−11
Tc_{99}	2.9E−12	6.0E−12	3.6E−12	1.7E−11
Th_{228+7d}	3.8E−08	3.4E−10	1.0E−13	3.5E−13
Th_{230}	2.7E−07	1.5E−09	1.8E−12	6.1E−12
Th_{232}	9.6E−09	5.3E−11	6.3E−14	2.1E−13
U_{234}	1.9E−07	1.5E−09	1.7E−11	2.0E−10
U_{235+1D}	2.8E−08	2.3E−10	2.5E−12	3.1E−11
U_{238+2d}	2.6E−06	1.8E−08	2.0E−10	2.3E−09
Rn_{222+4d}	2.0E−12	ND	ND	ND
Total Radionuclides	3.1E−06	2.3E−08	3.1E−10	3.0E−09
Chemicals				
arsenic	4.2E−09	7.2E−09	1.8E−09	2.2E−10
beryllium	2.2E−10	1.7E−09	3.3E−10	1.2E−12
cadmium	1.3E−09	ND	ND	ND
lead	NA	NA	NA	NA
nickel	NA	NA	NA	NA
pcbs	ND	1.7E−08	5.1E−08	6.4E−08
benzo(a)anthracene	2.1E−12	3.3E−11	1.9E−11	2.4E−11
benzo(a)pyrene	9.1E−12	1.4E−10	1.9E−10	2.4E−10
benzo(b)fluoranthene	1.3E−12	1.9E−11	9.9E−11	1.3E−10
benzo(k)fluoranthene	9.9E−14	1.5E−12	1.6E−11	2.0E−11
chrysene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
benzene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
Sum Chem. (TEF for PAHs):	5.8E−09	2.7E−08	5.3E−08	6.5E−08
Sum Chem. (BaP for PAHs):	5.8E−09	2.7E−08	5.4E−08	6.6E−08
TOTAL ALL (TEF):	3.1E−06	4.9E−08	5.3E−08	6.8E−08
TOTAL ALL (BaP):	3.1E−06	4.9E−08	5.4E−08	6.9E−08

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

TABLE E.IV-4
HAZARD QUOTIENTS FOR RME OFF-PROPERTY FARMER CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Toxicants				
cyanide	NA	NA	NA	NA
antimony	ND	6.0E-05	1.7E-05	6.6E-06
arsenic	ND	1.4E-05	3.5E-06	4.2E-07
barium	NA	NA	NA	NA
beryllium	ND	7.9E-08	1.5E-08	5.6E-11
cadmium	ND	2.8E-05	3.7E-06	2.7E-05
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
thallium	ND	4.6E-06	3.2E-05	6.5E-06
vanadium	NA	NA	NA	NA
thorium-total	ND	ND	ND	ND
uranium-total	ND	6.0E-05	6.7E-07	8.1E-06
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA
TOTAL:	0.0E+00	1.7E-04	5.7E-05	4.9E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

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TABLE E.IV–5
ILCRs FOR RME OFF–PROPERTY CHILD
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Radionuclides				
Cs_{137+1d}	4.9E−14	1.7E−12	1.3E−12	1.1E−11
Np_{237+1d}	4.7E−11	6.9E−12	1.7E−14	3.7E−14
Pu_{238}	1.3E−11	1.3E−12	2.1E−17	9.8E−17
$Pu_{239/240}$	2.4E−11	2.7E−12	9.3E−17	4.4E−16
Ra_{226+8d}	3.2E−11	7.1E−11	1.3E−12	5.5E−11
Ra_{228+1d}	4.9E−12	1.3E−11	8.0E−14	3.4E−12
Sr_{90+1d}	3.0E−13	4.0E−12	1.1E−13	1.3E−11
Tc_{99}	1.5E−13	4.5E−13	1.2E−13	3.3E−12
Th_{228+7d}	2.0E−09	2.5E−11	3.4E−15	6.8E−14
Th_{230}	1.4E−08	1.2E−10	6.1E−14	1.2E−12
Th_{232}	5.0E−10	3.9E−12	2.1E−15	4.1E−14
U_{234}	9.8E−09	1.1E−10	5.5E−13	3.9E−11
U_{235+1D}	1.5E−09	1.7E−11	8.4E−14	5.9E−12
U_{238+2d}	1.3E−07	1.3E−09	6.5E−12	4.6E−10
Rn_{222+4d}	1.0E−13	ND	ND	ND
Total Radionuclides	1.6E−07	1.7E−09	1.0E−11	5.9E−10
Chemicals				
arsenic	1.0E−09	2.5E−09	2.8E−10	2.0E−10
beryllium	5.4E−11	5.9E−10	5.1E−11	1.1E−12
cadmium	3.1E−10	ND	ND	ND
lead	NA	NA	NA	NA
nickel	NA	NA	NA	NA
pcbs	ND	6.0E−09	7.8E−09	5.8E−08
benzo(a)anthracene	5.0E−13	1.2E−11	2.9E−12	2.2E−11
benzo(a)pyrene	2.2E−12	4.9E−11	2.9E−11	2.2E−10
benzo(b)fluoranthene	3.0E−13	6.7E−12	1.5E−11	1.1E−10
benzo(k)fluoranthene	2.4E−14	5.4E−13	2.5E−12	1.8E−11
chrysene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
benzene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
Sum Chem. (TEF for PAHs):	1.4E−09	9.2E−09	8.2E−09	5.9E−08
Sum Chem. (BaP for PAHs):	1.4E−09	9.3E−09	8.4E−09	6.0E−08
TOTAL ALL (TEF):	1.6E−07	1.1E−08	8.2E−09	5.9E−08
TOTAL ALL (BaP):	1.6E−07	1.1E−08	8.4E−09	6.0E−08

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

TABLE E.IV-6
HAZARD QUOTIENTS FOR OFF-PROPERTY CHILD
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air			
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products
Toxicants				
cyanide	NA	NA	NA	NA
antimony	ND	2.4E-04	3.0E-05	7.0E-05
arsenic	ND	5.6E-05	6.3E-06	4.4E-06
barium	NA	NA	NA	NA
beryllium	ND	3.2E-07	2.8E-08	5.9E-10
cadmium	ND	1.1E-04	6.8E-06	2.9E-04
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
thallium	ND	1.9E-05	5.8E-05	6.8E-05
vanadium	NA	NA	NA	NA
thorium-total	ND	ND	ND	ND
uranium-total	ND	2.4E-04	1.2E-06	8.5E-05
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA
TOTAL:	0.0E+00	6.8E-04	1.0E-04	5.2E-04

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

TABLE E.IV-7
ILCRs FOR TRESPASSING YOUTH
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	External Exposure[a]
Radionuclides					
Cs_{137+1d}	2.2E−13	3.5E−10	NA	4.6E−07	
Np_{237+1d}	2.1E−10	1.7E−09	NA	6.1E−08	
Pu_{238}	5.7E−11	3.4E−10	NA	8.0E−13	
$Pu_{239/240}$	1.1E−10	7.2E−10	NA	1.5E−12	
Ra_{226+8d}	1.4E−10	1.7E−08	NA	2.4E−06	
Ra_{228+1d}	2.2E−11	3.4E−09	NA	1.8E−06	
Sr_{90+1d}	1.4E−12	8.4E−10	NA	ND	
Tc_{99}	6.7E−13	1.1E−10	NA	9.6E−13	
Th_{228+7d}	8.8E−09	6.7E−09	NA	1.2E−05	
Th_{230}	6.0E−08	3.0E−08	NA	2.2E−09	
Th_{232}	2.2E−09	1.0E−09	NA	4.1E−11	
U_{234}	4.5E−08	2.9E−08	NA	1.0E−09	
U_{235+1D}	5.0E−10	4.7E−09	NA	1.3E−06	
U_{238+2d}	5.9E−07	3.4E−07	NA	8.1E−06	
Rn_{222+4d}	4.8E−13	NA	NA	NA	
Total Radionuclides	7.1E−07	4.4E−07		2.7E−05	1.7E−05
Chemicals					
arsenic	1.6E−09	2.0E−07	3.6E−08	NA	NA
beryllium	8.6E−11	4.7E−08	7.9E−06	NA	NA
cadmium	4.9E−10	ND	ND	NA	NA
lead	NA	NA	NA	NA	NA
nickel	NA	NA	NA	NA	NA
pcbs	ND	1.5E−07	1.0E−06	NA	NA
benzo(a)anthracene	7.9E−13	1.0E−09	1.0E−09	NA	NA
benzo(a)pyrene	3.5E−12	4.4E−09	4.4E−09	NA	NA
benzo(b)fluoranthene	4.8E−13	6.1E−10	6.1E−10	NA	NA
benzo(k)fluoranthene	4.1E−14	4.8E−11	4.8E−11	NA	NA
chrysene	NA	4.0E−11	4.0E−11	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA
Sum Chem. (TEF for PAHs):	2.2E−09	4.1E−07	9.0E−06		
Sum Chem. (BaP for PAHs):	2.2E−09	4.3E−07	9.0E−06		
TOTAL ALL (TEF):	7.1E−07	8.5E−07	9.0E−06	2.7E−05	1.7E−05
TOTAL ALL (BaP):	7.1E−07	8.7E−07	9.0E−06	2.7E−05	1.7E−05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.
[b] Risk from dermal contact with PAHs is assumed to equal risk from oral ingestion of PAHs.

5511

TABLE E.IV-8
HAZARD QUOTIENTS FOR TRESPASSING YOUTH
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Air	Soil		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants				
cyanide	NA	NA	NA	NA
antimony	ND	5.8E-03	6.5E-02	NA
arsenic	ND	2.3E-03	4.0E-04	NA
barium	NA	NA	NA	NA
beryllium	ND	1.3E-05	2.1E-03	NA
cadmium	ND	4.9E-04	1.6E-02	NA
copper	NA	NA	NA	NA
lead	NA	NA	NA	NA
manganese	NA	NA	NA	NA
nickel	NA	NA	NA	NA
selenium	NA	NA	NA	NA
silver	NA	NA	NA	NA
thallium	ND	8.3E-04	1.4E-03	NA
vanadium	NA	NA	NA	NA
thorium-total	ND	ND	ND	NA
uranium-total	ND	1.1E-02	3.8E-01	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA
TOTAL:	0.0E+00	2.1E-02	4.7E-01	

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

5511

TABLE E.IV-9
ILCRs FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Soil		Surface Water	
Exposure Pathways: / Contaminants of Concern	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Radionuclides				
Cs_{137+1d}	3.7E-06	5.2E-06	3.7E-05	5.3E-05
Np_{237+1d}	6.1E-08	2.2E-08	NA	NA
Pu_{238}	1.1E-11	8.4E-12	NA	NA
$Pu_{239/240}$	2.2E-11	1.8E-11	NA	NA
Ra_{226+8d}	6.3E-07	4.5E-06	3.6E-08	2.7E-07
Ra_{228+1d}	1.2E-07	9.0E-07	6.1E-08	4.6E-07
Sr_{90+1d}	3.7E-06	7.4E-05	7.6E-07	1.5E-05
Tc_{99}	5.4E-05	2.5E-04	1.0E-05	4.9E-05
Th_{228+7d}	2.5E-09	8.5E-09	NA	NA
Th_{230}	1.1E-08	3.8E-08	8.5E-12	2.9E-11
Th_{232}	3.9E-10	1.3E-09	NA	NA
U_{234}	6.4E-07	7.7E-06	9.8E-07	1.2E-05
U_{235+1D}	1.0E-07	1.2E-06	5.4E-08	6.7E-07
U_{238+2d}	7.5E-06	9.0E-05	3.6E-06	4.4E-05
Total Radionuclides	7.1E-05	4.4E-04	5.2E-05	1.7E-04
Chemicals				
arsenic	7.4E-05	8.8E-06	5.0E-06	6.1E-07
beryllium	3.4E-06	1.2E-08	NA	NA
cadmium	ND	ND	NA	NA
lead	NA	NA	ND	ND
nickel	NA	NA	ND	ND
pcbs	3.4E-04	4.3E-04	NA	NA
benzo(a)anthracene	1.2E-06	1.5E-06	NA	NA
benzo(a)pyrene	8.8E-06	1.1E-05	NA	NA
benzo(b)fluoranthene	3.3E-06	4.2E-06	NA	NA
benzo(k)fluoranthene	4.3E-07	5.4E-07	NA	NA
chrysene	4.7E-08	5.9E-08	NA	NA
chloroform	NA	NA	1.6E-12	2.2E-12
tetrachloroethene	NA	NA	7.1E-11	9.2E-11
benzene	NA	NA	3.5E-10	4.6E-10
methylene chloride	NA	NA	2.4E-13	5.4E-13
Sum Chem. (TEF for PAHs):	4.3E-04	4.5E-04	5.0E-06	6.1E-07
Sum Chem. (BaP for PAHs):	4.8E-04	5.2E-04	5.0E-06	6.1E-07
TOTAL ALL (TEF):	5.0E-04	8.9E-04	5.7E-05	1.8E-04
TOTAL ALL (BaP):	5.5E-04	9.5E-04	5.7E-05	1.8E-04

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

TABLE E.IV-10
HAZARD QUOTIENTS FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS
CURRENT LAND USE, CURRENT SOURCE TERM

Transfer Media:	Soil		Surface Water	
Exposure Pathways:	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Toxicants				
cyanide	NA	NA	1.0E-07	1.3E-07
antimony	7.5E-01	3.0E-01	2.3E-02	9.4E-03
arsenic	1.4E-01	1.7E-02	9.5E-03	1.2E-03
barium	NA	NA	1.1E-03	1.0E-02
beryllium	1.6E-04	5.7E-07	NA	NA
cadmium	9.3E-02	6.7E-01	NA	NA
copper	NA	NA	1.2E-02	7.1E-03
lead	NA	NA	ND	ND
manganese	NA	NA	1.8E-05	6.3E-05
nickel	NA	NA	9.2E-03	6.1E-03
selenium	NA	NA	6.2E-03	6.7E-03
silver	NA	NA	4.0E-03	1.1E-01
thallium	2.9E-01	5.8E-02	NA	NA
vanadium	NA	NA	1.9E-02	6.1E-04
thorium-total	ND	ND	NA	NA
uranium-total	2.6E-02	3.1E-01	NA	NA
chloroform	NA	NA	2.6E-08	3.6E-08
tetrachloroethene	NA	NA	1.4E-07	1.8E-07
methylene chloride	NA	NA	5.2E-10	1.2E-09
toluene	NA	NA	2.6E-08	3.6E-08
2-nitrophenol	NA	NA	ND	ND
acetone	NA	NA	5.9E-10	1.3E-09
TOTAL:	1.3E+00	1.4E+00	8.4E-02	1.5E-01

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-11
ILCRs FOR TRESPASSING YOUTH
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Radionuclides										
Cs_{137+1d}	1.3E-10	2.2E-09	NA	2.8E-06	1.4E-12	NA	1.0E-10	NA	1.4E-07	
Np_{237+1d}	1.5E-07	1.3E-08	NA	4.5E-07	1.8E-10	NA	4.1E-10	NA	1.5E-08	
Pu_{238}	1.1E-08	9.9E-10	NA	2.3E-12	4.8E-12	NA	3.3E-10	NA	8.0E-13	
$Pu_{239/240}$	4.9E-08	4.5E-09	NA	9.6E-12	1.2E-12	NA	8.6E-11	NA	1.9E-13	
Ra_{226+8d}	2.8E-07	2.8E-07	NA	3.9E-05	NA	NA	NA	NA	NA	
Ru_{106}	1.6E-10	5.4E-10	NA	ND	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.2E-10	1.4E-09	NA	ND	5.6E-10	NA	2.3E-10	NA	ND	
Tc_{99}	1.6E-08	3.3E-09	NA	2.7E-11	4.8E-09	NA	2.3E-11	NA	2.0E-13	
Th_{230}	3.0E-05	1.5E-07	NA	1.1E-08	1.6E-11	NA	3.7E-09	NA	2.9E-10	
$Th_{232+10d}$	3.9E-06	7.1E-08	NA	6.4E-05	1.2E-11	NA	2.7E-09	NA	2.6E-06	
U_{234}	5.9E-06	5.2E-08	NA	1.8E-09	7.3E-09	NA	3.6E-09	NA	1.3E-10	
U_{235+1D}	1.6E-06	8.2E-09	NA	2.2E-06	8.3E-10	NA	4.0E-10	NA	1.1E-07	
U_{238+2d}	4.3E-05	3.7E-07	NA	8.5E-06	5.2E-08	NA	2.5E-08	NA	6.2E-07	
Rn_{222+4d}	5.7E-11	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	8.5E-05	9.5E-07		1.2E-04	6.6E-08		3.7E-08		3.5E-06	7.2E-06
Chemicals										
arsenic	4.2E-05	3.6E-05	8.3E-06	NA	3.6E-09	5.6E-10	2.9E-08	2.2E-08	NA	NA
beryllium	1.9E-08	1.3E-07	2.9E-05	NA	2.2E-10	3.3E-09	1.2E-08	8.2E-06	NA	NA
cadmium	2.0E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
chromium vi	7.9E-07	ND	ND	NA	ND	ND	ND	ND	NA	NA
lead	ND	ND	ND	NA	ND	ND	ND	ND	NA	NA
nickel	3.5E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
pcbs	ND	1.4E-07	1.2E-06	NA	3.5E-11	5.0E-08	4.2E-08	1.2E-06	NA	NA
benzo(a)anthracene	1.7E-11	8.2E-10	8.2E-10	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	1.4E-10	4.0E-09	4.0E-09	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	2.6E-11	6.2E-10	6.2E-10	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	3.0E-14	3.2E-11	3.2E-11	NA	NA	NA	NA	NA	NA	NA
chrysene	7.6E-13	3.3E-11	3.3E-11	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	6.2E-12	4.8E-11	4.8E-11	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	1.6E-09	1.2E-08	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	7.8E-11	5.8E-09	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	1.4E-08	1.8E-07	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	5.7E-11	3.3E-09	4.4E-08	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	2.4E-08	3.2E-07	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	2.0E-10	1.2E-08	1.6E-07	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	2.5E-11	1.5E-09	1.9E-08	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	2.3E-10	1.3E-08	1.8E-07	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	1.3E-11	7.6E-10	1.0E-08	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	1.8E-12	1.7E-10	1.7E-08	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	4.3E-05	3.6E-05	3.9E-05		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
Sum Chem (BaP for PAHs):	4.3E-05	3.6E-05	3.9E-05		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
TOTAL ALL (TEF Approach):	1.3E-04	3.7E-05	3.9E-05	1.2E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	7.2E-06
TOTAL ALL (BaP Approach):	1.3E-04	3.7E-05	3.9E-05	1.2E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	7.2E-06

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

ND – No data for toxicity assessment for exposure pathway.

