CH2MHILL

CH2M HILL
Mound, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, OH
45343-3030

ER-055/03
March 12 2003

Mr. Brian Nickel
Ohio EPA
401 E. Fifth Street
Dayton, Ohio 45402-2911

Mr. David Seely
U.S. EPA – Region 5 (SR-6J)
77 W. Jackson Boulevard
Chicago, Illinois 60604

Subject: Contract No. DE-AC24-03OH20152
PHASE I RISK REPORTS, FINAL

Dear Sirs:

Attached you will find the following documents being submitted to you:

- Phase I Residual Risk Evaluation, Final
- Phase I Ecological Scoping Report, Final

Authorization for distribution of the documents has been received from Mr. Rob Rothman, Miamisburg Closure Project, DOE.

If you have any questions, please call me at (937) 865-4543.

Sincerely,

Monte A. Williams
Deputy Project Manager, Environmental Restoration

MAW/KMA:jdg

Enclosure

cc: DCC

250401

CH2M HILL
Mound, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, OH
45343-3030

CH2MHILL

ER-054/03
March 12, 2003

Mr. Richard B. Provencher, Director
Miamisburg Closure Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45343-0066

ATTENTION: Robert S. Rothman

SUBJECT: Contract No. DE-AC24-03OH20152
PHASE I RISK REPORTS, FINAL

REFERENCE: Statement of Work Requirement 039 – PRS Documentation

Dear Mr. Provencher:

Rob Rothman from your office has approved the release of the following documents:

- Phase I Residual Risk Evaluation, Final
- Phase I Ecological Scoping Report, Final

Responses to public comments have been incorporated into the documents. If you or members of your staff have any questions regarding the documents, or if additional support is needed, please contact Dave Rakel at extension 4203.

Sincerely,

Monte A. Williams
Deputy Project Manager, Environmental Restoration

MAW/KMA:jdg

Enclosures

cc: David Seely, USEPA, (1) w/attachments
Brian Nickel, OEPA, (1) w/attachments
Ruth Vandegrift, ODH, (1) w/attachments
Paul Lucas, DOE/MCP, (1) w/attachments
Terrence Tracy, DOE/HQ, (1) w/attachments
Randy Tormey, DOE/OH, (1) w/attachments
J. D. Bonfiglio, MESH, (1) w/attachments
Monte Williams, CH2M HILL, (2) w/attachments
John Fulton, CH2M HILL, (1) w/o attachments
Gene Valett, CH2M HILL, (1) w/o attachments
Dave Rakel, CH2M HILL, (1) w/o attachments
Public Reading Room, (4) w/attachments
Admin Records, (2) w/attachments
DCC, (1) w/attachments

CH2MHILL

CH2M HILL
Mound, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, OH
45343-3030

ER-053/03
March 12, 2003

Mr. Robert S. Rothman
Miamisburg Closure Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45343-0066

SUBJECT: Contract No. DE-AC24-03OH20152
PHASE I RISK REPORTS, FINAL

REFERENCE: Statement of Work Requirement 039 - PRS Documents

Dear Mr. Rothman:

Please approve and authorize for release to USEPA, OEPA, and ODH the following documents:

- Phase I Residual Risk Evaluation, Final
- Phase I Ecological Scoping Report, Final

If you have any questions regarding the documents, please contact Dave Rakel at Extension 4203.

Sincerely,

Monte A. Williams
Deputy Project Manager, Environmental Restoration

MAW/KMA/jdg

Enclosures

Approved: _____ 3/12/03
Robert S. Rothman Date
CERCLA Program Manager

cc: Paul Lucas, DOE/MCP
DCC

BWX Technologies, Inc.
a McDermott company

BWXT of Ohio, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, Ohio 45343-3030
(937) 865-4020

ER-240/02
September 19, 2002

Mr. Richard B. Provencher, Director
Miamisburg Closure Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45343-0066

ATTENTION: Robert S. Rothman

SUBJECT: Contract No. DE-AC24-97OH20044
PHASE I RESIDUAL RISK EVALUATION. PUBLIC REVIEW DRAFT
PHASE I ECOLOGICAL SCOPING REPORT, PUBLIC REVIEW DRAFT

REFERENCE: Statement of Work Requirement C.7.1e - Regulator Reports

Dear Mr. Provencher:

Rob Rothman from your office has approved the release of the following documents to the regulators and the public for their review:

- **Phase I Residual Risk Evaluation, Public Review Draft**
- **Phase I Ecological Scoping Report, Public Review Draft**

The public review period will be from 25 September until 24 October 2002 and BWXTO will respond to any comments received and incorporate the responses into the final document.

The remaining CERCLA documents for Phase I are the Proposed Plan, Record of Decision, and Environmental Summary. The public review for the Proposed Plan is expected to begin in early October. The ROD and Environmental Summary will be issued in December.

If you or members of your staff have any questions regarding the document, or if additional support is needed, please contact Dave Rakel at extension 4203.

Sincerely,

Monte A. Williams
Project Manager, Environmental Restoration

MAW/DAR:jdg

Enclosures

cc: Tim Fischer, USEPA, (2) w/attachments
Brian Nickel, OEPA, (4) w/attachments
Ruth Vandegrift, ODH, (1) w/attachments
Paul Lucas, DOE/MCP, (1) w/attachments
Randy Tormey, DOE/OH, (1) w/attachments
Dann Bird, MMCIC, (3) w/attachments
J. D. Bonfiglio, MESH, (1) w/attachments
Craig Hansen, BWXT of Ohio, (1) w/attachments
Public Reading Room, (4) w/attachments
DCC

BWX Technologies, Inc.
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BWXT of Ohio, Inc.
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(937) 865-4020

ER-239/02
September 19, 2002

Mr. Robert S. Rothman
Miamisburg Closure Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45353-0066

MIAMISBURG
LOG F-01606
CODE 6442.1
09-19-02AU8:45 RCVD

SUBJECT: Contract No. DE-AC24-97OH20044
PHASE I RESIDUAL RISK EVALUATION, PUBLIC REVIEW DRAFT
PHASE I ECOLOGICAL SCOPING REPORT, PUBLIC REVIEW DRAFT

REFERENCE: Statement of Work Requirements C 7.1e - Regulator Reports

Dear Mr. Rothman:

Please approve and authorize for release to USEPA, OEPA, ODH, and the public the following documents:

- **Phase I Residual Risk Evaluation, Public Review Draft**
- **Phase I Ecological Scoping Report, Public Review Draft**

Also enclosed are responses to the regulators' comments on the Draft version of these documents. If you or members of your staff have any questions regarding the document, or if additional support is needed, please contact Dave Rakel at extension 4203.