[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.

[b] Risk from dermal contact with PAHs is assumed to equal risk from oral ingestion of PAHs.

TABLE E.IV-12
HAZARD QUOTIENTS FOR TRESPASSING YOUTH
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants									
cyanide	NA	NA	NA	NA	5.1E-05	ND	NA	NA	NA
antimony	ND	5.1E-03	7.5E-02	NA	1.6E-04	1.6E-04	1.4E-03	6.3E-02	NA
arsenic	ND	3.9E-01	9.2E-02	NA	4.0E-05	6.2E-06	3.2E-04	2.4E-04	NA
barium	8.5E-02	2.4E-03	5.8E-03	NA	3.5E-07	5.6E-08	1.6E-05	1.2E-04	NA
beryllium	ND	3.5E-05	7.8E-03	NA	6.0E-08	8.8E-07	3.2E-06	2.2E-03	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	ND	5.0E-04	2.2E-02	NA	5.7E-06	1.7E-05	1.2E-04	1.6E-02	NA
chromium vi	ND	4.6E-04	2.0E-02	NA	9.3E-07	5.5E-06	5.7E-05	8.0E-03	NA
cobalt	8.1E-02	1.5E-05	7.5E-05	NA	1.5E-07	2.0E-08	3.4E-06	5.4E-05	NA
copper	ND	1.7E-03	ND	NA	1.7E-06	ND	8.4E-06	ND	NA
lead	ND	ND	ND	NA	ND	ND	ND	ND	NA
manganese	8.2E-02	7.8E-04	5.7E-02	NA	1.1E-05	5.5E-05	8.2E-05	1.9E-02	NA
mercury	2.7E-05	7.3E-05	5.4E-03	NA	1.6E-05	1.6E-05	NA	NA	NA
molybdenum	ND	1.1E-03	6.4E-03	NA	4.7E-06	1.8E-06	1.7E-05	3.1E-04	NA
nickel	ND	2.0E-04	2.2E-04	NA	1.1E-06	1.6E-07	2.9E-05	1.0E-04	NA
selenium	ND	7.1E-05	2.0E-04	NA	8.0E-08	1.5E-08	NA	NA	NA
silver	ND	1.6E-04	ND	NA	4.8E-06	ND	3.5E-05	ND	NA
thallium	ND	4.4E-03	9.8E-03	NA	3.3E-06	4.8E-07	2.0E-04	1.4E-03	NA
vanadium	ND	5.1E-03	2.3E-02	NA	1.4E-06	4.0E-06	5.6E-05	7.8E-04	NA
thorium-total	ND	ND	ND	NA	NA	NA	ND	ND	NA
uranium-total	ND	1.7E-02	7.4E-01	NA	9.9E-03	2.9E-02	NA	NA	NA
fluoride	ND	2.5E-03	1.6E-02	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.3E-07	9.3E-06	NA	NA	NA	NA	NA	NA
phenanthrene	ND	ND	ND	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	ND	1.2E-09	ND	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	1.9E-06	1.9E-04	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA
SUM	2.5E-01	4.4E-01	1.1E+00		1.0E-02	2.9E-02	2.3E-03	1.1E-01	

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

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TABLE E.IV-13
ILCRs FOR GREAT MIAMI RIVER USER
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Surface Water								
Exposure Pathways: / Contaminants of Concern	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	Dermal Contact while Swimming	Incidental Ingestion while Swimming	Ingestion of Fish
Radionuclides									
Cs_{137+1d}	3.8E-12	1.5E-12	1.6E-12	2.3E-12	NA	NA	NA	2.1E-15	8.9E-11
Np_{237+1d}	5.0E-10	1.6E-10	5.6E-13	2.1E-13	NA	NA	NA	2.8E-13	5.8E-11
Pu_{238}	1.3E-11	3.9E-12	7.1E-17	5.9E-17	NA	NA	NA	7.2E-15	3.7E-12
$Pu_{239/240}$	3.4E-12	1.0E-12	2.0E-17	1.6E-17	NA	NA	NA	1.9E-15	9.7E-13
Ra_{226+Rd}	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ru_{106}	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sr_{90+1d}	1.5E-09	6.2E-10	2.2E-11	4.5E-10	NA	NA	NA	8.6E-13	5.3E-10
Tc_{99}	1.3E-08	4.1E-09	1.6E-09	7.8E-09	NA	NA	NA	7.2E-12	2.2E-09
Th_{230}	4.2E-11	1.3E-11	3.3E-15	1.1E-14	NA	NA	NA	2.3E-14	1.5E-11
$Th_{232+10d}$	3.2E-11	9.6E-12	2.5E-15	8.5E-15	NA	NA	NA	1.8E-14	1.1E-11
U_{234}	2.0E-08	6.0E-09	4.4E-11	5.5E-10	NA	NA	NA	1.1E-11	4.6E-10
U_{235+1D}	2.2E-09	6.7E-10	5.0E-12	6.2E-11	NA	NA	NA	1.2E-12	5.2E-11
U_{238+2d}	1.4E-07	4.3E-08	3.1E-10	3.9E-09	NA	NA	NA	7.9E-11	3.3E-09
Total Radionuclides	1.8E-07	5.4E-08	2.0E-09	1.3E-08				9.9E-11	6.7E-09
Chemicals									
arsenic	4.8E-09	1.7E-09	2.4E-10	2.9E-11	NA	1.5E-11	3.1E-12	2.7E-12	2.4E-09
beryllium	3.7E-10	1.3E-10	1.0E-11	3.6E-14	NA	1.0E-10	2.2E-11	2.0E-13	8.0E-11
cadmium	ND	ND	ND	ND	NA	ND	ND	ND	ND
chromium vi	ND	ND	ND	ND	NA	ND	ND	ND	ND
lead	ND	ND	ND	ND	NA	ND	ND	ND	ND
nickel	ND	ND	ND	ND	NA	ND	ND	ND	ND
pcbs	5.7E-11	7.4E-11	7.2E-11	9.1E-11	NA	3.2E-09	2.1E-10	3.2E-14	1.5E-08
benzo(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	5.2E-09	1.9E-09	3.2E-10	1.2E-10	0.0E+00	3.3E-09	2.4E-10	2.9E-12	1.7E-08
Sum Chem (BaP for PAHs):	5.2E-09	1.9E-09	3.2E-10	1.2E-10	0.0E+00	3.3E-09	2.4E-10	2.9E-12	1.7E-08
TOTAL ALL (TEF Approach):	1.8E-07	5.6E-08	2.3E-09	1.3E-08	0.0E+00	3.3E-09	2.4E-10	1.0E-10	2.4E-08
TOTAL ALL (BaP Approach):	1.8E-07	5.6E-08	2.3E-09	1.3E-08	0.0E+00	3.3E-09	2.4E-10	1.0E-10	2.4E-08

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-14
HAZARD QUOTIENTS FOR GREAT MIAMI RIVER USER
CURRENT LAND USE, FUTURE SOURCE TERM

Transfer Media:	Surface Water								
Exposure Pathways:	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	Dermal Contact while Swimming	Incidental Ingestion while Swimming	Ingestion of Fish
Toxicants									
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA
antimony	4.7E-05	3.1E-05	4.6E-06	1.8E-06	NA	9.1E-07	1.9E-07	2.6E-08	5.5E-07
arsenic	9.1E-06	3.3E-06	4.5E-07	5.5E-08	NA	2.8E-08	5.9E-09	5.1E-09	4.6E-06
barium	9.8E-08	9.2E-08	3.5E-09	3.3E-08	NA	3.1E-10	6.6E-11	5.5E-11	ND
beryllium	1.7E-08	6.2E-09	4.6E-10	1.7E-12	NA	4.9E-09	1.0E-09	9.5E-12	3.7E-09
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	1.6E-06	6.2E-06	4.3E-07	3.1E-06	NA	9.3E-08	2.0E-08	9.0E-10	1.5E-06
chromium vi	2.7E-07	1.4E-07	3.6E-08	3.9E-08	NA	3.1E-08	6.6E-09	1.5E-10	5.0E-08
cobalt	4.4E-08	2.1E-08	2.5E-08	1.0E-08	NA	1.1E-10	2.4E-11	2.4E-11	ND
copper	4.7E-07	8.5E-07	4.6E-07	2.8E-07	NA	ND	ND	2.6E-10	1.1E-06
lead	ND	ND	ND	ND	NA	ND	ND	ND	ND
manganese	3.1E-06	2.3E-06	1.1E-07	3.9E-07	NA	3.0E-07	6.4E-08	1.7E-09	ND
mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA
molybdenum	1.3E-06	7.3E-07	3.9E-07	4.0E-07	NA	9.9E-09	2.1E-09	7.3E-10	ND
nickel	3.2E-07	6.4E-07	1.4E-07	9.3E-08	NA	9.1E-10	1.9E-10	1.8E-10	1.7E-07
selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA
silver	1.4E-06	1.6E-06	5.6E-07	1.5E-05	NA	ND	ND	7.6E-10	4.9E-05
thallium	9.4E-07	3.0E-07	6.7E-07	1.4E-07	NA	2.7E-09	5.8E-10	5.2E-10	ND
vanadium	3.9E-07	1.6E-07	1.8E-08	6.0E-10	NA	2.3E-08	4.8E-09	2.2E-10	ND
thorium-total	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	2.8E-03	8.5E-04	6.3E-06	7.8E-05	NA	1.6E-04	3.5E-05	1.6E-06	6.6E-08
fluoride	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL:	2.9E-03	9.0E-04	1.4E-05	9.9E-05	0.0E+00	1.6E-04	3.5E-05	1.6E-06	5.7E-05

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-15
ILCRs FOR EXPANDED TRESPASSER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment			Buried Pit Material
Exposure Pathways: Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure	External Exposure[a]
Radionuclides										
Cs_{137+1d}	2.0E-10	3.6E-09	NA	6.5E-06	1.4E-12	NA	1.0E-10	NA	1.4E-07	
Np_{237+1d}	2.4E-07	2.1E-08	NA	1.0E-06	1.8E-10	NA	4.1E-10	NA	1.5E-08	
Pu_{238}	1.8E-08	1.6E-09	NA	5.2E-12	4.8E-12	NA	3.3E-10	NA	8.0E-13	
$Pu_{239/240}$	7.7E-08	7.5E-09	NA	2.2E-11	1.2E-12	NA	8.6E-11	NA	1.9E-13	
Ra_{226+8d}	4.3E-07	4.7E-07	NA	9.0E-05	NA	NA	NA	NA	NA	
Ru_{106}	2.6E-10	8.9E-10	NA	ND	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.9E-10	2.3E-09	NA	ND	5.6E-10	NA	2.3E-10	NA	ND	
Tc_{99}	2.5E-08	5.4E-09	NA	6.3E-11	4.8E-09	NA	2.3E-11	NA	2.0E-13	
Th_{230}	4.7E-05	2.5E-07	NA	2.6E-08	1.6E-11	NA	3.7E-09	NA	2.9E-10	
$Th_{232+10d}$	6.1E-06	1.2E-07	NA	1.5E-04	1.2E-11	NA	2.7E-09	NA	2.6E-06	
U_{234}	9.3E-06	8.6E-08	NA	4.0E-09	7.3E-09	NA	3.6E-09	NA	1.3E-10	
U_{235+1D}	2.4E-06	1.4E-08	NA	5.1E-06	8.3E-10	NA	4.0E-10	NA	1.1E-07	
U_{238+2d}	6.8E-05	6.0E-07	NA	2.0E-05	5.2E-08	NA	2.5E-08	NA	6.2E-07	
Rn_{222+4d}	9.1E-11	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	1.3E-04	1.6E-06		2.7E-04	6.6E-08		3.7E-08		3.5E-06	2.6E-05
Chemicals										
arsenic	5.8E-05	5.1E-05	3.2E-05	NA	3.6E-09	5.6E-10	2.9E-08	2.2E-08	NA	NA
beryllium	2.6E-08	1.9E-07	1.1E-04	NA	2.2E-10	3.3E-09	1.2E-08	8.2E-06	NA	NA
cadmium	2.8E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
chromium vi	1.1E-06	ND	ND	NA	ND	ND	ND	ND	NA	NA
lead	ND	ND	ND	NA	ND	ND	ND	ND	NA	NA
nickel	4.8E-08	ND	ND	NA	ND	ND	ND	ND	NA	NA
pcbs	ND	2.0E-07	4.8E-06	NA	3.5E-11	5.0E-08	4.2E-08	1.2E-06	NA	NA
benzo(a)anthracene	2.4E-11	1.2E-09	1.2E-09	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	1.9E-10	5.7E-09	5.7E-09	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	3.6E-11	8.9E-10	8.9E-10	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	4.1E-14	4.7E-11	4.7E-11	NA	NA	NA	NA	NA	NA	NA
chrysene	1.0E-12	4.8E-11	4.8E-11	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	8.6E-12	6.9E-11	6.9E-11	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	2.3E-09	4.6E-08	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.1E-10	2.2E-08	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	2.0E-08	7.0E-07	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	7.8E-11	4.8E-09	1.7E-07	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	3.5E-08	1.2E-06	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	2.7E-10	1.7E-08	6.0E-07	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	3.4E-11	2.1E-09	7.4E-08	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	3.1E-10	1.9E-08	6.8E-07	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	1.8E-11	1.1E-09	3.9E-08	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	2.5E-12	2.4E-10	6.4E-08	NA	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	6.0E-05	5.2E-05	1.5E-04		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
Sum Chem (BaP for PAHs):	6.0E-05	5.2E-05	1.5E-04		3.9E-09	5.3E-08	8.3E-08	9.4E-06		
TOTAL ALL (TEF Approach):	1.9E-04	5.3E-05	1.5E-04	2.7E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	2.6E-05
TOTAL ALL (BaP Approach):	1.9E-04	5.3E-05	1.5E-04	2.7E-04	7.0E-08	5.3E-08	1.2E-07	9.4E-06	3.5E-06	2.6E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

ND – No data for toxicity assessment for exposure pathway.

[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.

[b] Risk from dermal contact to PAH's is assumed to equal risk from oral ingestion of PAH's.

TABLE E.IV-16
HAZARD QUOTIENTS FOR EXPANDED TRESPASSER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Pit Material			Paddys Run Surface Water		Paddys Run Sediment		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants									
cyanide	NA	NA	NA	NA	5.1E-05	ND	NA	NA	NA
antimony	ND	6.3E-03	2.1E-01	NA	1.6E-04	1.6E-04	1.4E-03	6.3E-02	NA
arsenic	ND	4.9E-01	2.5E-01	NA	4.0E-05	6.2E-06	3.2E-04	2.4E-04	NA
barium	1.0E-01	2.9E-03	1.6E-02	NA	3.5E-07	5.6E-08	1.6E-05	1.2E-04	NA
beryllium	ND	4.4E-05	2.1E-02	NA	6.0E-08	8.8E-07	3.2E-06	2.2E-03	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	ND	6.2E-04	6.1E-02	NA	5.7E-06	1.7E-05	1.2E-04	1.6E-02	NA
chromium vi	ND	5.7E-04	5.6E-02	NA	9.3E-07	5.5E-06	5.7E-05	8.0E-03	NA
cobalt	9.5E-02	1.9E-05	2.1E-04	NA	1.5E-07	2.0E-08	3.4E-06	5.4E-05	NA
copper	ND	2.1E-03	ND	NA	1.7E-06	ND	8.4E-06	ND	NA
lead	ND	ND	ND	NA	ND	ND	ND	ND	NA
manganese	9.7E-02	9.6E-04	1.6E-01	NA	1.1E-05	5.5E-05	8.2E-05	1.9E-02	NA
mercury	3.2E-05	9.0E-05	1.5E-02	NA	1.6E-05	1.6E-05	NA	NA	NA
molybdenum	ND	1.4E-03	1.8E-02	NA	4.7E-06	1.8E-06	1.7E-05	3.1E-04	NA
nickel	ND	2.5E-04	6.1E-04	NA	1.1E-06	1.6E-07	2.9E-05	1.0E-04	NA
selenium	ND	8.8E-05	5.4E-04	NA	8.0E-08	1.5E-08	NA	NA	NA
silver	ND	2.0E-04	ND	NA	4.8E-06	ND	3.5E-05	ND	NA
thallium	ND	5.5E-03	2.7E-02	NA	3.3E-06	4.8E-07	2.0E-04	1.4E-03	NA
vanadium	ND	6.3E-03	6.2E-02	NA	1.4E-06	4.0E-06	5.6E-05	7.8E-04	NA
thorium-total	ND	ND	ND	NA	NA	NA	ND	ND	NA
uranium-total	ND	2.1E-02	2.0E+00	NA	9.9E-03	2.9E-02	NA	NA	NA
fluoride	ND	3.1E-03	4.5E-02	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.6E-07	2.6E-05	NA	NA	NA	NA	NA	NA
phenanthrene	ND	ND	ND	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	ND	1.5E-09	ND	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	2.4E-06	5.2E-04	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL:	2.9E-01	5.4E-01	3.0E+00		1.0E-02	2.9E-02	2.3E-03	1.1E-01	

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-17
ILCRs FOR ON-PROPERTY GROUNDSKEEPER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material			Buried Pit Material
Exposure Pathways:		Incidental	Dermal	External	External
Contaminants of Concern	Inhalation	Ingestion	Contact[b]	Exposure	Exposure[a]
Radionuclides					
Cs_{137+3d}	1.1E-09	1.6E-08	NA	1.0E-05	
Np_{237+1d}	1.3E-06	9.4E-08	NA	1.7E-06	
Pu_{238}	9.6E-08	7.3E-09	NA	8.5E-12	
$Pu_{239/240}$	4.1E-07	3.3E-08	NA	3.6E-11	
Ra_{226+8d}	2.3E-06	2.1E-06	NA	1.5E-04	
Ru_{106}	1.4E-09	4.0E-09	NA	ND	
Sr_{90+1d}	1.0E-09	1.0E-08	NA	ND	
Tc_{99}	1.3E-07	2.4E-08	NA	1.0E-10	
Th_{230}	2.5E-04	1.1E-06	NA	4.2E-08	
$Th_{232+10d}$	3.3E-05	5.3E-07	NA	2.4E-04	
U_{234}	5.0E-05	3.8E-07	NA	6.5E-09	
U_{235+1D}	1.3E-05	6.1E-08	NA	8.3E-06	
U_{238+2d}	3.6E-04	2.7E-06	NA	3.2E-05	
Rn_{222+4d}	4.9E-10	NA	NA	NA	
Total Radionuclides	7.2E-04	7.0E-06		4.4E-04	4.6E-05
Chemicals					
arsenic	2.2E-04	1.6E-04	9.7E-06	NA	NA
beryllium	9.9E-08	5.9E-07	3.4E-05	NA	NA
cadmium	1.0E-07	ND	ND	NA	NA
chromium vi	4.1E-06	ND	ND	NA	NA
lead	ND	ND	ND	NA	NA
nickel	1.8E-07	ND	ND	NA	NA
pcbs	ND	6.4E-07	1.5E-06	NA	NA
benzo(a)anthracene	9.0E-11	3.7E-09	3.7E-09	NA	NA
benzo(a)pyrene	7.2E-10	1.8E-08	1.8E-08	NA	NA
benzo(b)fluoranthene	1.4E-10	2.8E-09	2.8E-09	NA	NA
benzo(k)fluoranthene	1.6E-13	1.5E-10	1.5E-10	NA	NA
chrysene	3.9E-12	1.5E-10	1.5E-10	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	3.2E-11	2.2E-10	2.2E-10	NA	NA
n-nitrosodipropylamine	ND	7.3E-09	1.4E-08	NA	NA
pentachlorophenol	ND	3.5E-10	6.8E-09	NA	NA
vinyl chloride	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	6.3E-08	2.2E-07	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	2.9E-10	1.5E-08	5.2E-08	NA	NA
hexachlorodibenzofuran	NA	1.1E-07	3.8E-07	NA	NA
heptachlorodibenzo-p-dioxin	1.0E-09	5.3E-08	1.8E-07	NA	NA
heptachlorodibenzofuran	1.3E-10	6.6E-09	2.3E-08	NA	NA
octachlorodibenzo-p-dioxin	1.2E-09	6.1E-08	2.1E-07	NA	NA
octachlorodibenzofuran	6.6E-11	3.4E-09	1.2E-08	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	9.4E-12	7.7E-10	2.0E-08	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	2.2E-04	1.6E-04	4.6E-05		
Sum Chem (BaP for PAHs):	2.2E-04	1.6E-04	4.6E-05		
TOTAL ALL (TEF for PAHs):	9.4E-04	1.7E-04	4.6E-05	4.4E-04	4.6E-05
TOTAL ALL (BaP for PAHs):	9.4E-04	1.7E-04	4.6E-05	4.4E-04	4.6E-05

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

ND – No data for toxicity assessment for exposure pathway.

[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.

[b] Risk from dermal contact with PAHs is assumed to equal risk from oral ingestion of PAHs.

TABLE E.IV-18
HAZARD QUOTIENTS FOR ON-PROPERTY GROUNDKEEPER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants				
cyanide	NA	NA	NA	NA
antimony	ND	1.1E-02	4.2E-02	NA
arsenic	ND	8.6E-01	5.2E-02	NA
barium	2.1E-01	5.2E-03	3.3E-03	NA
beryllium	ND	7.7E-05	4.4E-03	NA
boron	NA	NA	NA	NA
cadmium	ND	1.1E-03	1.3E-02	NA
chromium vi	ND	1.0E-03	1.2E-02	NA
cobalt	2.0E-01	3.3E-05	4.3E-05	NA
copper	ND	3.7E-03	ND	NA
lead	ND	ND	ND	NA
manganese	2.0E-01	1.7E-03	3.2E-02	NA
mercury	6.7E-05	1.6E-04	3.0E-03	NA
molybdenum	ND	2.4E-03	3.6E-03	NA
nickel	ND	4.4E-04	1.3E-04	NA
selenium	ND	1.5E-04	1.1E-04	NA
silver	ND	3.5E-04	ND	NA
thallium	ND	9.6E-03	5.5E-03	NA
vanadium	ND	1.1E-02	1.3E-02	NA
thorium-total	ND	ND	ND	NA
uranium-total	ND	3.6E-02	4.2E-01	NA
fluoride	ND	5.4E-03	9.3E-03	NA
acenaphthylene	ND	ND	ND	NA
2-methylnaphthalene	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	NA
dibenzofuran	NA	NA	NA	NA
pentachlorophenol	ND	2.8E-07	5.3E-06	NA
phenanthrene	ND	ND	ND	NA
tributyl phosphate	NA	NA	NA	NA
2-hexanone	ND	2.7E-09	ND	NA
3-chloropropene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	ND	4.1E-06	1.1E-04	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA
TOTAL:	6.2E-01	9.5E-01	6.1E-01	

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.

TABLE E.IV-19
ILCRs FOR RME ON-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater						Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact[b]	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	External Exposure[a]
Radionuclides																			
Cs_{137+1d}	6.8E-09	1.6E-07	2.9E-07	4.0E-07	8.6E-07	3.7E-06	5.2E-06	8.1E-07	NA	5.4E-04	3.3E-05	4.6E-05	NA	NA	NA	NA	NA	NA	
Np_{237+1d}	8.1E-06	8.3E-07	4.7E-09	1.7E-09	1.4E-06	6.1E-08	2.2E-08	4.7E-06	NA	8.7E-05	NA	NA	1.3E-09	4.1E-10	1.4E-12	5.2E-13	NA	NA	
Pu_{238}	6.3E-07	4.5E-08	1.6E-12	1.3E-12	1.3E-09	1.1E-11	8.4E-12	3.7E-07	NA	4.4E-10	NA	NA	1.4E-06	4.3E-07	7.9E-12	6.5E-12	NA	NA	
$Pu_{239/240}$	2.7E-06	2.1E-07	1.6E-11	1.3E-11	2.6E-09	2.2E-11	1.8E-11	1.7E-06	NA	1.9E-09	NA	NA	NA	NA	NA	NA	NA	NA	
Ra_{226+1d}	1.5E-05	2.4E-05	9.9E-07	7.1E-06	2.1E-06	6.3E-07	4.5E-06	1.0E-04	NA	7.6E-03	6.3E-08	4.6E-07	6.8E-05	2.3E-05	4.3E-07	3.2E-06	NA	NA	
Ru_{106}	9.2E-09	2.5E-09	2.5E-10	3.1E-13	NA	NA	NA	2.0E-07	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	6.5E-09	6.1E-08	3.7E-09	7.3E-08	1.7E-05	3.7E-06	7.4E-05	5.1E-07	NA	ND	6.7E-07	1.4E-05	8.3E-09	3.3E-09	1.2E-10	2.4E-09	NA	NA	
Tc_{99}	8.6E-08	1.8E-07	1.1E-07	5.0E-07	1.4E-05	5.4E-05	2.5E-04	1.2E-06	NA	5.3E-09	1.3E-05	6.1E-05	1.1E-06	3.3E-07	1.3E-07	6.3E-07	NA	NA	
Th_{230}	1.6E-03	9.5E-06	1.1E-08	3.8E-08	2.1E-07	1.1E-08	3.8E-08	5.6E-05	NA	2.2E-06	1.0E-11	3.4E-11	6.6E-07	2.0E-07	5.2E-11	1.8E-10	NA	NA	
$Th_{232+10d}$	2.0E-04	4.0E-06	4.8E-09	1.6E-08	1.0E-07	5.6E-09	1.9E-08	2.6E-05	NA	1.2E-02	2.6E-09	9.0E-09	NA	NA	NA	NA	NA	NA	
U_{234}	3.3E-04	2.6E-06	2.9E-08	3.5E-07	9.6E-06	6.4E-07	7.7E-06	1.9E-05	NA	3.4E-07	1.3E-06	1.6E-05	1.8E-03	5.4E-04	4.0E-06	4.9E-05	NA	NA	
U_{235+1D}	8.7E-05	7.1E-07	7.9E-09	9.4E-08	1.5E-06	1.0E-07	1.2E-06	3.1E-06	NA	4.3E-04	7.2E-08	8.9E-07	4.1E-04	1.2E-04	9.1E-07	1.1E-05	NA	NA	
U_{238+2d}	2.4E-03	1.6E-05	1.8E-07	2.2E-06	1.1E-04	7.5E-06	9.0E-05	1.4E-04	NA	1.6E-03	5.4E-06	6.6E-05	1.5E-02	4.5E-03	3.3E-05	4.1E-04	NA	NA	
Rn_{222+4d}	3.3E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	4.7E-03	5.9E-05	1.6E-06	1.1E-05	1.6E-04	7.0E-05	4.4E-04	3.5E-04		2.3E-02	5.3E-05	2.0E-04	1.7E-02	5.1E-03	3.8E-05	4.7E-04			1.2E-03
Chemicals																			
arsenic	1.5E-03	2.5E-03	6.3E-04	7.5E-05	6.2E-05	7.4E-05	8.8E-06	8.1E-03	2.7E-04	NA	5.5E-06	6.6E-07	2.8E-02	9.9E-03	1.4E-03	1.7E-04	ND	8.4E-05	NA
beryllium	5.4E-07	4.2E-06	8.1E-07	2.9E-09	3.6E-06	3.4E-06	1.2E-08	3.0E-05	9.5E-04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	6.9E-07	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
chromium vi	2.7E-05	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
nickel	1.1E-06	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
pcbs	ND	8.4E-06	2.4E-05	3.1E-05	9.8E-05	3.4E-04	4.3E-04	3.2E-05	4.1E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	6.3E-10	1.0E-08	5.6E-09	7.2E-09	1.1E-06	1.2E-06	1.5E-06	1.9E-07	1.9E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	4.7E-09	7.4E-08	9.8E-08	1.2E-07	3.0E-06	8.8E-06	1.1E-05	9.1E-07	9.1E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	9.5E-10	1.4E-08	7.4E-08	9.4E-08	1.9E-07	3.3E-06	4.2E-06	1.4E-07	1.4E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	4.0E-12	6.2E-11	6.4E-10	8.1E-10	1.0E-08	4.3E-07	5.4E-07	7.4E-09	7.4E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	2.6E-11	4.2E-10	2.4E-10	3.1E-10	4.5E-08	4.7E-08	5.9E-08	7.6E-09	7.6E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	2.1E-10	3.2E-09	2.0E-07	2.5E-07	NA	NA	NA	1.1E-08	1.1E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	1.3E-07	3.9E-12	4.9E-12	NA	NA	NA	3.7E-07	3.9E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	5.5E-09	7.7E-10	9.8E-10	NA	NA	NA	1.8E-08	1.9E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	3.2E-06	6.1E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	1.9E-09	2.3E-08	2.3E-07	3.3E-07	NA	NA	NA	7.6E-07	1.5E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	5.5E-06	1.1E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	6.7E-09	7.9E-08	8.0E-07	1.1E-06	NA	NA	NA	2.7E-06	5.2E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	8.4E-10	9.9E-09	6.3E-09	9.0E-09	NA	NA	NA	3.3E-07	6.4E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	7.7E-09	9.1E-08	9.2E-07	1.3E-06	NA	NA	NA	3.1E-06	5.9E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	4.4E-10	5.2E-09	3.3E-09	4.7E-09	NA	NA	NA	1.7E-07	3.3E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6E-12	2.2E-12	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	6.1E-11	3.4E-08	1.7E-11	2.2E-11	NA	NA	NA	3.9E-08	5.5E-07	NA	7.1E-11	9.2E-11	9.0E-13	5.0E-13	1.5E-16	1.9E-16	1.3E-13	7.2E-13	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0E-10	4.0E-10	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.2E-13	5.0E-13	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	1.5E-03	2.5E-03	6.6E-04	1.1E-04	1.7E-04	4.3E-04	4.5E-04	8.2E-03	1.3E-03		5.5E-06	6.6E-07	2.8E-02	9.9E-03	1.4E-03	1.7E-04	1.3E-13	8.4E-05	
Sum Chem (BaP for PAHs):	1.5E-03	2.5E-03	6.6E-04	1.1E-04	1.9E-04	4.8E-04	5.2E-04	8.2E-03	1.3E-03		5.5E-06	6.6E-07	2.8E-02	9.9E-03	1.4E-03	1.7E-04	1.3E-13	8.4E-05	
TOTAL ALL (TEF Approach):	6.2E-03	2.6E-03	6.6E-04	1.2E-04	3.3E-04	5.0E-04	8.9E-04	8.5E-03	1.3E-03	2.3E-02	5.8E-05	2.1E-04	4.5E-02	1.5E-02	1.4E-03	6.4E-04	1.3E-13	8.4E-05	1.2E-03
TOTAL ALL (BaP Approach):	6.2E-03	2.6E-03	6.6E-04	1.2E-04	3.5E-04	5.5E-04	9.5E-04	8.6E-03	1.3E-03	2.3E-02	5.8E-05	2.1E-04	4.5E-02	1.5E-02	1.4E-03	6.4E-04	1.3E-13	8.4E-05	1.2E-03

Notes:

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

ND – No data for toxicity assessment for exposure pathway.