Sincerely,

Monte A. Williams
Project Manager, Environmental Restoration

MAW/DAR:jdg

Enclosures

Approved: _____ 9/19/02
Robert S. Rothman Date
CERCLA Program Manager

cc: Paul Lucas, DOE/MCP
DCC

BWX Technologies, Inc.
a McDermott company

BWXT of Ohio, Inc.
1 Mound Road
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Miamisburg, Ohio 45343-3030
(937) 865-4020

ER-241/02
September 19, 2002

Mr. Brian Nickel
Ohio EPA
401 E. Fifth Street
Dayton, Ohio 45402-2911

Mr. Tim Fischer
U.S. EPA
SRF-5J
77 W. Jackson
Chicago, Illinois 60604

Subject: Contract No. DE-AC24-97OH20044
PHASE I RESIDUAL RISK EVALUATION, PUBLIC REVIEW DRAFT
PHASE I ECOLOGICAL SCOPING REPORT, PUBLIC REVIEW DRAFT

Dear Sirs:

Attached you will find the following documents being submitted to you as documentation of the beginning of Public Review:

- **Phase I Residual Risk Evaluation, Public Review Draft**
- **Phase I Ecological Scoping Report, Public Review Draft**

The Public Review period will be from 25 September until 24 October 2002 and BWXTO will respond to any comments received and incorporate the responses into the final document. Authorization for distribution of these documents has been received from Mr. Rob Rothman, Miamisburg Environmental Management Project, DOE.

Also enclosed are BWXTO's responses to regulator comments on the Draft version of these documents and a copy of the newspaper ad for public review.

If you have any questions, please call Dave Rakel at (937) 865-4203.

Sincerely,

Monte A. Williams
Project Manager, Environmental Restoration

MAW/DAR:jdg

Enclosure

cc: DCC

BWX Technologies, Inc.
a McDermott company

BWXT of Ohio, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, Ohio 45343-3030
(937) 865-4020

ER-175/02
July 2, 2002

Mr. Richard B. Provencher, Director
Miamisburg Environmental Management Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45343-0066

ATTENTION: Robert S. Rothman

SUBJECT: Contract No. DE-AC24-97OH20044
PHASE I RESIDUAL RISK EVALUATION - DRAFT

REFERENCE: Statement of Work Requirement C.7.1e - Regulator Reports

Dear Mr. Provencher:

Rob Rothman from your office has approved the release of the Draft Residual Risk Evaluation for Phase I to the regulators for review:

If you or members of your staff have any questions regarding the document, or if additional support is needed, please contact Dave Rakel at extension 4203.

Sincerely,

M. A. Williams
Project Manager, Environmental Restoration

MAW/DAR:jdg

Enclosure

cc: Tim Fischer, USEPA, (1) w/attachments
Brian Nickel, OEPA, (4) w/attachments
Ruth Vandegrift, ODH, (1) w/attachments
Paul Lucas, DOE/MEMP, (1) w/attachments
Sue Smiley, DOE/MEMP, (1) w/attachments
Randy Tormey, DOE/OH, (1) w/attachments
DCC, (2) w/ attachments

BWX Technologies, Inc.
a McDermott company

BWXT of Ohio, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, Ohio 45343
(937) 865-4020

ER-176/02
July 2, 2002

Mr. Brian Nickel
Ohio EPA
401 E. Fifth Street
Dayton, Ohio 45402-2911

Mr. Tim Fischer
U.S. EPA
SRF-5J
77 W. Jackson
Chicago, Illinois 60604

Subject: Contract No. DE-AC24-97OH20044
PHASE I RESIDUAL RISK EVLUATION - DRAFT

Dear Sirs:

Attached you will find the Draft Residual Risk Evaluation to Phase I for your review.

Authorization for distribution of the documents has been received from Mr. Rob Rothman, Miamisburg Environmental Management Project, DOE.

If you have any questions, please call Dave Rakel at (937) 865-4203.

Sincerely,

M. A. Williams
Project Manager, Environmental Restoration

MAW/DAR:jdg

Enclosure

cc: DCC

BWX Technologies, Inc.
a McDermott company

BWXT of Ohio, Inc.
1 Mound Road
P.O. Box 3030
Miamisburg, Ohio 45343
(937) 865-4020

ER-174/02
July 2, 2002

Mr. Robert S. Rothman
Miamisburg Environmental Management Project
U. S. Department of Energy
P. O. Box 66
Miamisburg, OH 45353-0066

SUBJECT: Contract No. DE-AC24-97OH20044
PHASE I RESIDUAL RISK EVALUATION - DRAFT

REFERENCE: Statement of Work Requirements C 7.1e - - Regulator Reports

Dear Mr. Rothman:

Please approve and authorize for release to USEPA, OEPA, and ODH the following document:

- Draft Residual Risk Evaluation for Phase I

If you or members of your staff have any questions regarding the document, or if additional support is needed, please contact Dave Rakel at extension 4203.

Sincerely,

M. A. Williams
Project Manager, Environmental Restoration

MAW/DAR:jdg

Enclosure

Approved: _____ July 2, 02
Robert S. Rothman Date
CERCLA Program Manager

cc: Paul Lucas, DOE/MEMP
DCC

QC Review Checklist

Document Title: Phase I Residual Risk Evaluation

Author/contributors: Rakel / Arthur / Serazin / Huntsman / E. Rothman

document prep. review (initial/date): RAR 6/28/2	
numbers in text consistent with tables	(yes) / no / na
summary information consistent with details	(yes) / no / na
units correct	(yes) / no / na
equations dimensionally correct	(yes) / no / na
calculations checked	(yes) / no / na
other:	yes / no / (na)

QC review (initial/date): 7/1/02	
cover and footer information match (title, revision, date)	(yes) / no / na
text section titles & page numbers match table of contents	(yes) / no / na
figure/table/appendix titles match table of contents	(yes) / no / na
acronyms defined in text	(yes) / no / na
acronym list complete and without extras	(yes) / no / na
references match text	(yes) / no / na
reference titles correct	(yes) / no / na
acceptable copy quality	(yes) / no / na
other/comments:	

Sr. Technical Review*	Karen: Formatted Produced Tables	Monte:
(sign/date):	Dave: 7/1/2	Paul/(Dick.) → Reviewed 6/27/2 Rob:

*ho ho check

17 June 02

PHASE I
RESIDUAL RISK EVALUATION
REGULATOR PREVIEW COPY
DRAFT, AUGUST 2002
OHIO EPA COMMENTS
SEPTEMBER 4, 2002

COMMENTS ON RESPONSE TO COMMENTS

1. Page vii, Executive Summary (**Original Comment 5**)- First paragraph, second sentence – Revise sentence to incorporate the bold text. The revised sentence should state "A residual risk evaluation (RRE) quantifies human health risks **and non-cancer health effects** associated with residual levels of contamination remaining within an area to ensure that **current** and future users of the land will not be exposed to contaminant levels that are unacceptable. In the **National Oil & Hazardous Substances Pollution Contingency Plan (NCP, EPA 1990), EPA defines the** acceptable **risk range as 10^{-4} to 10^{-6} with a departure at 10^{-6}, and a hazard index of one is defined as the acceptable threshold for non-cancer health effects."** An explanation of the meaning of the risk range and HI should be placed in this section as they are introduced (presently found in Section 2.4.3). Please spell out HI.