[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.

[b] Risk from dermal contact with PAHs is assumed to equal risk from oral ingestion of PAHs.

TABLE E.IV-20
HAZARD QUOTIENTS FOR RME ON-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater					
Exposure Pathways: / Toxicants	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E-07	1.3E-07	5.8E-06	2.8E-06	5.7E-12	7.3E-12	ND	ND
antimony	ND	1.2E-02	3.4E-03	1.4E-03	1.5E+00	7.5E-01	3.0E-01	2.0E-01	4.2E-01	NA	2.0E-02	8.0E-03	1.2E+01	7.9E+00	1.2E+00	4.7E-01	ND	2.3E-01
arsenic	ND	4.7E+00	1.2E+00	1.4E-01	1.2E-01	1.4E-01	1.7E-02	1.5E+01	5.2E-01	NA	1.0E-02	1.3E-03	5.3E+01	1.9E+01	2.6E+00	3.2E-01	ND	1.6E-01
barium	5.0E-01	3.5E-02	2.6E-03	2.5E-02	NA	NA	NA	9.3E-02	3.3E-02	NA	9.7E-04	9.1E-03	2.5E-01	2.4E-01	9.2E-03	8.6E-02	ND	8.0E-04
beryllium	ND	1.9E-04	3.8E-05	1.4E-07	1.7E-04	1.6E-04	5.7E-07	1.4E-03	4.4E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.1E-02	1.9E-02	8.0E-04	6.1E-03	ND	1.8E-03
cadmium	ND	1.5E-02	2.0E-03	1.4E-02	6.3E-01	9.3E-02	6.7E-01	2.0E-02	1.3E-01	NA	NA	NA	1.7E-11	6.6E-11	4.5E-12	3.3E-11	ND	9.9E-13
chromium vi	ND	2.6E-03	2.0E-03	2.2E-03	NA	NA	NA	1.8E-02	1.2E-01	NA	NA	NA	NA	NA	NA	NA	NA	NA
cobalt	4.8E-01	4.4E-05	1.2E-04	4.8E-05	NA	NA	NA	6.0E-04	4.3E-04	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper	ND	5.4E-02	5.7E-02	3.4E-02	NA	NA	NA	6.6E-02	ND	NA	1.2E-02	7.1E-03	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
manganese	4.8E-01	1.1E-02	9.6E-04	3.3E-03	NA	NA	NA	3.0E-02	3.2E-01	NA	3.3E-05	1.1E-04	4.1E-01	3.0E-01	1.4E-02	5.1E-02	ND	3.9E-02
mercury	1.6E-04	7.2E-04	2.0E-02	1.4E-04	NA	NA	NA	2.9E-03	3.0E-02	NA	NA	NA	3.3E-02	1.3E-02	2.2E-01	1.6E-03	ND	6.3E-04
molybdenum	ND	1.1E-02	1.0E-02	1.0E-02	NA	NA	NA	4.3E-02	3.6E-02	NA	NA	NA	9.3E-02	5.2E-02	2.8E-02	2.8E-02	ND	7.0E-04
nickel	ND	4.9E-03	2.3E-03	1.5E-03	NA	NA	NA	7.8E-03	1.3E-03	NA	8.1E-03	5.4E-03	NA	NA	NA	NA	NA	NA
selenium	ND	1.9E-03	2.4E-03	2.6E-03	NA	NA	NA	2.8E-03	1.1E-03	NA	6.5E-03	7.0E-03	NA	NA	NA	NA	NA	NA
silver	ND	1.5E-03	9.8E-04	2.6E-02	NA	NA	NA	6.3E-03	ND	NA	7.3E-03	2.0E-01	NA	NA	NA	NA	NA	NA
thallium	ND	3.1E-02	2.2E-01	4.3E-02	2.9E-03	2.9E-01	5.8E-02	1.7E-01	5.5E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
vanadium	ND	3.8E-02	1.3E-02	4.0E-04	NA	NA	NA	2.0E-01	1.3E-01	NA	2.7E-02	9.0E-04	NA	NA	NA	NA	NA	NA
thorium-total	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	ND	1.4E-01	1.6E-03	1.9E-02	3.9E-01	2.6E-02	3.1E-01	6.6E-01	4.2E+00	NA	NA	NA	2.9E+02	8.8E+01	6.5E-01	8.0E+00	ND	1.7E+01
fluoride	ND	1.3E-03	ND	ND	NA	NA	NA	9.7E-02	9.3E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.5E-06	2.1E-07	2.7E-07	NA	NA	NA	5.0E-06	5.3E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	ND	2.1E-08	7.4E-13	9.3E-13	NA	NA	NA	4.9E-08	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6E-08	3.6E-08	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	6.5E-05	3.3E-08	4.3E-08	NA	NA	NA	7.4E-05	1.1E-03	NA	1.4E-07	1.8E-07	1.7E-09	9.7E-10	2.9E-13	3.7E-13	ND	1.4E-09
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.8E-10	1.1E-09	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.3E-08	3.2E-08	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA
TOTAL:	1.5E+00	5.1E+00	1.5E+00	3.3E-01	2.6E+00	1.3E+00	1.4E+00	1.7E+01	6.1E+00		9.3E-02	2.4E-01	3.6E+02	1.2E+02	4.7E+00	9.0E+00	0.0E+00	1.7E+01

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-21
ILCRs FOR RME ON-PROPERTY CHILD
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater						Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact[b]	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	External Exposure[a]
Radionuclides																			
Cs_{137+1d}	1.2E-10	1.2E-08	9.5E-09	7.8E-08	6.4E-08	1.2E-07	1.0E-06	7.7E-08	NA	4.1E-05	1.1E-06	9.0E-06	NA	NA	NA	NA	NA	NA	
Np_{237+1d}	1.5E-07	6.2E-08	1.5E-10	3.3E-10	1.0E-07	2.0E-09	4.3E-09	4.5E-07	NA	6.5E-06	NA	NA	5.4E-11	3.0E-11	4.7E-14	1.0E-13	NA	NA	
Pu_{238}	1.1E-08	3.4E-09	5.4E-14	2.5E-13	9.4E-11	3.5E-13	1.6E-12	3.5E-08	NA	3.3E-11	NA	NA	6.1E-08	3.2E-08	2.6E-13	1.3E-12	NA	NA	
$Pu_{239/240}$	4.9E-08	1.6E-08	5.4E-13	2.5E-12	2.0E-10	7.3E-13	3.4E-12	1.6E-07	NA	1.4E-10	NA	NA	NA	NA	NA	NA	NA	NA	
Ra_{226+Bd}	2.8E-07	1.8E-06	3.3E-08	1.4E-06	1.6E-07	2.1E-08	8.8E-07	1.0E-05	NA	5.7E-04	2.1E-09	9.0E-08	2.9E-06	1.7E-06	1.4E-08	6.1E-07	NA	NA	
Ru_{106}	1.7E-10	1.8E-10	8.1E-12	5.9E-14	NA	NA	NA	1.9E-08	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	1.2E-10	4.5E-09	1.2E-10	1.4E-08	1.3E-06	1.2E-07	1.4E-05	4.9E-08	NA	ND	2.2E-08	2.6E-06	3.5E-10	2.5E-10	4.0E-12	4.7E-10	NA	NA	
Tc_{99}	1.6E-09	1.3E-08	3.5E-09	9.8E-08	1.0E-06	1.8E-06	4.9E-05	1.2E-07	NA	4.0E-10	4.2E-07	1.2E-05	4.5E-08	2.5E-08	4.4E-09	1.2E-07	NA	NA	
Th_{230}	3.0E-05	7.1E-07	3.7E-10	7.3E-09	1.5E-08	3.8E-10	7.4E-09	5.3E-06	NA	1.6E-07	3.3E-13	6.7E-12	2.8E-08	1.5E-08	1.7E-12	3.5E-11	NA	NA	
$Th_{232+10d}$	3.7E-06	3.0E-07	1.6E-10	3.1E-09	7.6E-09	1.9E-10	3.6E-09	2.5E-06	NA	9.4E-04	8.7E-11	1.8E-09	NA	NA	NA	NA	NA	NA	
U_{234}	6.0E-06	1.9E-07	9.5E-10	6.7E-08	7.2E-07	2.1E-08	1.5E-06	1.8E-06	NA	2.6E-08	4.2E-08	3.0E-06	7.7E-05	4.0E-05	1.3E-07	9.6E-06	NA	NA	
U_{235+1D}	1.6E-06	5.3E-08	2.6E-10	1.8E-08	1.1E-07	3.4E-09	2.4E-07	2.9E-07	NA	3.2E-05	2.4E-09	1.7E-07	1.8E-05	9.2E-06	3.0E-08	2.2E-06	NA	NA	
U_{238+2d}	4.4E-05	1.2E-06	6.1E-09	4.3E-07	8.4E-06	2.5E-07	1.7E-05	1.3E-05	NA	1.2E-04	1.8E-07	1.3E-05	6.4E-04	3.3E-04	1.1E-06	7.9E-05	NA	NA	
Rn_{222+4d}	6.0E-11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	8.5E-05	4.4E-06	5.4E-08	2.1E-06	1.2E-05	2.3E-06	8.5E-05	3.4E-05		1.7E-03	1.7E-06	4.0E-05	7.3E-04	3.8E-04	1.3E-06	9.2E-05			2.5E-07
Chemicals																			
arsenic	1.2E-04	8.6E-04	9.7E-05	6.8E-05	2.1E-05	1.1E-05	8.0E-06	3.6E-03	3.8E-05	NA	8.4E-07	6.0E-07	5.6E-03	3.5E-03	2.1E-04	1.5E-04	ND	1.2E-05	NA
beryllium	4.6E-08	1.4E-06	1.3E-07	2.6E-09	1.2E-06	5.3E-07	1.1E-08	1.3E-05	1.3E-04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	5.9E-08	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
chromium vi	2.3E-06	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
nickel	9.7E-08	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
pcbs	ND	2.9E-06	3.8E-06	2.8E-05	3.4E-05	5.2E-05	3.9E-04	1.4E-05	5.7E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	5.3E-11	3.5E-09	8.7E-10	6.5E-09	4.0E-07	1.8E-07	1.4E-06	8.3E-08	8.3E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	4.0E-10	2.6E-08	1.5E-08	1.1E-07	1.0E-06	1.4E-06	1.0E-05	4.0E-07	4.0E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	8.0E-11	5.0E-09	1.1E-08	8.5E-08	6.6E-08	5.1E-07	3.8E-06	6.3E-08	6.3E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	3.3E-13	2.1E-11	9.9E-11	7.3E-10	3.6E-09	6.6E-08	4.9E-07	3.3E-09	3.3E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	2.2E-12	1.5E-10	3.8E-11	2.8E-10	1.6E-08	7.2E-09	5.4E-08	3.4E-09	3.4E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.8E-11	1.1E-09	3.1E-08	2.3E-07	NA	NA	NA	4.8E-09	4.8E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	4.6E-08	6.0E-13	4.4E-12	NA	NA	NA	1.6E-07	5.5E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.9E-09	1.2E-10	8.9E-10	NA	NA	NA	7.9E-09	2.6E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	1.4E-06	8.4E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	1.6E-10	8.0E-09	3.6E-08	3.0E-07	NA	NA	NA	3.4E-07	2.0E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	2.5E-06	1.5E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	5.7E-10	2.8E-08	1.2E-07	1.0E-06	NA	NA	NA	1.2E-06	7.2E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	7.1E-11	3.4E-09	9.8E-10	8.2E-09	NA	NA	NA	1.5E-07	8.9E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	6.5E-10	3.2E-08	1.4E-07	1.2E-06	NA	NA	NA	1.4E-06	8.2E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	3.7E-11	1.8E-09	5.1E-10	4.3E-09	NA	NA	NA	7.7E-08	4.6E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.4E-13	2.0E-12	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	5.2E-12	1.2E-08	2.7E-12	2.0E-11	NA	NA	NA	1.7E-08	7.6E-08	NA	1.1E-11	8.4E-11	1.8E-13	1.7E-13	2.3E-17	1.8E-16	5.2E-14	1.0E-13	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.7E-11	3.6E-10	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.4E-14	4.5E-13	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	1.3E-04	8.7E-04	1.0E-04	9.9E-05	5.8E-05	6.6E-05	4.1E-04	3.6E-03	1.8E-04		8.4E-07	6.0E-07	5.6E-03	3.5E-03	2.1E-04	1.5E-04	5.2E-14	1.2E-05	
Sum Chem (BaP for PAHs):	1.3E-04	8.7E-04	1.0E-04	1.0E-04	6.5E-05	7.4E-05	4.7E-04	3.6E-03	1.8E-04		8.4E-07	6.0E-07	5.6E-03	3.5E-03	2.1E-04	1.5E-04	5.2E-14	1.2E-05	
TOTAL ALL (TEF Approach):	2.1E-04	8.7E-04	1.0E-04	1.0E-04	7.0E-05	6.9E-05	5.0E-04	3.7E-03	1.8E-04	1.7E-03	2.6E-06	4.0E-05	6.3E-03	3.8E-03	2.1E-04	2.4E-04	5.2E-14	1.2E-05	2.5E-07
TOTAL ALL (BaP Approach):	2.1E-04	8.7E-04	1.0E-04	1.0E-04	7.6E-05	7.6E-05	5.5E-04	3.7E-03	1.8E-04	1.7E-03	2.6E-06	4.0E-05	6.3E-03	3.8E-03	2.1E-04	2.4E-04	5.2E-14	1.2E-05	2.5E-07

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND – No data for toxicity assessment for exposure pathway.
[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources in pit 4.
[b] Risk from dermal contact with PAHs is assumed to equal risk from oral ingestion of PAHs.