   COMMENT - The bold text was added as requested. The explanation of the risk range and hazard index was not incorporated as requested.

2. Page vii, Executive Summary **(Original Comment 7 now page viii, first full paragraph)** - Last paragraph - This paragraph is difficult to follow since the text discussion keeps switching between the current construction worker and current and future site employee (first sentence, for example). Revise this paragraph to discuss the risk and non-cancer hazard results for the construction worker separate from the site employee. Specifically, one paragraph will summarize the results for the construction worker (summarize risk estimates and non-cancer HI's for current use in a few sentences and then summarize the risk and HI results for the future scenario). A separate paragraph will discuss the risk and HI results (current scenario and then future scenario) for the site employee.

   COMMENT – The revised text is fine except the first sentence in the first full paragraph on page viii. Remove the reference to the future Site Employee. Add the sentence which can be found on page 35 in section 6.5 Conclusions which states "The future residual (or cumulative incremental) risk for the Site Employee is at the limit of the acceptable risk range."

PHASE I
RESIDUAL RISK EVALUATION
REGULATOR PREVIEW COPY
DRAFT, AUGUST 2002
OHIO EPA COMMENTS
SEPTEMBER 4, 2002

3. Page ix, Executive Summary **(Original Comment 9 now page viii)** – As discussed, the Overall Summary of Risks table will be removed. Move Tables 34-36 up to replace the removed table.

   COMMENT- The response indicated that the tables had been placed in the Executive Summary. The tables do not appear in this section. Please place the tables in the Executive Summary.

4. Page 5, Section 2.2 Environmental Media Considered and Data Availability **(Original Comment 24)** - Revise the last sentence of the first paragraph to include the bold text "Phase I does not contain surface water **bodies or sediment**"

   COMMENT – The response indicated that the text was changed, however the text reads "Phase I does not contain surface water in bodies of sediment." Please change to the above requested sentence.

5. Page 13, Section 3.3.2 Site Employee **(Original Comment 43 now page 14)** - Bullets - Dermal contact with surface soil is potentially complete considering that incidental ingestion may involve hand/mouth interaction. All complete pathways must be evaluated in the RRE or the exclusion justified within the text.

   COMMENT - The response included text that was said to have been added to the document. This section did not include the text indicated in the response. Please add to this section, the text included in the response to this comment.

6. Page 17, Section 3.5.2 Groundwater Exposure Pathways **(Original Comment 47 now on page 19)** – In the equation on this page, the units for the "Constituent Intake" should be mg/kg-day.

   COMMENT - The change was made as requested. There are two other equations in this section that should have the "d" spelled out to "day". Please change if possible.

7. Page 29, Section 5.2.3 Overall Summary of Risk Results **(New Comment)** – Last Paragraph – Change the second sentence to "The cumulative incremental future risk for the Site Employee (1.1×10^{-4}) is at the limit of the acceptable risk range (10^{-4} to 10^{-6})."

8. Page 35 Section 6.5 Conclusions **(New Comment)** – Add the conclusions for the non-cancer results. If this section is discussing incremental risk, please indicate.

9. Ground Water Exposure Appendix **(New Comment)** – Update table B-2 to include the new wells added to the flow model resulting from the MCL exceedance effort.

10. Tables Appendix **(New Comment)** – The guideline values for strontium 90 for the construction worker and site employee in ground water differ from Ohio EPA calculated values. The values are first presented on Tables 6 and 8. It appears that the difference is in assuming risk from daughters. Given the minimal impact on the risk, this reconciliation can be completed outside of the revision of this document.

11. Tables Appendix **(New Comment)** – Tables 10 and 12- As was done on Tables 6 and 8, the MCL values should be used to screen against nitrate, nitrite and nitrate/nitrite concentrations.

12. Appendix C **(Original Comment 95)** – Table 14 – Add ground water exposure assumptions and all dermal exposure assumptions to this table.

    COMMENT – The ground water assumptions were added as requested. Please add all dermal assumptions as discussed in the comment resolution meeting.

13. Appendix C **(New Comment)** – Table 15 – Replace radium 228 long lived decay values with thorium 232 long lived decay values in the soil radionulcide section.

14. Appendix C **(Original Comment 101)** – All applicable risk tables – On the last column, the heading is Total Non-C Hazard. Please spell out cancer.

    COMMENT - The response indicates that the change was made as requested. Tables 16, 17 18, 20, etc. still has the column heading of "Total Non-C Hazard".

15. Appendix C **(Original Comment 102)** – Table 19 – Add the word "Soil" to the heading of this table.

    COMMENT - The response indicates that the change was made as requested. The table is missing the word soil in the heading.

16. Appendix C **(Original Comment 105)**– Table 34 -36 - These tables should be presented in main portion of text.

    COMMENT – The response indicates that the tables are included in the Executive Summary. The tables are not presented in the Executive Summary. Please include the tables after the Executive Summary text.

17. Appendix C **(New Comment)** – Table 19 – The "*Toxicity criteria used to calculate risk include radionuclide daughters" statement should footnote the long lived decay radionuclides. Please include this statement on tables 16-33 and footnote the appropriate radionuclides.

18. Appendix F **(Original Comment 111)** – Page 8 0f 10 – Third paragraph from the bottom, first sentence discusses three locations in the Phase I. The second sentence indicates five locations summarized below. Please reconcile.

    COMMENT – The response indicated that this had been corrected. The original text noting five locations remains in this version. Please correct as indicated in the original response to comments.

19. Appendix H **(Original Comment 115)** - The text of this section dealing with secular equilibrium needs to be revised. We are presently working on some suggestions, but request a group discuss to finalize the wording.

    COMMENT – The recommended text had been incorporated, however, there were indicators within the text pointing out numbers that may change and areas where equations need to be inserted. Please remove those indicators and place the correct or requested information in place of the indicator.

20. Appendix J **(New Comment)** - Please spell check this section.

OhioEPA

State of Ohio Environmental Protection Agency

Southwest District Office

401 East Fifth Street
Dayton, Ohio 45402-2911

TELE: (937) 285-6357 FAX: (937) 285-6249

Bob Taft, Governor
Maureen O'Connor, Lt. Governor
Christopher Jones, Director

July 31, 2002

Mr. Rob Rothman
U.S. DOE MEMP
P.O. Box 66
1 Mound Road
Miamisburg, Ohio 45343-0066

Comments on the Phase I Residual Risk Evaluation

Dear Mr. Rothman:

The Ohio Environmental Protection Agency has completed our review of the Phase I Residual Risk Evaluation, Draft, July 2002. Please refer to the attached comments on the document. These comments were also forwarded via email on July 31, 2002.