5511

TABLE E.IV-22
HAZARD QUOTIENTS FOR RME ON-PROPERTY CHILD FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater					
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Toxicants																		
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.8E-07	1.4E-06	1.3E-05	1.1E-05	1.0E-11	7.8E-11	ND	ND
antimony	ND	5.1E-02	6.2E-03	1.4E-02	6.1E+00	1.4E+00	3.2E+00	1.0E+00	6.9E-01	NA	3.6E-02	8.5E-02	2.8E+01	3.2E+01	2.1E+00	4.9E+00	ND	3.7E-01
arsenic	ND	1.9E+01	2.2E+00	1.5E+00	4.8E-01	2.5E-01	1.8E-01	8.0E+01	8.4E-01	NA	1.9E-02	1.3E-02	1.2E+02	7.7E+01	4.7E+00	3.4E+00	ND	2.6E-01
barium	4.9E-01	1.4E-01	4.8E-03	2.6E-01	NA	NA	NA	4.8E-01	5.3E-02	NA	1.8E-03	9.6E-02	5.9E-01	9.7E-01	1.7E-02	9.1E-01	ND	1.3E-03
beryllium	ND	7.9E-04	6.8E-05	1.4E-06	6.7E-04	2.9E-04	6.0E-06	7.1E-03	7.1E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	7.2E-02	7.5E-02	1.5E-03	6.5E-02	ND	2.9E-03
cadmium	ND	5.9E-02	3.6E-03	1.5E-01	2.5E+00	1.7E-01	7.1E+00	1.0E-01	2.0E-01	NA	NA	NA	4.0E-11	2.7E-10	8.2E-12	3.5E-10	ND	1.6E-12
chromium vi	ND	1.1E-02	3.6E-03	2.3E-02	NA	NA	NA	9.4E-02	1.9E-01	NA	NA	NA	NA	NA	NA	NA	NA	NA
cobalt	4.7E-01	1.8E-04	2.2E-04	5.1E-04	NA	NA	NA	3.1E-03	6.9E-04	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper	ND	2.2E-01	1.0E-01	3.6E-01	NA	NA	NA	3.4E-01	ND	NA	2.1E-02	7.6E-02	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
manganese	4.7E-01	4.3E-02	1.7E-03	3.5E-02	NA	NA	NA	1.6E-01	5.3E-01	NA	5.9E-05	1.2E-03	9.5E-01	1.2E+00	2.6E-02	5.3E-01	ND	6.3E-02
mercury	1.6E-04	2.9E-03	3.6E-02	1.5E-03	NA	NA	NA	1.5E-02	4.9E-02	NA	NA	NA	7.6E-02	5.3E-02	3.9E-01	1.7E-02	ND	1.0E-03
molybdenum	ND	4.4E-02	1.9E-02	1.1E-01	NA	NA	NA	2.2E-01	5.9E-02	NA	NA	NA	2.2E-01	2.1E-01	5.0E-02	3.0E-01	ND	1.1E-03
nickel	ND	2.0E-02	4.1E-03	1.6E-02	NA	NA	NA	4.1E-02	2.0E-03	NA	1.5E-02	5.7E-02	NA	NA	NA	NA	NA	NA
selenium	ND	7.7E-03	4.4E-03	2.8E-02	NA	NA	NA	1.4E-02	1.8E-03	NA	1.2E-02	7.4E-02	NA	NA	NA	NA	NA	NA
silver	ND	5.9E-03	1.8E-03	2.8E-01	NA	NA	NA	3.3E-02	ND	NA	1.3E-02	2.1E+00	NA	NA	NA	NA	NA	NA
thallium	ND	1.2E-01	3.9E-01	4.6E-01	1.2E-02	5.2E-01	6.1E-01	9.0E-01	9.0E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
vanadium	ND	1.6E-01	2.3E-02	4.2E-03	NA	NA	NA	1.0E+00	2.1E-01	NA	4.9E-02	9.5E-03	NA	NA	NA	NA	NA	NA
thorium-total	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	ND	5.7E-01	2.8E-03	2.0E-01	1.6E+00	4.7E-02	3.3E+00	3.4E+00	6.8E+00	NA	NA	NA	6.8E+02	3.6E+02	1.2E+00	8.5E+01	ND	2.7E+01
fluoride	ND	5.3E-03	ND	ND	NA	NA	NA	5.0E-01	1.5E-01	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	6.2E-06	3.9E-07	2.9E-06	NA	NA	NA	2.6E-05	8.6E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	ND	8.3E-08	1.3E-12	9.9E-12	NA	NA	NA	2.5E-07	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.7E-08	3.9E-07	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	2.6E-04	6.0E-08	4.5E-07	NA	NA	NA	3.9E-04	1.7E-03	NA	2.5E-07	1.9E-06	4.0E-09	3.9E-09	5.2E-13	3.9E-12	ND	2.3E-09
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.7E-10	1.2E-08	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.1E-08	3.4E-07	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA
TOTAL:	1.4E+00	2.1E+01	2.8E+00	3.5E+00	1.1E+01	2.3E+00	1.4E+01	8.9E+01	9.9E+00		1.7E-01	2.5E+00	8.4E+02	4.7E+02	8.5E+00	9.5E+01	0.0E+00	2.8E+01

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

5511

TABLE E.IV-23
ILCRs FOR CT ON-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater						Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact[b]	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing	External Exposure[a]
Radionuclides																			
Cs_{137+1d}	5.1E-10	1.0E-08	1.9E-08	2.2E-08	5.5E-08	2.5E-07	2.8E-07	5.5E-08	NA	5.2E-05	2.2E-06	2.5E-06	NA	NA	NA	NA	NA	NA	
Np_{237+1d}	6.0E-07	5.3E-08	3.1E-10	9.1E-11	9.1E-08	4.1E-09	1.2E-09	3.2E-07	NA	8.4E-06	NA	NA	8.8E-11	2.6E-11	9.5E-14	2.8E-14	NA	NA	
Pu_{238}	4.7E-08	2.9E-09	1.1E-13	7.0E-14	8.2E-11	7.1E-13	4.6E-13	2.5E-08	NA	4.2E-11	NA	NA	1.0E-07	2.8E-08	5.3E-13	3.5E-13	NA	NA	
$Pu_{239/240}$	2.0E-07	1.4E-08	1.1E-12	7.1E-13	1.7E-10	1.5E-12	9.5E-13	1.2E-07	NA	1.8E-10	NA	NA	NA	NA	NA	NA	NA	NA	
Ra_{226+8d}	1.1E-06	1.6E-06	6.7E-08	3.9E-07	1.4E-07	4.2E-08	2.4E-07	7.2E-06	NA	7.3E-04	4.2E-09	2.5E-08	4.8E-06	1.5E-06	2.9E-08	1.7E-07	NA	NA	
Ru_{106}	6.8E-10	1.6E-10	1.7E-11	1.6E-14	NA	NA	NA	1.4E-08	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	4.8E-10	3.9E-09	2.5E-10	4.0E-09	1.1E-06	2.5E-07	4.0E-06	3.5E-08	NA	ND	4.5E-08	7.3E-07	5.9E-10	2.2E-10	8.1E-12	1.3E-10	NA	NA	
Tc_{99}	6.4E-09	1.1E-08	7.2E-09	2.7E-08	9.0E-07	3.6E-06	1.4E-05	8.4E-08	NA	5.1E-10	8.5E-07	3.3E-06	7.4E-08	2.1E-08	8.8E-09	3.4E-08	NA	NA	
Th_{230}	1.2E-04	6.1E-07	7.6E-10	2.0E-09	1.3E-08	7.6E-10	2.0E-09	3.8E-06	NA	2.1E-07	6.7E-13	1.8E-12	4.7E-08	1.3E-08	3.5E-12	9.6E-12	NA	NA	
$Th_{232+10d}$	1.5E-05	2.6E-07	3.3E-10	8.7E-10	6.6E-09	3.8E-10	1.0E-09	1.8E-06	NA	1.2E-03	1.8E-10	4.9E-10	NA	NA	NA	NA	NA	NA	
U_{234}	2.5E-05	1.7E-07	1.9E-09	1.9E-08	6.2E-07	4.3E-08	4.1E-07	1.3E-06	NA	3.3E-08	8.4E-08	8.4E-07	1.3E-04	3.5E-05	2.7E-07	2.7E-06	NA	NA	
U_{235+1D}	6.5E-06	4.6E-08	5.3E-10	5.1E-09	9.9E-08	6.8E-09	6.6E-08	2.1E-07	NA	4.1E-05	4.8E-09	4.8E-08	2.9E-05	8.0E-06	6.1E-08	6.1E-07	NA	NA	
U_{238+2d}	1.8E-04	1.1E-06	1.2E-08	1.2E-07	7.3E-06	5.1E-07	4.8E-06	9.3E-06	NA	1.6E-04	3.6E-07	3.6E-06	1.0E-03	2.9E-04	2.2E-06	2.2E-05	NA	NA	
Rn_{222+4d}	2.5E-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	3.5E-04	3.8E-06	1.1E-07	5.8E-07	1.0E-05	4.7E-06	2.4E-05	2.4E-05		2.2E-03	3.5E-06	1.1E-05	1.2E-03	3.3E-04	2.6E-06	2.5E-05			1.6E-04
Chemicals																			
arsenic	1.1E-04	1.6E-04	4.2E-05	4.1E-06	4.0E-06	5.0E-06	4.8E-07	5.6E-04	4.8E-06	NA	3.7E-07	3.6E-08	2.0E-03	6.4E-04	9.3E-05	9.1E-06	ND	5.0E-06	NA
beryllium	4.1E-08	2.7E-07	5.4E-08	1.6E-10	2.3E-07	2.3E-07	6.6E-10	2.0E-06	1.7E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cadmium	5.2E-08	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
chromium vi	2.0E-06	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
nickel	8.5E-08	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA
pcbs	ND	5.4E-07	1.6E-06	1.7E-06	6.3E-06	2.3E-05	2.3E-05	2.2E-06	7.2E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	4.7E-11	6.5E-10	3.8E-10	3.9E-10	7.4E-08	8.0E-08	8.1E-08	1.3E-08	1.3E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	3.5E-10	4.8E-09	6.6E-09	6.7E-09	1.9E-07	5.9E-07	6.0E-07	6.2E-08	6.2E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	7.1E-11	9.3E-10	5.0E-09	5.1E-09	1.2E-08	2.2E-07	2.3E-07	9.7E-09	9.7E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	2.9E-13	4.0E-12	4.3E-11	4.3E-11	6.7E-10	2.9E-08	2.9E-08	5.1E-10	5.1E-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chrysene	1.9E-12	2.7E-11	1.6E-11	1.7E-11	2.9E-09	3.2E-09	3.2E-09	5.2E-10	5.2E-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.6E-11	2.0E-10	1.3E-08	1.4E-08	NA	NA	NA	7.4E-10	7.4E-10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	8.5E-09	2.6E-13	2.6E-13	NA	NA	NA	2.5E-08	6.9E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	3.6E-10	5.2E-11	5.3E-11	NA	NA	NA	1.2E-09	3.3E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	2.2E-07	1.1E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	1.4E-10	1.5E-09	1.6E-08	1.8E-08	NA	NA	NA	5.2E-08	2.6E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	3.8E-07	1.9E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	5.0E-10	5.1E-09	5.4E-08	6.2E-08	NA	NA	NA	1.8E-07	9.1E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	6.2E-11	6.4E-10	4.3E-10	4.9E-10	NA	NA	NA	2.3E-08	1.1E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	5.7E-10	5.9E-09	6.2E-08	7.1E-08	NA	NA	NA	2.1E-07	1.0E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	3.3E-11	3.3E-10	2.2E-10	2.5E-10	NA	NA	NA	1.2E-08	5.9E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.1E-13	1.2E-13	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	4.5E-12	2.2E-09	1.2E-12	1.2E-12	NA	NA	NA	2.7E-09	9.7E-09	NA	4.8E-12	5.0E-12	6.4E-14	3.2E-14	1.0E-17	1.0E-17	1.3E-14	5.2E-14	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.0E-11	2.2E-11	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.5E-14	2.7E-14	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	1.1E-04	1.6E-04	4.4E-05	5.9E-06	1.1E-05	2.9E-05	2.4E-05	5.6E-04	2.3E-05		3.7E-07	3.6E-08	2.0E-03	6.4E-04	9.3E-05	9.1E-06	1.3E-14	5.0E-06	
Sum Chem (BaP for PAHs):	1.1E-04	1.6E-04	4.4E-05	6.0E-06	1.2E-05	3.2E-05	2.8E-05	5.6E-04	2.3E-05		3.7E-07	3.6E-08	2.0E-03	6.4E-04	9.3E-05	9.1E-06	1.3E-14	5.0E-06	
TOTAL ALL (TEF Approach):	4.6E-04	1.6E-04	4.4E-05	6.5E-06	2.1E-05	3.4E-05	4.8E-05	5.9E-04	2.3E-05	2.2E-03	3.9E-06	1.1E-05	3.2E-03	9.7E-04	9.5E-05	3.4E-05	1.3E-14	5.0E-06	1.6E-04
TOTAL ALL (BaP Approach):	4.6E-04	1.6E-04	4.4E-05	6.6E-06	2.2E-05	3.7E-05	5.1E-05	5.9E-04	2.3E-05	2.2E-03	3.9E-06	1.1E-05	3.2E-03	9.7E-04	9.5E-05	3.4E-05	1.3E-14	5.0E-06	1.6E-04

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

ND – No data for toxicity assessment for exposure pathway.

[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources in pit 4.

[b] Risk from dermal contact to PAH's is assumed to equal risk from oral ingestion of PAH's.

5511

TABLE E.IV-24
HAZARD QUOTIENTS FOR CT ON-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Groundwater					
Exposure Pathways: / Toxicants	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.4E-08	5.5E-08	3.2E-06	1.4E-06	3.0E-12	3.1E-12	NA	ND
antimony	ND	6.3E-03	1.8E-03	5.7E-04	7.5E-01	3.9E-01	1.3E-01	1.1E-01	5.8E-02	NA	1.0E-02	3.4E-03	6.6E+00	4.0E+00	6.1E-01	2.0E-01	NA	1.1E-01
arsenic	ND	2.4E+00	6.3E-01	6.0E-02	5.9E-02	7.4E-02	7.1E-03	8.2E+00	7.1E-02	NA	5.4E-03	5.3E-04	2.9E+01	9.5E+00	1.4E+00	1.3E-01	NA	7.5E-02
barium	2.9E-01	1.8E-02	1.4E-03	1.0E-02	NA	NA	NA	5.0E-02	4.5E-03	NA	5.1E-04	3.8E-03	1.4E-01	1.2E-01	4.8E-03	3.6E-02	NA	3.7E-04
beryllium	ND	9.7E-05	2.0E-05	5.7E-08	8.3E-05	8.3E-05	2.4E-07	7.3E-04	6.0E-03	NA	NA	NA	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.7E-02	9.3E-03	4.2E-04	2.6E-03	NA	8.3E-04
cadmium	ND	7.3E-03	1.0E-03	6.1E-03	3.2E-01	4.9E-02	2.8E-01	1.0E-02	1.7E-02	NA	NA	NA	9.5E-12	3.3E-11	2.4E-12	1.4E-11	NA	4.6E-13
chromium vi	ND	1.3E-03	1.0E-03	9.0E-04	NA	NA	NA	9.6E-03	1.6E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
cobalt	2.8E-01	2.2E-05	6.3E-05	2.0E-05	NA	NA	NA	3.2E-04	5.8E-05	NA	NA	NA	NA	NA	NA	NA	NA	NA
copper	ND	2.7E-02	3.0E-02	1.4E-02	NA	NA	NA	3.5E-02	ND	NA	6.2E-03	3.0E-03	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	NA	ND
manganese	2.8E-01	5.3E-03	5.0E-04	1.4E-03	NA	NA	NA	1.6E-02	4.4E-02	NA	1.7E-05	4.8E-05	2.2E-01	1.5E-01	7.5E-03	2.1E-02	NA	1.8E-02
mercury	9.2E-05	3.6E-04	1.0E-02	6.0E-05	NA	NA	NA	1.5E-03	4.2E-03	NA	NA	NA	1.8E-02	6.5E-03	1.1E-01	6.7E-04	NA	2.9E-04
molybdenum	ND	5.4E-03	5.4E-03	4.3E-03	NA	NA	NA	2.3E-02	4.9E-03	NA	NA	NA	5.1E-02	2.6E-02	1.5E-02	1.2E-02	NA	3.3E-04
nickel	ND	2.4E-03	1.2E-03	6.4E-04	NA	NA	NA	4.2E-03	1.7E-04	NA	4.2E-03	2.3E-03	NA	NA	NA	NA	NA	NA
selenium	ND	9.6E-04	1.3E-03	1.1E-03	NA	NA	NA	1.5E-03	1.5E-04	NA	3.4E-03	2.9E-03	NA	NA	NA	NA	NA	NA
silver	ND	7.4E-04	5.1E-04	1.1E-02	NA	NA	NA	3.4E-03	ND	NA	3.8E-03	8.2E-02	NA	NA	NA	NA	NA	NA
thallium	ND	1.5E-02	1.1E-01	1.8E-02	1.4E-03	1.5E-01	2.4E-02	9.2E-02	7.5E-03	NA	NA	NA	NA	NA	NA	NA	NA	NA
vanadium	ND	1.9E-02	6.6E-03	1.7E-04	NA	NA	NA	1.1E-01	1.7E-02	NA	1.4E-02	3.8E-04	NA	NA	NA	NA	NA	NA
thorium-total	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	ND	7.0E-02	8.1E-04	7.8E-03	2.0E-01	1.4E-02	1.3E-01	3.5E-01	5.7E-01	NA	NA	NA	1.6E+02	4.4E+01	3.4E-01	3.4E+00	NA	7.8E+00
fluoride	ND	6.6E-04	ND	ND	NA	NA	NA	5.1E-02	1.3E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	7.7E-07	1.1E-07	1.1E-07	NA	NA	NA	2.6E-06	7.2E-06	NA	NA	NA	NA	NA	NA	NA	NA	NA
phenanthrene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	ND	1.0E-08	3.9E-13	3.9E-13	NA	NA	NA	2.6E-08	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.4E-08	1.5E-08	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	3.3E-05	1.7E-08	1.8E-08	NA	NA	NA	4.0E-05	1.4E-04	NA	7.1E-08	7.4E-08	9.5E-10	4.9E-10	1.5E-13	1.6E-13	NA	7.8E-10
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.5E-10	4.6E-10	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.2E-08	1.3E-08	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA
TOTAL:	8.4E-01	2.6E+00	8.0E-01	1.4E-01	1.3E+00	6.8E-01	5.7E-01	9.1E+00	8.4E-01		4.8E-02	9.9E-02	2.0E+02	5.8E+01	2.5E+00	3.8E+00	0.0E+00	8.0E+00

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

5511

TABLE E.IV-25
ILCRs FOR RME ON-PROPERTY FARMER, USE OF PERCHED GROUNDWATER[a]
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Perched Groundwater[a]			Great Miami Aquifer			Buried Pit Material
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Incidental Ingestion	Dermal Contact[a]	External Exposure	Ingestion of Meat	Ingestion of Milk	Ingestion of Drinking Water	Inhalation of VOC's	Dermal Contact while Bathing[b]	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	External Exposure[b]
Radionuclides																			
Cs_{137+1d}	6.8E-09	1.6E-07	2.9E-07	4.0E-07	8.6E-07	3.7E-06	5.2E-06	8.1E-07	NA	5.4E-04	3.3E-05	4.6E-05	1.2E-06	NA	NA	NA	NA	NA	
Np_{237+1d}	8.1E-06	8.3E-07	4.7E-09	1.7E-09	1.4E-06	6.1E-08	2.2E-08	4.7E-06	NA	8.7E-05	NA	NA	8.1E-05	NA	NA	4.1E-10	1.4E-12	5.2E-13	
Pu_{239}	6.3E-07	4.5E-08	1.6E-12	1.3E-12	1.3E-09	1.1E-11	8.4E-12	3.7E-07	NA	4.4E-10	NA	NA	5.3E-06	NA	NA	4.3E-07	7.9E-12	6.5E-12	
$Pu_{238/240}$	2.7E-06	2.1E-07	1.6E-11	1.3E-11	2.6E-09	2.2E-11	1.8E-11	1.7E-06	NA	1.9E-09	NA	NA	5.6E-07	NA	NA	NA	NA	NA	
Ra_{226+1d}	1.5E-05	2.4E-05	9.9E-07	7.1E-06	2.1E-06	6.3E-07	4.5E-06	1.0E-04	NA	7.6E-03	6.3E-08	4.6E-07	2.8E-03	NA	NA	2.3E-05	4.3E-07	3.2E-06	
Ru_{106}	9.2E-09	2.5E-09	2.5E-10	3.1E-13	NA	NA	NA	2.0E-07	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	
Sr_{90+1d}	6.5E-09	6.1E-08	3.7E-09	7.3E-08	1.7E-05	3.7E-06	7.4E-05	5.1E-07	NA	ND	6.7E-07	1.4E-05	7.1E-05	NA	NA	3.3E-09	1.2E-10	2.4E-09	
Tc_{99}	8.6E-08	1.8E-07	1.1E-07	5.0E-07	1.4E-05	5.4E-05	2.5E-04	1.2E-06	NA	5.3E-09	1.3E-05	6.1E-05	1.7E-04	NA	NA	3.3E-07	1.3E-07	6.3E-07	
Th_{230}	1.6E-03	9.5E-06	1.1E-08	3.8E-08	2.1E-07	1.1E-08	3.8E-08	5.6E-05	NA	2.2E-06	1.0E-11	3.4E-11	1.9E-07	NA	NA	2.0E-07	5.2E-11	1.8E-10	
Th_{232+1d}	2.0E-04	4.0E-06	4.8E-09	1.6E-08	1.0E-07	5.6E-09	1.9E-08	2.6E-05	NA	1.2E-02	2.6E-09	9.0E-09	4.2E-07	NA	NA	NA	NA	NA	
U_{234}	3.3E-04	2.6E-06	2.9E-08	3.5E-07	9.6E-06	6.4E-07	7.7E-06	1.9E-05	NA	3.4E-07	1.3E-06	1.6E-05	1.1E-01	NA	NA	5.4E-04	4.0E-06	4.9E-05	
U_{235+1D}	8.7E-05	7.1E-07	7.9E-09	9.4E-08	1.5E-06	1.0E-07	1.2E-06	3.1E-06	NA	4.3E-04	7.2E-08	8.9E-07	2.1E-02	NA	NA	1.2E-04	9.1E-07	1.1E-05	
U_{238+2d}	2.4E-03	1.6E-05	1.8E-07	2.2E-06	1.1E-04	7.5E-06	9.0E-05	1.4E-04	NA	1.6E-03	5.4E-06	6.6E-05	4.4E-01	NA	NA	4.4E-03	3.3E-05	4.1E-04	
Rn_{222+4d}	3.3E-09	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Total Radionuclides	4.7E-03	5.9E-05	1.6E-06	1.1E-05	1.6E-04	7.0E-05	4.4E-04	3.5E-04		2.3E-02	5.3E-05	2.0E-04	5.8E-01			5.1E-03	3.8E-05	4.7E-04	1.2E-03
Chemicals																			
arsenic	1.5E-03	2.5E-03	6.3E-04	7.5E-05	6.2E-05	7.4E-05	8.8E-06	8.1E-03	2.7E-04	NA	5.5E-06	6.6E-07	3.0E-02	ND	9.2E-05	9.9E-03	1.4E-03	1.7E-04	NA
beryllium	5.4E-07	4.2E-06	8.1E-07	2.9E-09	3.6E-06	3.4E-06	1.2E-08	3.0E-05	9.5E-04	NA	NA	NA	2.4E-03	ND	6.9E-04	NA	NA	NA	NA
cadmium	6.9E-07	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	ND	ND	ND	ND	ND	ND	NA
chromium vi	2.7E-05	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	ND	ND	ND	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	NA
nickel	1.1E-06	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	NA	NA	NA	NA
pcbs	ND	8.4E-06	2.4E-05	3.1E-05	9.8E-05	3.4E-04	4.3E-04	3.2E-05	4.1E-05	NA	NA	NA	3.1E-02	ND	8.3E-01	NA	NA	NA	NA
benzo(a)anthracene	9.2E-10	1.5E-08	8.2E-09	1.0E-08	1.7E-06	1.7E-06	2.2E-06	2.7E-07	2.7E-07	NA	NA	NA	1.2E-03	ND	1.2E-03	NA	NA	NA	NA
benzo(a)pyrene	4.7E-09	7.4E-08	9.8E-08	1.2E-07	3.0E-06	8.8E-06	1.1E-05	9.1E-07	9.1E-07	NA	NA	NA	8.0E-03	ND	8.0E-03	NA	NA	NA	NA
benzo(b)fluoranthene	1.2E-09	1.8E-08	9.1E-08	1.2E-07	2.3E-07	4.1E-06	5.2E-06	1.7E-07	1.7E-07	NA	NA	NA	9.8E-04	ND	9.8E-04	NA	NA	NA	NA
benzo(k)fluoranthene	2.1E-11	3.2E-10	3.3E-09	4.2E-09	5.4E-08	2.2E-06	2.8E-06	3.9E-08	3.9E-08	NA	NA	NA	4.2E-04	ND	4.2E-04	NA	NA	NA	NA
chrysene	0.0E+00	4.2E-10	2.4E-10	3.1E-10	4.5E-08	4.7E-08	5.9E-08	7.6E-09	7.6E-09	NA	NA	NA	3.5E-05	ND	3.5E-05	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.2E-03	ND	2.2E-03	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	0.0E+00	8.8E-09	5.6E-07	7.1E-07	NA	NA	NA	3.0E-08	3.0E-08	NA	NA	NA	2.2E-03	ND	2.2E-03	NA	NA	NA	NA
n-nitrosodipropylamine	ND	1.3E-07	3.9E-12	4.9E-12	NA	NA	NA	3.7E-07	3.9E-07	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	5.5E-09	7.7E-10	9.8E-10	NA	NA	NA	1.8E-08	1.9E-07	NA	NA	NA	6.6E-04	ND	1.4E-02	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.1E-02	3.0E-02	3.1E-03	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	3.2E-06	6.1E-06	NA	NA	NA	2.2E-03	ND	2.4E-01	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.3E-04	ND	5.3E-02	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	1.9E-09	2.3E-08	2.3E-07	3.3E-07	NA	NA	NA	7.6E-07	1.5E-06	NA	NA	NA	3.1E-04	ND	3.8E-02	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	5.5E-06	1.1E-05	NA	NA	NA	4.9E-04	ND	6.1E-02	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	6.7E-09	7.9E-08	8.0E-07	1.1E-06	NA	NA	NA	2.7E-06	5.2E-06	NA	NA	NA	3.9E-05	ND	4.9E-03	NA	NA	NA	NA
heptachlorodibenzofuran	8.4E-10	9.9E-09	6.3E-09	9.0E-09	NA	NA	NA	3.3E-07	6.4E-07	NA	NA	NA	8.2E-05	ND	1.0E-02	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	7.7E-09	9.1E-08	9.2E-07	1.3E-06	NA	NA	NA	3.1E-06	5.9E-06	NA	NA	NA	7.4E-06	ND	9.4E-04	NA	NA	NA	NA
octachlorodibenzofuran	4.4E-10	5.2E-09	3.3E-09	4.7E-09	NA	NA	NA	1.7E-07	3.3E-07	NA	NA	NA	4.5E-06	ND	5.7E-04	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.6E-12	2.2E-12	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	6.1E-11	3.4E-08	1.7E-11	2.2E-11	NA	NA	NA	3.9E-08	5.5E-07	NA	7.1E-11	9.2E-11	2.0E-04	2.9E-05	1.6E-04	5.0E-13	1.5E-16	1.9E-16	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.0E-10	4.0E-10	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.2E-13	5.0E-13	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	1.5E-03	2.5E-03	6.6E-04	1.1E-04	1.7E-04	4.3E-04	4.6E-04	8.2E-03	1.3E-03		5.5E-06	6.6E-07	1.3E-01	3.0E-02	8.9E-01	9.9E-03	1.4E-03	1.7E-04	
Sum Chem (BaP for PAHs):	1.5E-03	2.5E-03	6.6E-04	1.1E-04	1.9E-04	5.2E-04	5.7E-04	8.2E-03	1.3E-03		5.5E-06	6.6E-07	1.7E-01	3.0E-02	8.9E-01	9.9E-03	1.4E-03	1.7E-04	
TOTAL ALL (TEF Approach):	6.2E-03	2.5E-03	6.6E-04	1.2E-04	3.3E-04	5.0E-04	8.9E-04	8.5E-03	1.3E-03	2.3E-02	5.8E-05	2.1E-04	7.1E-01	3.0E-02	8.9E-01	1.5E-02	1.4E-03	6.4E-04	1.2E-03
TOTAL ALL (BaP Approach):	6.2E-03	2.5E-03	6.6E-04	1.2E-04	3.5E-04	5.9E-04	1.0E-03	8.5E-03	1.3E-03	2.3E-02	5.8E-05	2.1E-04	7.5E-01	3.0E-02	8.9E-01	1.5E-02	1.4E-03	6.4E-04	1.2E-03

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable. ND - No data for toxicity assessment for exposure pathway.

[a] Risk calculated using 1-hit equation for calculating risks from higher dose (EPA, 1989a), therefore total risks will not exceed one and are not additive.

[b] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources.

[c] Risk from dermal contact with PAHs is assumed to equal risk from oral ingestion of PAHs.

TABLE E.IV-26
HAZARD QUOTIENTS FOR RME ON-PROPERTY FARMER, USE OF PERCHED GROUNDWATER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Soil			Exposed Waste Pit Material			Surface Water		Perched Groundwater			Great Miami Aquifer		
Exposure Pathways:	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk	Incidental Ingestion	Dermal Contact	External Exposure	Ingestion of Meat	Ingestion of Milk	Ingestion of Drinking Water	Inhalation of VOC's	Dermal Contact while Bathing	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk
Toxicants																		
cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E-07	1.3E-07	4.9E+00	ND	ND	2.8E-06	5.7E-12	7.3E-12
antimony	ND	1.2E-02	3.4E-03	1.4E-03	1.5E+00	7.5E-01	3.0E-01	2.0E-01	4.2E-01	NA	2.0E-02	8.0E-03	6.5E+01	ND	1.3E+00	7.9E+00	1.2E+00	4.7E-01
arsenic	ND	4.7E+00	1.2E+00	1.4E-01	1.2E-01	1.4E-01	1.7E-02	1.5E+01	5.2E-01	NA	1.0E-02	1.3E-03	5.8E+01	ND	1.7E-01	1.9E+01	2.6E+00	3.2E-01
barium	5.0E-01	3.5E-02	2.6E-03	2.5E-02	NA	NA	NA	9.3E-02	3.3E-02	NA	9.7E-04	9.1E-03	7.7E-01	ND	2.4E-03	2.4E-01	9.2E-03	8.6E-02
beryllium	ND	1.9E-04	3.8E-05	1.4E-07	1.7E-04	1.6E-04	5.7E-07	1.4E-03	4.4E-02	NA	NA	NA	1.1E-01	ND	3.2E-02	NA	NA	NA
boron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.9E-01	ND	5.1E-02	1.9E-02	8.0E-04	6.1E-03
cadmium	ND	1.5E-02	2.0E-03	1.4E-02	6.3E-01	9.3E-02	6.7E-01	2.0E-02	1.3E-01	NA	NA	NA	3.2E+00	ND	1.9E-01	6.6E-11	4.5E-12	3.3E-11
chromium vi	ND	2.6E-03	2.0E-03	2.2E-03	NA	NA	NA	1.8E-02	1.2E-01	NA	NA	NA	7.1E-01	ND	8.1E-02	NA	NA	NA
cobalt	4.8E-01	4.4E-05	1.2E-04	4.8E-05	NA	NA	NA	6.0E-04	4.3E-04	NA	NA	NA	1.5E-01	ND	3.9E-04	NA	NA	NA
copper	ND	5.4E-02	5.7E-02	3.4E-02	NA	NA	NA	6.6E-02	ND	NA	1.2E-02	7.1E-03	6.5E-01	ND	ND	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND
manganese	4.8E-01	1.1E-02	9.6E-04	3.3E-03	NA	NA	NA	3.0E-02	3.2E-01	NA	3.3E-05	1.1E-04	4.7E-01	ND	4.5E-02	3.0E-01	1.4E-02	5.1E-02
mercury	1.6E-04	7.2E-04	2.0E-02	1.4E-04	NA	NA	NA	2.9E-03	3.0E-02	NA	NA	NA	2.0E+00	ND	3.8E-02	1.3E-02	2.2E-01	1.6E-03
molybdenum	ND	1.1E-02	1.0E-02	1.0E-02	NA	NA	NA	4.3E-02	3.6E-02	NA	NA	NA	6.3E+02	ND	4.8E+00	5.2E-02	2.8E-02	2.8E-02
nickel	ND	4.9E-03	2.3E-03	1.5E-03	NA	NA	NA	7.8E-03	1.3E-03	NA	8.1E-03	5.4E-03	2.9E+00	ND	8.4E-03	NA	NA	NA
selenium	ND	1.9E-03	2.4E-03	2.6E-03	NA	NA	NA	2.8E-03	1.1E-03	NA	6.5E-03	7.0E-03	2.1E-02	ND	7.5E-05	NA	NA	NA
silver	ND	1.5E-03	9.8E-04	2.6E-02	NA	NA	NA	6.3E-03	ND	NA	7.3E-03	2.0E-01	3.7E-01	ND	ND	NA	NA	NA
thallium	ND	3.1E-02	2.2E-01	4.3E-02	2.9E-03	2.9E-01	5.8E-02	1.7E-01	5.5E-02	NA	NA	NA	3.0E+02	ND	8.5E-01	NA	NA	NA
vanadium	ND	3.8E-02	1.3E-02	4.0E-04	NA	NA	NA	2.0E-01	1.3E-01	NA	2.7E-02	9.0E-04	5.6E+00	ND	3.2E-01	NA	NA	NA
thorium-total	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
uranium-total	ND	1.4E-01	1.6E-03	1.9E-02	3.9E-01	2.6E-02	3.1E-01	6.6E-01	4.2E+00	NA	NA	NA	4.6E+03	ND	2.6E+02	8.8E+01	6.5E-01	8.0E+00
fluoride	ND	1.3E-03	ND	ND	NA	NA	NA	9.7E-02	9.3E-02	NA	NA	NA	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.5E-06	2.1E-07	2.7E-07	NA	NA	NA	5.0E-06	5.3E-05	NA	NA	NA	1.8E-01	ND	4.0E+00	NA	NA	NA
phenanthrene	ND	ND	ND	ND	NA	NA	NA	ND	ND	NA	NA	NA	ND	ND	ND	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	ND	2.1E-08	7.4E-13	9.3E-13	NA	NA	NA	4.9E-08	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.6E-08	3.6E-08	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	6.5E-05	3.3E-08	4.3E-08	NA	NA	NA	7.4E-05	1.1E-03	NA	1.4E-07	1.8E-07	3.8E-01	ND	3.1E-01	9.7E-10	2.9E-13	3.7E-13
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	4.8E-10	1.1E-09	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.3E-08	3.2E-08	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E-09	2.3E-09	NA	NA	NA	NA	NA	NA
TOTAL:	1.5E+00	5.1E+00	1.5E+00	3.3E-01	2.6E+00	1.3E+00	1.4E+00	1.7E+01	6.1E+00		9.3E-02	2.4E-01	5.6E+03	0.0E+00	2.7E+02	1.2E+02	4.7E+00	9.0E+00