I would like to thank John Lyons and Dave Rakel for all their work in preparing the data for the risk evaluation. Their efforts have improved the quality of the report and reduced the amount of time and effort spent on the review. This in turn, provides the public with a higher quality document. Dave has been extremely responsive to our questions and is a pleasure to work with.

Should there be any questions concerning the above, please feel free to contact Jane O'Dell (937) 285-6066, Laurie Eggert (937) 285-6457 or me at (937) 285-6468.

Sincerely,

Mr. Brian Nickel
OEPA/Mound Project Manager
Office of Federal Facilities Oversight

cc: Tim Fischer, USEPA Region V
Monte Williams, BWXTO
Dave Rakel, BWXTO

PHASE I
RESIDUAL RISK EVALUATION
DRAFT, JULY 2000
OHIO EPA COMMENTS
JULY 31, 2002

GENERAL COMMENTS

1. A summary of the information and action associated with the review of the soil data in Phase I exceeding three times the 10^{-5} risk based guideline value plus any background value needs to be incorporated within this document.

2. As discussed, the sources for toxicity criteria used to calculate RBGV and risk should remain consistent with the hierarchy and sources listed in the RREM. The updated RBGVs include toxicity sources other than those listed in the RREM (IRIS, HEAST and NCEA). Please revised the RBGVs and calculated risk using only the values from the toxicity criteria sources listed in the RREM. Toxicity criteria for 1,1,1 –Trichloroethene and Trichloroethylene provided directly by NCEA should replace any NCEA value obtained through another source.

3. While reviewing the data CD, there are some records for inorganics in ground water that are lab qualified as a "B" meaning the reported value is greater than the instrument detection limit but less than the contract required detection limit. There are also data qualifiers associated with some of this data flagged with a "U" meaning undetected. Half the detection limit was used to calculate the EPC. The U data qualifier is questionable. Further discussion is needed on this data.

4. Create a new sub-section in section 4.0 Toxicity Assessment to qualitatively discuss adverse effects associated with any COPC that does not have a slope factor or reference dose listed on Table 15.

SPECIFIC COMMENTS

5. Page vii, Executive Summary- First paragraph, second sentence – Revise sentence to incorporate the bold text. The revised sentence should state "A residual risk evaluation (RRE) quantifies human health risks **and non-cancer health effects** associated with residual levels of contamination remaining within an area to ensure that **current** and future users of the land will not be exposed to contaminant levels that are unacceptable. In the **National Oil & Hazardous Substances Pollution Contingency Plan (NCP, EPA 1990), EPA defines the** acceptable **risk range as 10^{-4} to 10^{-6} with a departure at 10^{-6}, and a hazard index of one is defined as the acceptable threshold for non-cancer health effects."** An explanation of the meaning of the risk range and HI should be placed in this section as they are introduced (presently found in Section 2.4.3). Please spell out HI.

6. Page vii, Executive Summary - Third paragraph - Add the bold text to last sentence of the paragraph therefore the sentence should read "Overall, cancer and non-cancer risks associated with exposure to soil and air **in both the current and future use scenarios** fall within the acceptable risk range....."

7. Page vii, Executive Summary - Last paragraph - This paragraph is difficult to follow since the text discussion keeps switching between the current construction worker and current and future site employee (first sentence, for example). Revise this paragraph to discuss the risk and non-cancer hazard results for the construction worker separate from the site employee. Specifically, one paragraph will summarize the results for the construction worker (summarize risk estimates and non-cancer HI's for current use in a few sentences and then summarize the risk and HI results for the future scenario). A separate paragraph will discuss the risk and HI results (current scenario and then future scenario) for the site employee.

8. Page viii, Executive Summary - Last paragraph - Remove the first three full sentences in this paragraph (i.e. The groundwater model does not take into account.....). Revise the paragraph, beginning with the first partial sentence at the top of the page, to state "groundwater and are **most likely** due to the conservative assumptions used in the **flow tube model to assess future groundwater.** These assumptions are likely to result in an overestimation of **future** groundwater risk. Details of the uncertainties associated with the assessment of future exposure to groundwater are provided in Section 6.0, Uncertainties. Given the conservative nature of the RRE and the associated uncertainties, the risks presented in the table below represent the upper-bound plausible limit of risks (worst case scenario) **for Phase I**. Remove the last sentence of this paragraph (i.e. based on the protective measures presented in the Proposed Plan.....). Risk Management decisions should be made in the Rod and Proposed Plan.

9. Page ix, Executive Summary – As discussed, the Overall Summary of Risks table will be removed. Move Tables 34-36 up to replace the removed table.

10. Page 1, Section 1.0 Introduction - Second paragraph - Revise last sentence to include bold text "In this report residual risk at Phase I is evaluated for **both current and future** commercial/industrial use of the parcel."

11. Page 1, Section 1.0 Introduction - Last paragraph - Revise the second to last sentence to include bold text "A Residual risk evaluation assesses human health risks associated with residual levels of contamination remaining within an area to ensure that future users of the land will not be exposed to contaminant levels that would pose unacceptable risks **and/or adverse health effects.**

12. Page 1, Section 1.0 Introduction - Last paragraph - Revise the last sentence to include bold text "The Phase I RRE results will be used **by risk managers**, together with Applicable....."

13. Page 2, Section 1.1 Purpose of Residual Risk Evaluation - Revise the first sentence to include bold text "The **purpose** of the Phase I RRE .....remaining after all necessary **remedial** actions within Phase I have been taken.

14. Page 2, Section 1.2, Scope of Phase I RRE - First paragraph - Revise third sentence to include bold text "Residual contaminants in Phase I were evaluated for two potential receptor groups: construction workers.....and **air for an exposure duration of** 5 years, and site employees.....**for an exposure duration of** 25 years."

15. Page 2, Section 1.2, Scope of Phase I RRE - First paragraph - Replace the second to the last sentence of this paragraph with "The assumptions used in this evaluation are presented in Table 14.

16. Page 2, Section 1.2, Scope of Phase I RRE - First paragraph - Move the last sentence of this paragraph to the beginning of the paragraph after the second sentence, which defines RME.

17. Page 2, Section 1.2 Scope of the Phase I RRE – Second to last sentence – Identify the "EPA" mentioned as USEPA. Please complete this consistency throughout the document.

18. Page 2, Section 1.2 Scope of the Phase I RRE – Last sentence on page – Change the term "Incremental risk can" to "Incremental risk is".

19. Page 3, Section 2.0 Data Compilation and Evaluation - Change the fourth sentence to state **"All available information and results were reviewed to ensure that only analytical data of the highest quality and confidence were used in the quantitative portion of the risk assessment. Data determined to be of insufficient quality for use in the risk assessment were removed from the data set and segregated based on the following criteria. "**

20. Page 4, Section 2.0 Data Compilation and Evaluation - Paragraph at top of page - Remove the last sentence (i.e. The measurements of antimony.....) and replace with "Historical data that is no longer representative of current conditions, based on trends of subsequent analytical results, were segregated from the data set."