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-27
ILCRs FOR RME OFF-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Groundwater					
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Radionuclides										
Cs_{137+1d}	2.9E-10	6.8E-09	1.2E-08	1.7E-08	NA	NA	NA	NA	NA	NA
Np_{237+1d}	3.7E-07	3.8E-08	2.1E-10	7.8E-11	1.3E-16	4.3E-17	1.5E-19	5.6E-20	NA	NA
Pu_{238}	3.8E-08	2.7E-09	9.9E-14	7.9E-14	NA	NA	NA	NA	NA	NA
$Pu_{239/240}$	2.2E-07	1.7E-08	1.3E-12	1.1E-12	NA	NA	NA	NA	NA	NA
Ra_{226+8d}	1.1E-06	1.6E-06	6.8E-08	4.9E-07	NA	NA	NA	NA	NA	NA
Ru_{106}	6.1E-10	1.6E-10	1.6E-11	2.0E-14	NA	NA	NA	NA	NA	NA
Sr_{90+1d}	2.9E-10	2.7E-09	1.6E-10	3.3E-09	1.0E-11	4.2E-12	1.5E-13	3.1E-12	NA	NA
Tc_{99}	5.9E-09	1.2E-08	7.3E-09	3.4E-08	2.0E-07	6.3E-08	2.5E-08	1.2E-07	NA	NA
Th_{230}	1.2E-04	7.1E-07	8.5E-10	2.8E-09	NA	NA	NA	NA	NA	NA
$Th_{232+10d}$	1.3E-05	2.5E-07	3.0E-10	1.0E-09	NA	NA	NA	NA	NA	NA
U_{234}	1.4E-05	1.1E-07	1.2E-09	1.4E-08	1.3E-04	4.1E-05	3.0E-07	3.7E-06	NA	NA
U_{235+1D}	1.3E-06	1.1E-08	1.2E-10	1.4E-09	3.1E-05	9.5E-06	7.0E-08	8.6E-07	NA	NA
U_{238+2d}	5.8E-05	4.0E-07	4.4E-09	5.3E-08	1.1E-03	3.4E-04	2.5E-06	3.1E-05	NA	NA
Rn_{222+4d}	2.2E-10	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radionuclides	2.1E-04	3.2E-06	9.5E-08	6.2E-07	1.3E-03	3.9E-04	2.9E-06	3.6E-05		
Chemicals										
arsenic	9.0E-05	1.5E-04	3.9E-05	4.7E-06	NA	NA	NA	NA	NA	NA
beryllium	4.4E-08	3.3E-07	6.5E-08	2.3E-10	NA	NA	NA	NA	NA	NA
cadmium	4.9E-08	ND	ND	ND	NA	NA	NA	NA	NA	NA
chromium vi	2.2E-06	ND	ND	ND	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
nickel	8.2E-08	ND	ND	ND	NA	NA	NA	NA	NA	NA
pcbs	ND	5.3E-07	1.6E-06	2.0E-06	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	4.0E-11	6.3E-10	3.5E-10	4.5E-10	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	2.9E-10	4.6E-09	6.1E-09	7.7E-09	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	5.5E-11	8.4E-10	4.3E-09	5.5E-09	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	2.6E-13	4.1E-12	4.2E-11	5.3E-11	NA	NA	NA	NA	NA	NA
chrysene	1.6E-12	2.5E-11	1.5E-11	1.9E-11	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.3E-11	1.9E-10	1.2E-08	1.5E-08	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	7.6E-09	2.2E-13	2.8E-13	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	3.3E-10	4.6E-11	5.9E-11	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	1.2E-10	1.4E-09	1.4E-08	2.0E-08	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	4.0E-10	4.7E-09	4.8E-08	6.8E-08	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	5.0E-11	5.9E-10	3.8E-10	5.4E-10	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	4.6E-10	5.4E-09	5.5E-08	7.8E-08	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	2.6E-11	3.1E-10	2.0E-10	2.8E-10	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	4.7E-13	2.6E-10	1.3E-13	1.7E-13	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	9.3E-05	1.5E-04	4.1E-05	6.8E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Chem (BaP for PAHs):	9.3E-05	1.5E-04	4.1E-05	6.9E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
TOTAL ALL (TEF Approach):	3.1E-04	1.6E-04	4.1E-05	7.5E-06	1.3E-03	3.9E-04	2.9E-06	3.6E-05	0.0E+00	0.0E+00
TOTAL ALL (BaP Approach):	3.1E-04	1.6E-04	4.1E-05	7.5E-06	1.3E-03	3.9E-04	2.9E-06	3.6E-05	0.0E+00	0.0E+00

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

ND – No data for toxicity assessment for exposure pathway.

TABLE E.IV-28
HAZARD QUOTIENTS FOR RME OFF-PROPERTY FARMER
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Groundwater					
Exposure Pathways: / Toxicants	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
cyanide	NA	NA	NA	NA	1.7E-08	8.2E-09	1.7E-14	2.2E-14	NA	ND
antimony	ND	1.2E-03	3.2E-04	1.3E-04	NA	NA	NA	NA	NA	NA
arsenic	ND	2.9E-01	7.4E-02	8.9E-03	NA	NA	NA	NA	NA	NA
barium	3.4E-02	2.4E-03	1.8E-04	1.7E-03	1.9E-07	1.8E-07	6.7E-09	6.3E-08	NA	5.9E-10
beryllium	ND	1.5E-05	3.0E-06	1.1E-08	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	8.0E-04	4.8E-04	2.1E-05	1.6E-04	NA	4.6E-05
cadmium	ND	1.0E-03	1.4E-04	1.0E-03	NA	NA	NA	NA	NA	NA
chromium vi	ND	2.1E-04	1.6E-04	1.8E-04	NA	NA	NA	NA	NA	NA
cobalt	3.9E-02	3.6E-06	9.8E-06	3.9E-06	NA	NA	NA	NA	NA	NA
copper	ND	2.8E-03	2.9E-03	1.8E-03	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
manganese	3.1E-02	6.8E-04	6.1E-05	2.2E-04	NA	NA	NA	NA	NA	NA
mercury	9.1E-06	4.1E-05	1.1E-03	8.2E-06	3.5E-08	1.4E-08	2.3E-07	1.7E-09	NA	6.6E-10
molybdenum	ND	6.4E-04	6.1E-04	6.1E-04	1.0E-06	5.6E-07	3.0E-07	3.0E-07	NA	7.6E-09
nickel	ND	3.5E-04	1.6E-04	1.1E-04	NA	NA	NA	NA	NA	NA
selenium	ND	1.1E-04	1.5E-04	1.6E-04	NA	NA	NA	NA	NA	NA
silver	ND	6.5E-05	4.3E-05	1.2E-03	NA	NA	NA	NA	NA	NA
thallium	ND	1.2E-03	8.7E-03	1.7E-03	NA	NA	NA	NA	NA	NA
vanadium	ND	3.1E-03	1.0E-03	3.2E-05	NA	NA	NA	NA	NA	NA
thorium-total	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
uranium-total	ND	5.8E-03	6.4E-05	7.7E-04	2.2E+01	6.7E+00	5.0E-02	6.1E-01	NA	1.3E+00
fluoride	ND	7.8E-05	ND	ND	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	9.2E-08	1.3E-08	1.6E-08	NA	NA	NA	NA	NA	NA
phenanthrene	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	5.0E-07	2.6E-10	3.3E-10	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL:	1.0E-01	3.1E-01	9.0E-02	1.8E-02	2.2E+01	6.7E+00	5.0E-02	6.1E-01	0.0E+00	1.3E+00

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-29
ILCRs FOR RME OFF-PROPERTY CHILD
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Groundwater					
Exposure Pathways: / Contaminants of Concern	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
Radionuclides										
Cs_{137+1d}	5.2E-12	5.1E-10	4.0E-10	3.3E-09	NA	NA	NA	NA	NA	NA
Np_{237+1d}	6.7E-09	2.8E-09	7.1E-12	1.5E-11	5.7E-18	3.2E-18	5.0E-21	1.1E-20	NA	NA
Pu_{238}	7.0E-10	2.0E-10	3.3E-15	1.5E-14	NA	NA	NA	NA	NA	NA
$Pu_{239/240}$	4.1E-09	1.3E-09	4.5E-14	2.1E-13	NA	NA	NA	NA	NA	NA
Ra_{226+8d}	1.9E-08	1.2E-07	2.3E-09	9.5E-08	NA	NA	NA	NA	NA	NA
Ru_{106}	1.1E-11	1.2E-11	5.4E-13	4.0E-15	NA	NA	NA	NA	NA	NA
Sr_{90+1d}	5.2E-12	2.0E-10	5.4E-12	6.3E-10	4.5E-13	3.1E-13	5.0E-15	6.0E-13	NA	NA
Tc_{99}	1.1E-10	9.0E-10	2.4E-10	6.7E-09	8.5E-09	4.7E-09	8.3E-10	2.3E-08	NA	NA
Th_{230}	2.3E-06	5.3E-08	2.8E-11	5.5E-10	NA	NA	NA	NA	NA	NA
$Th_{232+10d}$	2.3E-07	1.9E-08	1.0E-11	2.0E-10	NA	NA	NA	NA	NA	NA
U_{234}	2.5E-07	8.1E-09	4.0E-11	2.8E-09	5.8E-06	3.0E-06	9.9E-09	7.2E-07	NA	NA
U_{235+1D}	2.4E-08	8.1E-10	4.0E-12	2.8E-10	1.3E-06	7.0E-07	2.3E-09	1.7E-07	NA	NA
U_{238+2d}	1.1E-06	3.0E-08	1.5E-10	1.0E-08	4.8E-05	2.5E-05	8.3E-08	6.0E-06	NA	NA
Rn_{222+4d}	4.0E-12	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Radionuclides	3.8E-06	2.4E-07	3.1E-09	1.2E-07	5.5E-05	2.9E-05	9.6E-08	6.9E-06		
Chemicals										
arsenic	7.6E-06	5.3E-05	6.0E-06	4.2E-06	NA	NA	NA	NA	NA	NA
beryllium	3.7E-09	1.2E-07	1.0E-08	2.1E-10	NA	NA	NA	NA	NA	NA
cadmium	4.1E-09	ND	ND	ND	NA	NA	NA	NA	NA	NA
chromium vi	1.9E-07	ND	ND	ND	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
nickel	6.9E-09	ND	ND	ND	NA	NA	NA	NA	NA	NA
pcbs	ND	1.9E-07	2.4E-07	1.8E-06	NA	NA	NA	NA	NA	NA
benzo(a)anthracene	3.3E-12	2.2E-10	5.4E-11	4.1E-10	NA	NA	NA	NA	NA	NA
benzo(a)pyrene	2.5E-11	1.6E-09	9.4E-10	7.0E-09	NA	NA	NA	NA	NA	NA
benzo(b)fluoranthene	4.7E-12	2.9E-10	6.7E-10	5.0E-09	NA	NA	NA	NA	NA	NA
benzo(k)fluoranthene	2.2E-14	1.4E-12	6.5E-12	4.8E-11	NA	NA	NA	NA	NA	NA
chrysene	1.3E-13	8.8E-12	2.3E-12	1.7E-11	NA	NA	NA	NA	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	1.1E-12	6.6E-11	1.9E-09	1.4E-08	NA	NA	NA	NA	NA	NA
n-nitrosodipropylamine	ND	2.7E-09	3.4E-14	2.6E-13	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	1.2E-10	7.2E-12	5.4E-11	NA	NA	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	9.9E-12	4.8E-10	2.2E-09	1.8E-08	NA	NA	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	3.4E-11	1.6E-09	7.4E-09	6.2E-08	NA	NA	NA	NA	NA	NA
heptachlorodibenzofuran	4.2E-12	2.0E-10	5.8E-11	4.9E-10	NA	NA	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	3.9E-11	1.9E-09	8.5E-09	7.1E-08	NA	NA	NA	NA	NA	NA
octachlorodibenzofuran	2.2E-12	1.1E-10	3.1E-11	2.6E-10	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	3.9E-14	9.0E-11	2.1E-14	1.5E-13	NA	NA	NA	NA	NA	NA
benzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sum Chem (TEF for PAHs):	7.8E-06	5.4E-05	6.3E-06	6.2E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Sum Chem (BaP for PAHs):	7.8E-06	5.4E-05	6.3E-06	6.3E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
TOTAL ALL (TEF Approach):	1.2E-05	5.4E-05	6.3E-06	6.3E-06	5.5E-05	2.9E-05	9.6E-08	6.9E-06	0.0E+00	0.0E+00
TOTAL ALL (BaP Approach):	1.2E-05	5.4E-05	6.3E-06	6.4E-06	5.5E-05	2.9E-05	9.6E-08	6.9E-06	0.0E+00	0.0E+00

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..

ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-30
HAZARD QUOTIENTS FOR RME OFF-PROPERTY CHILD
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air				Groundwater					
Exposure Pathways: / Toxicants	Inhalation	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Drinking Water	Ingestion of Vegetables and Fruits	Ingestion of Meat	Ingestion of Milk Products	Inhalation of VOC's	Dermal Contact while Bathing
cyanide	NA	NA	NA	NA	4.0E-08	3.3E-08	3.0E-14	2.3E-13	NA	ND
antimony	ND	4.7E-03	5.8E-04	1.4E-03	NA	NA	NA	NA	NA	NA
arsenic	ND	1.2E+00	1.3E-01	9.4E-02	NA	NA	NA	NA	NA	NA
barium	3.4E-02	9.8E-03	3.3E-04	1.8E-02	4.4E-07	7.1E-07	1.2E-08	6.7E-07	NA	9.6E-10
beryllium	ND	6.3E-05	5.4E-06	1.1E-07	NA	NA	NA	NA	NA	NA
boron	NA	NA	NA	NA	1.9E-03	1.9E-03	3.7E-05	1.7E-03	NA	7.5E-05
cadmium	ND	4.2E-03	2.5E-04	1.1E-02	NA	NA	NA	NA	NA	NA
chromium vi	ND	8.7E-04	2.9E-04	1.9E-03	NA	NA	NA	NA	NA	NA
cobalt	3.8E-02	1.5E-05	1.8E-05	4.1E-05	NA	NA	NA	NA	NA	NA
copper	ND	1.1E-02	5.3E-03	1.9E-02	NA	NA	NA	NA	NA	NA
lead	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
manganese	3.0E-02	2.8E-03	1.1E-04	2.3E-03	NA	NA	NA	NA	NA	NA
mercury	8.9E-06	1.7E-04	2.1E-03	8.7E-05	8.1E-08	5.6E-08	4.2E-07	1.8E-08	NA	1.1E-09
molybdenum	ND	2.6E-03	1.1E-03	6.5E-03	2.4E-06	2.3E-06	5.4E-07	3.2E-06	NA	1.2E-08
nickel	ND	1.4E-03	3.0E-04	1.2E-03	NA	NA	NA	NA	NA	NA
selenium	ND	4.6E-04	2.6E-04	1.6E-03	NA	NA	NA	NA	NA	NA
silver	ND	2.6E-04	7.8E-05	1.2E-02	NA	NA	NA	NA	NA	NA
thallium	ND	5.0E-03	1.6E-02	1.8E-02	NA	NA	NA	NA	NA	NA
vanadium	ND	1.2E-02	1.8E-03	3.4E-04	NA	NA	NA	NA	NA	NA
thorium-total	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
uranium-total	ND	2.3E-02	1.2E-04	8.1E-03	5.2E+01	2.7E+01	8.9E-02	6.5E+00	NA	2.1E+00
fluoride	ND	3.1E-04	ND	ND	NA	NA	NA	NA	NA	NA
acenaphthylene	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
pentachlorophenol	ND	3.7E-07	2.3E-08	1.7E-07	NA	NA	NA	NA	NA	NA
phenanthrene	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-hexanone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
tetrachloroethene	ND	2.0E-06	4.6E-10	3.4E-09	NA	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL:	1.0E-01	1.3E+00	1.6E-01	2.0E-01	5.2E+01	2.7E+01	8.9E-02	6.5E+00	0.0E+00	2.1E+00

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
ND - No data for toxicity assessment for exposure pathway.

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TABLE E.IV-31
ILCRs FOR ON-PROPERTY HOME BUILDER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material			Buried Pit Material
Exposure Pathways: Contaminants of Concern	Inhalation	Incidental Ingestion	Dermal Contact[b]	External Exposure	External Exposure[a]
Radionuclides					
Cs_{137+1d}	2.1E-10	1.5E-08	NA	1.6E-06	
Np_{237+1d}	2.4E-07	9.0E-08	NA	2.5E-07	
Pu_{238}	1.9E-08	7.0E-09	NA	1.3E-12	
$Pu_{239/240}$	8.2E-08	3.2E-08	NA	5.4E-12	
Ra_{226+8d}	4.7E-07	2.0E-06	NA	2.2E-05	
Ru_{106}	2.8E-10	3.8E-09	NA	ND	
Sr_{90+1d}	2.0E-10	9.8E-09	NA	ND	
Tc_{99}	2.6E-09	2.3E-08	NA	1.5E-11	
Th_{230}	5.0E-05	1.1E-06	NA	6.3E-09	
$Th_{232+10d}$	6.2E-06	5.0E-07	NA	3.6E-05	
U_{234}	1.0E-05	3.7E-07	NA	9.8E-10	
U_{235+1D}	2.6E-06	5.8E-08	NA	1.2E-06	
U_{238+2d}	7.3E-05	2.6E-06	NA	4.7E-06	
Rn_{222+4d}	1.0E-10	NA	NA	NA	
Total Radionuclides	1.4E-04	6.8E-06		6.6E-05	6.8E-09
Chemicals					
arsenic	4.4E-05	1.5E-04	1.9E-06	NA	NA
beryllium	1.6E-08	5.6E-07	6.8E-06	NA	NA
cadmium	2.1E-08	ND	ND	NA	NA
chromium vi	8.2E-07	ND	ND	NA	NA
lead	ND	ND	ND	NA	NA
nickel	3.5E-08	ND	ND	NA	NA
pcbs	ND	6.1E-07	2.9E-07	NA	NA
benzo(a)anthracene	1.9E-11	3.6E-09	3.6E-09	NA	NA
benzo(a)pyrene	1.4E-10	1.7E-08	1.7E-08	NA	NA
benzo(b)fluoranthene	2.9E-11	2.7E-09	2.7E-09	NA	NA
benzo(k)fluoranthene	1.2E-13	1.4E-10	1.4E-10	NA	NA
chrysene	7.9E-13	1.4E-10	1.4E-10	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	6.3E-12	2.1E-10	2.1E-10	NA	NA
n-nitrosodipropylamine	ND	7.0E-09	2.8E-09	NA	NA
pentachlorophenol	ND	3.4E-10	1.4E-09	NA	NA
vinyl chloride	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	6.0E-08	4.3E-08	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	5.9E-11	1.4E-08	1.0E-08	NA	NA
hexachlorodibenzofuran	NA	1.1E-07	7.6E-08	NA	NA
heptachlorodibenzo-p-dioxin	2.0E-10	5.1E-08	3.7E-08	NA	NA
heptachlorodibenzofuran	2.5E-11	6.3E-09	4.5E-09	NA	NA
octachlorodibenzo-p-dioxin	2.3E-10	5.8E-08	4.2E-08	NA	NA
octachlorodibenzofuran	1.3E-11	3.3E-09	2.4E-09	NA	NA
chloroform	NA	NA	NA	NA	NA
tetrachloroethene	1.8E-12	7.4E-10	3.9E-09	NA	NA
benzene	NA	NA	NA	NA	NA
methylene chloride	NA	NA	NA	NA	NA
SUM (TEF for PAHs):	4.5E-05	1.6E-04	9.2E-06		
SUM (BaP for PAHs):	4.5E-05	1.6E-04	9.3E-06		
TOTAL RAD. & CHEM.	1.9E-04	1.6E-04	9.2E-06	6.6E-05	6.8E-09
TOTAL RAD. & CHEM.	1.9E-04	1.6E-04	9.3E-06	6.6E-05	6.8E-09

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.

ND – No data for toxicity assessment for exposure pathway.

[a] Risk from external radiation exposure is calculated from total exposure to all gamma radiation sources in pit 4.

[b] Risk from dermal contact with PAHs is assumed to equal risk from oral ingestion of PAHs.

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TABLE E.IV-32
HAZARD QUOTIENTS FOR ON-PROPERTY HOME BUILDER FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air	Surface Soil and Exposed Waste Pit Material		
Exposure Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	External Exposure
Toxicants				
cyanide	NA	NA	NA	NA
antimony	ND	5.5E-01	4.4E-01	NA
arsenic	ND	4.3E+01	5.4E-01	NA
barium	2.2E+00	2.6E-01	3.4E-02	NA
beryllium	ND	3.8E-03	4.6E-02	NA
boron	NA	NA	NA	NA
cadmium	ND	5.5E-02	1.3E-01	NA
chromium vi	ND	5.0E-02	1.2E-01	NA
cobalt	2.1E+00	1.7E-03	4.4E-04	NA
copper	ND	1.8E-01	ND	NA
lead	ND	ND	ND	NA
manganese	2.1E+00	8.5E-02	3.4E-01	NA
mercury	7.0E-04	8.0E-03	3.2E-02	NA
molybdenum	ND	1.2E-01	3.8E-02	NA
nickel	ND	2.2E-02	1.3E-03	NA
selenium	ND	7.7E-03	1.2E-03	NA
silver	ND	1.8E-02	ND	NA
thallium	ND	4.8E-01	5.8E-02	NA
vanadium	ND	5.5E-01	1.3E-01	NA
thorium-total	ND	ND	ND	NA
uranium-total	ND	1.8E+00	4.4E+00	NA
fluoride	ND	2.7E-01	9.7E-02	NA
acenaphthylene	ND	ND	ND	NA
2-methylnaphthalene	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	ND	NA
dibenzofuran	NA	NA	NA	NA
pentachlorophenol	ND	1.4E-05	5.5E-05	NA
phenanthrene	ND	ND	ND	NA
tributyl phosphate	NA	NA	NA	NA
2-hexanone	ND	1.4E-07	ND	NA
3-chloropropene	NA	NA	NA	NA
chloroform	NA	NA	NA	NA
tetrachloroethene	ND	2.1E-04	1.1E-03	NA
methylene chloride	NA	NA	NA	NA
toluene	NA	NA	NA	NA
2-nitrophenol	NA	NA	NA	NA
acetone	NA	NA	NA	NA
TOTAL:	6.4E+00	4.7E+01	6.4E+00	

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable.
ND - No data for toxicity assessment for exposure pathway.

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TABLE E.IV-33
ILCRs FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air		Surface Soil		Surface Water	
Exposure Pathways: / Contaminants of Concern	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Radionuclides						
Cs_{137+1d}	2.9E-07	4.0E-07	3.7E-06	5.2E-06	3.3E-05	4.6E-05
Np_{237+1d}	4.7E-09	1.7E-09	6.1E-08	2.2E-08	NA	NA
Pu_{238}	1.6E-12	1.3E-12	1.1E-11	8.4E-12	NA	NA
$Pu_{239/240}$	1.6E-11	1.3E-11	2.2E-11	1.8E-11	NA	NA
Ra_{226+8d}	9.9E-07	7.1E-06	6.3E-07	4.5E-06	6.3E-08	4.6E-07
Ru_{106}	2.5E-10	3.1E-13	NA	NA	NA	NA
Sr_{90+1d}	3.7E-09	7.3E-08	3.7E-06	7.4E-05	6.7E-07	1.4E-05
Tc_{99}	1.1E-07	5.0E-07	5.4E-05	2.5E-04	1.3E-05	6.1E-05
Th_{230}	1.1E-08	3.8E-08	1.1E-08	3.8E-08	1.0E-11	3.4E-11
$Th_{232+10d}$	4.8E-09	1.6E-08	5.6E-09	1.9E-08	2.6E-09	9.0E-09
U_{234}	2.9E-08	3.5E-07	6.4E-07	7.7E-06	1.3E-06	1.6E-05
U_{235+1D}	7.9E-09	9.4E-08	1.0E-07	1.2E-06	7.2E-08	8.9E-07
U_{238+2d}	1.8E-07	2.2E-06	7.5E-06	9.0E-05	5.4E-06	6.6E-05
Total Radionuclides	1.6E-06	1.1E-05	7.0E-05	4.4E-04	5.3E-05	2.0E-04
Chemicals						
arsenic	6.3E-04	7.5E-05	7.4E-05	8.8E-06	5.5E-06	6.6E-07
beryllium	8.1E-07	2.9E-09	3.4E-06	1.2E-08	NA	NA
cadmium	ND	ND	ND	ND	NA	NA
chromium vi	ND	ND	NA	NA	NA	NA
lead	ND	ND	NA	NA	ND	ND
nickel	ND	ND	NA	NA	ND	ND
pcbs	2.4E-05	3.1E-05	3.4E-04	4.3E-04	NA	NA
benzo(a)anthracene	5.6E-09	7.2E-09	1.2E-06	1.5E-06	NA	NA
benzo(a)pyrene	9.8E-08	1.2E-07	8.8E-06	1.1E-05	NA	NA
benzo(b)fluoranthene	7.4E-08	9.4E-08	3.3E-06	4.2E-06	NA	NA
benzo(k)fluoranthene	6.4E-10	8.1E-10	4.3E-07	5.4E-07	NA	NA
chrysene	2.4E-10	3.1E-10	4.7E-08	5.9E-08	NA	NA
dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA
indeno(1,2,3-cd)pyrene	2.0E-07	2.5E-07	NA	NA	NA	NA
n-nitrosodipropylamine	3.9E-12	4.9E-12	NA	NA	NA	NA
pentachlorophenol	7.7E-10	9.8E-10	NA	NA	NA	NA
vinyl chloride	NA	NA	NA	NA	NA	NA
tetrachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA
tetrachlorodibenzofuran	NA	NA	NA	NA	NA	NA
pentachlorodibenzofuran	NA	NA	NA	NA	NA	NA
hexachlorodibenzo-p-dioxin	2.3E-07	3.3E-07	NA	NA	NA	NA
hexachlorodibenzofuran	NA	NA	NA	NA	NA	NA
heptachlorodibenzo-p-dioxin	8.0E-07	1.1E-06	NA	NA	NA	NA
heptachlorodibenzofuran	6.3E-09	9.0E-09	NA	NA	NA	NA
octachlorodibenzo-p-dioxin	9.2E-07	1.3E-06	NA	NA	NA	NA
octachlorodibenzofuran	3.3E-09	4.7E-09	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	1.6E-12	2.2E-12
tetrachloroethene	1.7E-11	2.2E-11	NA	NA	7.1E-11	9.2E-11
benzene	NA	NA	NA	NA	3.0E-10	4.0E-10
methylene chloride	NA	NA	NA	NA	2.2E-13	5.0E-13
Sum Chem (TEF for PAHs):	6.6E-04	1.1E-04	4.3E-04	4.5E-04	5.5E-06	6.6E-07
Sum Chem (BaP for PAHs):	6.6E-04	1.1E-04	4.8E-04	5.2E-04	5.5E-06	6.6E-07
TOTAL ALL (TEF Approach):	6.6E-04	1.2E-04	5.0E-04	8.9E-04	5.8E-05	2.1E-04
TOTAL ALL (BaP Approach):	6.6E-04	1.2E-04	5.5E-04	9.5E-04	5.8E-05	2.1E-04

NA - Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
ND - No data for toxicity assessment for exposure pathway.

TABLE E.IV-34
HAZARD QUOTIENTS FOR OFF-PROPERTY USER OF MEAT AND MILK PRODUCTS
FUTURE LAND USE, FUTURE SOURCE TERM

Transfer Media:	Air		Surface Soil		Surface Water	
Exposure Pathways:	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products	Ingestion of Meat	Ingestion of Milk Products
Toxicants						
cyanide	NA	NA	NA	NA	1.0E-07	1.3E-07
antimony	3.4E-03	1.4E-03	7.5E-01	3.0E-01	2.0E-02	8.0E-03
arsenic	1.2E+00	1.4E-01	1.4E-01	1.7E-02	1.0E-02	1.3E-03
barium	2.6E-03	2.5E-02	NA	NA	9.7E-04	9.1E-03
beryllium	3.8E-05	1.4E-07	1.6E-04	5.7E-07	NA	NA
boron	NA	NA	NA	NA	NA	NA
cadmium	2.0E-03	1.4E-02	9.3E-02	6.7E-01	NA	NA
chromium vi	2.0E-03	2.2E-03	NA	NA	NA	NA
cobalt	1.2E-04	4.8E-05	NA	NA	NA	NA
copper	5.7E-02	3.4E-02	NA	NA	1.2E-02	7.1E-03
lead	ND	ND	NA	NA	ND	ND
manganese	9.6E-04	3.3E-03	NA	NA	3.3E-05	1.1E-04
mercury	2.0E-02	1.4E-04	NA	NA	NA	NA
molybdenum	1.0E-02	1.0E-02	NA	NA	NA	NA
nickel	2.3E-03	1.5E-03	NA	NA	8.1E-03	5.4E-03
selenium	2.4E-03	2.6E-03	NA	NA	6.5E-03	7.0E-03
silver	9.8E-04	2.6E-02	NA	NA	7.3E-03	2.0E-01
thallium	2.2E-01	4.3E-02	2.9E-01	5.8E-02	NA	NA
vanadium	1.3E-02	4.0E-04	NA	NA	2.7E-02	9.0E-04
thorium-total	ND	ND	ND	ND	NA	NA
uranium-total	1.6E-03	1.9E-02	2.6E-02	3.1E-01	NA	NA
fluoride	ND	ND	NA	NA	NA	NA
acenaphthylene	ND	ND	NA	NA	NA	NA
2-methylnaphthalene	NA	NA	NA	NA	NA	NA
4-chloro-3-methylphenol	NA	NA	NA	NA	NA	NA
benzo(g,h,i)perylene	ND	ND	NA	NA	NA	NA
dibenzofuran	NA	NA	NA	NA	NA	NA
pentachlorophenol	2.1E-07	2.7E-07	NA	NA	NA	NA
phenanthrene	ND	ND	NA	NA	NA	NA
tributyl phosphate	NA	NA	NA	NA	NA	NA
2-hexanone	7.4E-13	9.3E-13	NA	NA	NA	NA
3-chloropropene	NA	NA	NA	NA	NA	NA
chloroform	NA	NA	NA	NA	2.6E-08	3.6E-08
tetrachloroethene	3.3E-08	4.3E-08	NA	NA	1.4E-07	1.8E-07
methylene chloride	NA	NA	NA	NA	4.8E-10	1.1E-09
toluene	NA	NA	NA	NA	2.3E-08	3.2E-08
2-nitrophenol	NA	NA	NA	NA	ND	ND
acetone	NA	NA	NA	NA	1.0E-09	2.3E-09
TOTAL:	1.5E+00	3.3E-01	1.3E+00	1.4E+00	9.3E-02	2.4E-01

NA – Not applicable. Chemical not a chemical of interest for media or exposure pathway not applicable..
ND – No data for toxicity assessment for exposure pathway.

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TABLE E.IV-42

RISKS FROM PENETRATING RADIATION FUTURE CONDITIONS - BURIED PIT MATERIAL ON-PROPERTY HOME BUILDER UNDER FUTURE LAND USE[A]

Source	Source Surface Area (m^2)	Fraction of Time Exposed To Source Material[b] (unitless)	Total Time Spent Exposed to Source[c] (hr/Lifetime)	Dose Rate[d] (mRem/hr)	Total Exposure[e] (mRem/Life)	Risk[f] (risk/Life)
Pit 4	7790	1.0	1400	7.8×10^{-6}	1.1×10^{-2}	6.8×10^{-9}
					Total Risk	6.8×10^{-9}

[a]These risks are in addition to risks associated with penetrating radiation from surface soils.
[b]Assumes the home is built on Pit 4, as described in the conceptual model.
[c]Assumes the home builder builds a house in 175 days for 8 hours per day.
[d]Results of Microshield calculations (Table E.3-6)
[e]The product of the total time exposed (hr/Life) and the doserate (mRem/hr)
[f]The product of the total exposure (mrem/Life) and the dose to risk conversion factor from the WPA (6.2 E-7 risk/mRem) (DOE, 1993a)

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