21. Page 4, Section 2.0 Data Compilation and Evaluation - Remove the last sentence of this section and replace with the following **"Analytical results not segregated were determined to be of sufficient quality for use in the risk assessment. This data was the basis for the risk calculations and can be found on the attached CD-Rom. Data that was segregated (based on the criteria discussed above) and was not used in the risk calculations can also be found on the CD-Rom."**

22. Page 4, Section 2.1 Data Quality Assessment - Add the following to the end of the last sentence of this section ".....were separated from the data set **and not used in the risk calculations**.

23. Page 4, Section 2.2 Environmental Media Considered and Data Availability – Add explosives to the list of analyses.

24. Page 5, Section 2.2 Environmental Media Considered and Data Availability - Revise the last sentence of the first paragraph to include the bold text "Phase I does not contain surface water **bodies or sediment**"

25. Page 6, Section 2.32 Data Analysis - Revise the first sentence to state **"If the data follows a lognormal distribution, the data must first be transformed using the natural log function. The 95% UCL is then calculated using the H-Statistic.** The 95% UCL equation of the arithmetic mean **for lognormal distributions** was calculated as follows:"

26. Page 5, Section 2.3 Data Analysis – In the 95% UCL equation, the t statistic table is in Reference 9, not Reference 4 as indicated in the text. Please correct.

27. Page 6, Section 2.32 Data Analysis - Equation - If it is possible in the word processing software used to generate this report, please use the superscript function instead of the "^" in any equations presented in this report.

28. Page 6, Section 2.32 Data Analysis - Add the following to the text after the presentation of the 95% UCL equation for lognormal distribution, **"The 95% UCL for data sets in which the distribution is not normal or lognormal, was determined by assuming a lognormal distribution. EPA guidance states that most environmental data sets are log normally distributed, rather than normally distributed, therefore it is reasonable to assume a lognormal distribution (EPA, 1992 = Reference 10).**

29. Page 6, Section 2.3 Data Analysis – The 95% UCL equation is incomplete. Add after "e = constant", "(base of the natural log)" and add "mean = mean of the transformed data".

30. Page 6, Section 2.3 Data Analysis – Last sentence – Appendix F is referenced as the source for data and lab qualifiers. The qualifiers are missing from this document. Please add them as an appendix.

31. Page 6, Section 2.4 Data Screening Process - Revise the title of this section to "**Screening Process for the Selection of Contaminants of Potential Concern.**" This title is clearer and does not confuse the reader with the data quality screening that was discussed in previous sections of this report.

32. Page 6, Section 2.4 Data Screening Process - Second paragraph - Revise first sentence to include bold "To make the COPC selection**....separate tables are provided for each receptor and the respective exposure scenario** (i.e. Current and Future Construction Worker vs. Current and Future Site Employee).

33. Page 7, Section 2.4 Data Screening Process - Second full sentence on the page – Change the sentence to read "The second table identifies final COPCs to be carried through the RRE by comparing the EPCs for the COPCS carried through from the first screening table to background values.

34. Page 7, Section 2.4.2, Screening Constituents Based on Background - First sentence - Electronically paste the tables summarizing the background levels as an appendix in this RRE Report.

35. Page 8, Section 2.4.2 Screening Constituents Based on Background – First sentence in the first full paragraph – Remove the word "initial" from in front of COPCs and replace with ..."COPCs carried through from the first screening table, the 95% UCL ..."

36. Page 8, Section 2.4.3 Screening Constituents Based on Guideline Values - Move the last paragraph of this section (begins on page 9 "A Hazard Quotient....") before the preceding paragraph (begins on page 8 "Some of the radionuclides....").

37. Page 10, Section 3.1 Characterization of Exposure Setting - This section must include a brief and general overview summarizing the "atmosphere" or "setting" of Phase I for current/future industrial use. This is necessary information which "sets the stage" for the reader to get a feel for the site and potential exposure pathways. For example, information presented in the first four paragraphs of Appendix F Building Information can be summarized to address this comment.

38. Page 11, Section 3.3 Identifying Exposure Scenarios - Include the rationale for evaluating only two receptors (construction worker and site employee) in the text. Also state that the future use of the site is restricted to industrial use.

39. Page 12, Section 3.3.1 Construction Worker Scenario - Top of page. Reference 14 is incorrect and should be revised to Reference 16, if appropriate.

40. Section 3.3.1 Construction Worker Scenario, page 12: First paragraph. The sentence that states "*The exclusion of this pathway is expected to have a minimal impact on the final risk based calculations.*" is confusing and implies that exposure via the dermal pathway was not quantified in this RRE. Please clarify text stating that exposure via the dermal pathway was assessed since results for the dermal route are presented in this report.

41. Page 12, Section 3.3.1 Construction Worker Scenario – Add to the exposure pathways the following " dermal contact with contaminated soil".

42. Page 12, Section 3.3.1 Construction Worker Scenario - Bullets - If perched groundwater is present in Phase I, then the construction worker receptor could potentially be exposed to groundwater during activities such as excavation, utility repair/installation, remediation. Therefore, dermal contact, inhalation and incidental ingestion of groundwater could occur. Provide rationale supporting those exposure pathways that are not complete.

43. Page 13, Section 3.3.2 Site Employee - Bullets - Dermal contact with surface soil is potentially complete considering that incidental ingestion may involve hand/mouth interaction. All complete pathways must be evaluated in the RRE or the exclusion justified within the text.

44. Page 13, Section 3.4 Exposure Point Concentration - This section is repetitive with the discussion on page 5. Consider combining these sections into one.

45. Page 14, Section 3.5.1 Soil Exposure Pathways –Add to this section the equation for calculating absorbed dose from dermal exposure to soil (Pg. 38 RREM). Discuss application of this pathway.

46. Page 17, Section 3.5.2 Groundwater Exposure Pathways – Add to this section the equation for calculating intake from ingestion of radionuclides in groundwater (Pg. 39 RREM).

47. Page 17, Section 3.5.2 Groundwater Exposure Pathways – In the equation on this page, the units for the "Constituent Intake" should be mg/kg-day.

48. Page 18, Section 3.5.2 Groundwater Exposure Pathways – In the first equation on this page, please remove the extra line under the denominator of the equation.

49. Page 20, Section 4.0 Toxicity Assessment – First paragraph, last sentence – Add "air" to the list of exposures summed in the tables.

50. Page 20, Section 4.0 Toxicity Assessment – In the last sentence please spell out RfDs.

51. Page 25, Section 5.2.1 Construction Worker Risk Results – Please list the Hazard Index values for soil.

52. Page 25, Section 5.2.1 Construction Worker Risk Results - First Paragraph, second to the last sentence – Change the reference to radium from 226 to radium-228.

53. Page 25, Section 5.2.1 Construction Worker Risk Results – Current Groundwater – List the background residual risks and hazard as was done in the soil and future groundwater sections.

54. Page 25, Section 5.2.1 Construction Worker Risk Results – Future Groundwater, second to the last sentence – This sentence will change due to the recalculation of the dermal pathway for tritium (see comment on Appendix C, Table 28).

55. Page 26, Section 5.2.2 Site Employee Risk Results – Soil – List the values for total, incremental and background Hazard Index.

56. Page 26, Section 5.2.2 Site Employee Risk Results – Soil, fourth sentence – Change the reference from plutonium as a basis for the background risk to arsenic.

57. Page 27, Overall Summary of Risk Results – First sentence - If the summary table in the Executive Summary is removed as discussed, please change this sentence to reflect the action.

58. Page 27, Section 6.0 Uncertainties - Uncertainties associated with the methods used to assess future groundwater exposure should be discussed here. Also, include a discussion regarding why the flow tube model was designed utilizing conservative assumptions (potential data gaps and limited characterization).

59. Page 29, Section 6.2 Uncertainty in Exposure Assessment - Last paragraph, third sentence – Please change the sentence to read "Chromium VI is highly reactive and as a result has a very short holding time." Chromium VI is not difficult to measure, as long as it is present.

60. Page 29, Section 6.2 Uncertainty in Exposure Assessment – Last paragraph, fourth sentence – The text references 2228 measurements of chromium contributing to this risk, four with results of 0.01 mg/l and an EPC of 960 mg/l. The Tables in Appendix I sum to 180 measurements with four for chromium VI, all at a detection level of 0.02 mg/l. The EPC, according to Table 30 for chromium is 0.958 mg/l. Please reconcile.

61. Page 31, Section 6.3 Uncertainty Related to Toxicity Information – Last paragraph, second sentence – Please provide the reader with a brief explanation of the classification (class A, B, C) in terms of weight of evidence.

62. Appendix A: Should state that trends in air COPCs have not increased since this evaluation was conducted, therefore estimates are representative of current/future exposure.

63. Appendix B – Please update the information in the example used, Antimony. According to the tables in Appendix I, there are 158 analyses for antimony.

64. Appendix B – Table B-1 – As discussed, the values in Table B-1 are incorrect. Please provide the correct future groundwater modeled results.

65. Appendix C - Tables 2-15 - These tables should be in the main portion of the report. This information is key to the risk assessment process and will likely "get lost" and not reviewed by reader if presented in appendix.

66. Appendix C – Table 1 lists PRS 274/275 as a source for the data. Please indicate that this in one borehole(B103) on the edge of the PRS.

67. Appendix C – All initial screening tables – For analytes screened out due to the human nutrient option, change the "Yes" in the COPC column to "No:4" with a corresponding footnote description.

68. Appendix C – All screening tables – Indicate in the footnote for RBGV that the level corresponds to a 10^{-6} risk level or 0.1 hazard index.

69. Appendix C – All soil and groundwater final screening tables – For the analytes affected by the "secular equilibrium" agreement, please place "Yes:1" (if applicable) in the daughter's COPC column. The Yes:1 footnote should indicate that the risk from this analyte is incorporated into the long-lived decay parent radionuclide's risk calculation. The reader should be referred to Appendix H for an explanation. Please place, in the parent's COPC column, "Yes:2 or 3 or n" (if applicable). The associated footnotes should indicate that this analyte is the parent of those daughters screened through on the final screening table. For example, Th232 on Table 3 would have a footnote indicating that this is the parent of Ac228, Ra224, Ra228 and Th208 among other anayltes and to see Appendix H for a complete list.

70. Appendix C – Tables 4 and 5 –As discussed, the data pulled for the site employee soil risk assumed all units were in feet. Some soil units in the data were in inches. This created a slightly different data set than what should have been used. I understand that this problem will be corrected in the rerun of the RRE.

71. Appendix C – Table 4 and 5 – Lead 210+D and Lead 210 long lived decay have different frequency of detects than Lead 210. Please correct.

72. Appendix C – Tables 6, 8, 10, 12 and future ground water risk calculations - IRIS provides RfDo values for nitrate and nitrite. A hazard index (RBGV) should be calculated for these analytes and listed on the screening tables. The more conservative of the nitrate or nitrite RfDo should be used to calculate a hazard index (RBGV) for the combined nitrate/nitrite. These RfDo values should be used to calculate risk using the EPCs for nitrate, nitrite and nitrate/nitrite.

73. Appendix C – All ground water tables – Change the footnote description on "No:3" to read "screened out based on comparison of the lower of RBGV or MCL"

74. Appendix C - Tables 6, 8, 10 and 12– Add the value 0.005, footnoted as a "c" in the RBGV column for cadmium.

75. Appendix C – Table 6 – Change the footnote from "c" to "b" on the RBGV for chromium VI.

76. Appendix C – Table 6 – Add the RBGV value of 0.479 footnoted as "b" to manganese.

77. Appendix C – Table 6 and 8 – When checking the frequency of detect column compared to the data on the provided CD, I consistently found fewer number of analyses for the inorganics in ground water. The numbers do not vary much, but please double check the number of analyses in the current ground water (production wells) data.

78. Appendix C – Table 6 - Please duplicate Ra226 background concentration in the Ra226+d and Ra226 LLD rows.

79. Appendix C - All initial ground water screening tables – The RBGVs for ground water radionuclides were incorrectly calculated using the soil ingestion slope factor instead of the water ingestion slope factor. Please rerun the RBGV and incorporate the correct RBGVs into the RRE.

80. Appendix C – Table 7 and 22 – The EPC should be the lower of the maximum detect or 95% UCL (if applicable). Please rerun the tables and show the correct EPCs. Remove the calculated 95% UCL from the analytes with fewer than 20 samples (1,2-Dichlorothene).

81. Appendix C – Table 8 – Add the value 0.48 footnoted as "b" to the RBGV column for manganese.

82. Appendix C – Table 8 – Add the value 0.314 to the Background Concentration column for thorium 232 LLD.

83. Appendix C – Table 8 – Once radionuclide ground water RBGV are recalculated, ensure Ra226+D and Ra226 LLD has a value in the RBGV column.

84. Appendix C – Table 9 – Add the value 1485 to the Background Concentration column for tritium.

85. Appendix C - Table 10 - As indicated, while comparing the Frequency of Detect column to the data CD, I had difficulty in matching the number of analyses for zinc and vanadium. I found 151 analyses for vanadium and 153 for zinc. Please look into this discrepancy. This may affect more than the two analytes listed.

86. Appendix C - Table 10 - Add the value 0.139 to the Background Concentration column for americium 241 and 0.975 to the Background Concentration column for strontium 90.

87. Appendix C – Table 10 – The * footnote indicates that cis-1,2 – Dichloroethene values were used for screening values of 1,2 – Dichloroethene. Please be consistent in the use of these values between current and future ground water screening tables.

88. Appendix C – Table 11 – Add units to this table.

89. Appendix C – Table 11 – Add to this table, the current ground water COPCs 1,2 – Dichloroethene and Tert-butyl methyl ether.

90. Appendix C – Table 11 and 13– Add the current concentration contribution for cadmium to the future concentration for both receptors. Tables 28 and 31 are also affected for cadmium.

91. Appendix C – Table 11 and 13 – Add the value 0.975 to the Background Concentration columns for strontium 90.

92. Appendix C – Table 11 and 13 – According to the table provided by SAIC, the future modeled screening concentration for tritium is 66797.9 not the 73198.957 listed in those columns on both tables. The erroneous EPCs appears on Tables 28 and 31.

93. Appendix C – Table 12 - Add the value 0.480 to the RBGV column for manganese.

94. Appendix C – Table 12 - Add the value 0.700 footnoted as "c" to the RBGV column for 1,2 cis-Dichloroethene.

95. Appendix C – Table 14 – Add ground water exposure assumptions and all dermal exposure assumptions to this table.

96. Appendix C – Table 14 – Do not round the averaging time values (carcinogen or noncarcinogen). The carcinogen averaging time should be 25,550 days or 70 years, not 26,000 days or 71.2 years.

97. Appendix C – Table 15 – Provide source information for all columns/rows. For example, indicate the Dermal Absorption Factors are defaults from guidance.

98. Appendix C – Table 15 – Remove the adjusted Oral CSF values for the all non-applicable radionuclides.

99. Appendix C – Table 15 – Given the secular equilibrium parent comment, thorium 232 toxicity criteria will need to be added to this table and perhaps other analytes.

100. Appendix C – Table 15 – Add a footnote to identify those analytes that do not have toxicity criteria.

101. Appendix C – All applicable risk tables – On the last column, the heading is Total Non-C Hazard. Please spell out cancer.

102. Appendix C – Table 19 – Add the word "Soil" to the heading of this table.

103. Appendix C – Table 28 – The risk calculated for the dermal pathway for tritium is incorrect. Please recalculate using the correct conversion factor.

104. Appendix C – Table 29 – The total column for cancer, dermal and inhalation needs to be filled in with the tritium values.

105. Appendix C – Table 34 -36 - These tables should be presented in main portion of text.

106. Appendix C – Table 34 – To remain consistent with terminology, add the word "oral" to the row in the pathway column indicating "ingestion" pathway.

107. Appendix C – Table 34 – Change the last column to read "Total Cancer Risk" Remove the ELCR footnote from all summary tables.

108. Appendix C – All summary tables – Increase the width of the pathway column so that the word "showering" is not "showerin".

109. Appendix C – Table 35 – The "Cumulative Background Future Risk" total column is incorrect and only has the Future Groundwater Total Risk value listed. Please correct.

110. Appendix D – Figure 3 – The Conceptual Site Model should be presented in the main text of the report.

111. Appendix F – Page 8 0f 10 – Third paragraph from the bottom, first sentence discusses three locations in the Phase I. The second sentence indicates five locations summarized below. Please reconcile.

112. Appendix F – Page 8 0f 10 – Third paragraph from the bottom, first sentence discusses three locations in the Phase I. The second sentence indicates five locations summarized below. Please reconcile.

113. Appendix G – Page 3 of 4 – Add PRS 352 and a brief summary.

114. Appendix G – Page 4 of 4 – In the PRS 406 summary, first sentence, a number is referenced (283). What is this number?

115. Appendix H - The text of this section dealing with secular equilibrium needs to be revised. We are presently working on some suggestions, but request a group discuss to finalize the wording.

116. Appendix H - Ground water data and text will need to be incorporated in this section.

117. Appendix H – Add the "Super Daughter Table" found in the June 7, 2002 draft of the RBGV Update. This table will illustrate the summing of the slope factors for the radionuclides assumed to be in secular equilibrium. Note HEAST as the source on the table.

From: <Fischer.Timothy@epamail.epa.gov>
To: <rakeda@doe-md.gov>
Date: 7/25/02 3:04PM
Subject: Comments on the RRE for Phase I

Dave,

Here are my comments on the Phase I RRE..... Overall, I think the document was extremely well written and does a great job of explaining the process for conducting the RRE and the uncertainties associated with it. Also, as a general comment, I think we have all agreed that an explanation for the "elevated historical sampling locations" should be included somewhere in the report.

(1) Page vii of ix - Put all of the risk number in the next to last line on the same line of text.

(2) Page viii of ix - Please delete the last sentence of the Executive Summary. Although it is true that we will manage the risks presented in this RRE, that should be left to the Proposed Plan and ROD. The RRE should just present the results of the risk calculation and show how the results relate to the acceptable risks levels identified in CERCLA.

(3) Page 1 of 33 - Place all of "Phase I" in the third line of the last paragraph on this page on the same line of text.

(4) Page 3 of 33 - Please insert the phrase "from the site during remedial action" between "removed" and "were segregated" in the 3rd from last line on this page.

(5) Page 4 of 33 - Change "purpose" to "purposes" in the 7th line on the page.

(6) Page 9 of 33 - Should "GVs" in the 1st line of the page be in parentheses or deleted?? Or should "estimates" be deleted?

(7) Page 15 of 33 - Change "was" to "were" in the sentence that begins "Radionuclide intake estimates....."

(8) Page 15 of 33 - Change "were" to "was" in the 5th line of the first full paragraph.

(9) Page 25 of 33 - I think it would be appropriate to describe how much of the HI of 4.7 for future groundwater for the construction worker is due to chromium, as is done on page 26 for the site employee. Because the assumption that all of the chromium is hexavalent chromium is a very conservative assumption, this helps to show that the HI of 4.7 would be a very conservative estimate of the possibility for noncancer effects.

(10) Page 26 of 33 - Add the word "of" between "Both" and "these" in the 5th line of the last paragraph on this page.

(11) Page 27 of 33 - In the second paragraph of Section 5.2.3, combine the two middle sentences together, so the text will read... "The cumulative future risk for the site employee is also acceptable, but the

cumulative future non-cancer hazard for the site employee exceeds the acceptable level."

(12) In Tables 2 through 13, check the numbered notes in the "COPC" column which explain why a potential COPC was screened out. In many cases, it appears that either the 2s and 3s are reversed, or the note at the end of table is reversed.

(13) Table 5 - Lithium is included in this table even though it was already screened out in Table 4.

(14) Table 7 - The EPC for TCE should be .002, EPC for U-235 should be 0.466, EPC for U-238 should be 0.409. Also, as we have discussed in other emails.... we need to be consistent between Tables 7 and 9 in how we determine the EPC for COPCs with less than 20 detects (Cadmium, Copper, Lead, Tert-Butyl methyl ether, Th-230, U-234).

(15) Table 33 - This table is included in the report twice with a different number for total risk in each table.

(16) Appendix F - Building Information - Page 1 of 10 - The text in the first line of the 5th paragraph refers to a Figure 5. I was not able to locate this figure in the document. I think a map showing the building locations should be included however.

(17) Appendix G - PRS Information - Page 3 of 4 - There is a typo in PRS 369, referring to PRS 469.

(18) Appendix G - PRS Information - Page 3 of 4 - Add space after the end of first sentence in PRS 371.

(19) Appendix G - PRS Information - Page 4 of 4 - Add more information on PRS 421. At least there should be some description of the fact that sampling was conducted and a removal action occurred.

Those are all of my comments on the document... I look forward to discussing the issue of the NCEA numbers with you in detail in the near future.

If you have any questions, just give me a call!!
Tim

CC: <Brian.Nickel@epa.state.oh.us>, <jane.odell@epa.state.oh.us>, <willma@doe-md.gov>, <Robert.rothman@ohio.doe.gov>

Phase I

Residual Risk Evaluation

Final

March 2003

Miamisburg Closure Project

Phase I

Residual Risk Evaluation

Final

March 2003

Miamisburg Closure Project

The Mound Core Team
P.O. Box 66
Miamisburg, Ohio 45343-0066

Mr. Daniel Bird, AICP
Planning Manager
Miamisburg Mound Community Improvement Corporation
720 Mound Road
COS Bldg. 4221
Miamisburg, Ohio 45342-6714

Dear Mr. Bird:

The Core Team, consisting of the U.S. Department of Energy Miamisburg Environmental Management Project (DOE-MEMP), U.S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), appreciates your comments on the Phase I Residual Risk Evaluation, Phase I Ecological Scoping Report, and the Phase I Proposed Plan. Attached are our responses.

Should the responses to comments require additional detail, please contact Rob Rothman at (937) 865-3823 and we will gladly arrange a meeting or telephone conference.

Sincerely,

DOE/MEMP: 12-11-02
Robert S. Rothman, Remedial Project Manager

USEPA 2/7/03
Timothy J. Fischer, Remedial Project Manager

OEPA 12/11/02
Brian K. Nickel, Project Manager

Comment 1. MMCIC acknowledges that the residual risks calculated in the Residual Risk Evaluation (RRE) for an hypothetical construction worker and site worker in Release Phase 1 exceed the acceptable risk thresholds or ranges for some exposure media, exposure pathways, and/or routes of exposure, given the assumptions incorporated into the Mound 2000 Residual Risk Evaluation Methodology (DOE, January 1997). These exceedances include the incremental and total non-carcinogenic hazards for the future construction worker and future site employee, which exceed a Hazard Index of one due to potential exposure to groundwater. In addition, the total lifetime cancer risk for the future site employee scenario (1.2×10^{-4}) exceeds the acceptable risk range (10^{-4} to 10^{-6}). These risk exceedances are driven by the exposure to groundwater risk calculation.

MMCIC understands that the conservative assumptions incorporated into Mound's groundwater risk model will overestimate risk. These assumptions (that natural attenuation physical and chemical processes are not included in the calculation of the input groundwater concentration term, the use of the maximum detected value (from as much as seventeen years' worth of data), and the assumption that certain contaminants (such as chromium) are present in only their most toxic form) are intended to be conservative and were all accepted and commented upon during the public review period of the *Residual Risk Evaluation Methodology*. With this in mind, MMCIC understands that the actual groundwater risks are likely to be lower and accepts that the proposed action for Phase 1, namely institutional controls that will bar the use of groundwater at the Mound facility and continued groundwater modeling for Trichloroethylene (TCE) in the area of Well 0411, will be protective of human health and the environment under an industrial/commercial exposure scenario.

Response 1. Thank you for your comment and support.

Comment 2. MMCIC concurs with the conclusion of the Ecological Scoping Report, that based on the completion of the Ecological Scoping Checklist (Ohio EPA, April 2001 Procedure), the fact that no threatened or endangered species were observed in Phase 1 and that no sensitive environments or ecologically important resources were identified within Phase 1, and the review of numerous investigation reports performed in the Phase 1 area, a more detailed assessment of the ecological risk is not warranted.

Response 2. Thank you for the comment and concurrence.

Comment 3. MMCIC recommends that the Proposed Plan more clearly state for the public reader the reasons why TCE groundwater monitoring in the vicinity of Well 0411 is incorporated into the preferred remedial alternative for Phase 1, whereas the monitoring of barium, nickel and chromium *will* be performed on an ongoing basis in Phase 1, but is not included as part of the preferred alternative. Please clarify the process of identifying TCE as a *contaminant of concern* for the Phase 1 area, while barium, nickel, and chromium are identified, in this instance, as *constituents of interest*. MMCIC believes this issue could create confusion for the public reader.

Response 3. This ROD is, in effect, the final version of the Proposed Plan. The "Comparison of Groundwater Contaminants to MCLs" section of this ROD was rewritten with your comment in mind. The phrase "constituent of interest" is no longer used in the

document. In addition, an MCL exceedance for radium-226 and 228 was recently observed at well 0445. As a result of your comment and the radium exceedance, the last four paragraphs of this section now read:

"There are currently six groundwater monitoring wells and one seep located within the boundary of Phase I that show MCL exceedances. Four of the monitoring wells (0411, 0443, 0445, and 0399) are screened in the bedrock groundwater system, and two of the monitoring wells (0319 and 0400) are screened in the BVA. Wells 0411, 0443, and Seep 0617 exceed the MCL (5 parts per billion (ppb)) for TCE. Well 0445 exceeds the MCL for barium (2 parts per million (ppm)) and the MCL for radium-226 and 228 (5 pCi/L combined). Wells 0400, 0319, 0399, and 0411 exceed the MCLs for nickel (100 ppb) and chromium (100 ppb). The locations of the wells in Phase I are shown in Figure 5. In the last two years (September 2000 to present), the TCE concentrations at well 0411 have ranged from 8 to 16 ppb. The most recent result (Summer 2002) was 14 ppb.

Collectively, the soil data and groundwater data from the wells in the vicinity of well 0411 suggest that the TCE contamination is most likely limited to the area adjacent to well 0411. There is no known continuing source of TCE contamination in the soil in Phase I. However, TCE is not naturally occurring and was widely used in plant operations. Therefore, TCE is a contaminant of concern (COC) for the groundwater in Phase I and is addressed by the selected remedy.

Collectively, the soil data and groundwater data in the vicinity of well 0445 suggest that the elevated barium concentrations are most likely limited to the area immediately adjacent to well 0445. Other properties (high levels of total dissolved solids, very low tritium level, elevated levels of radium-226 and radium-228) of the groundwater observed at well 0445 are unlike the values typically observed in the bedrock groundwater at Mound, indicating that the groundwater at well 0445 may be neither representative of overall site conditions nor the result of plant operations. Therefore, barium, radium-226, and radium-228 in the Phase I property are not considered contaminants of concern to be addressed in the proposed remedies. To provide assurance that the understanding of the barium, radium-226, and radium-228 in groundwater situation is correct, DOE will continue to monitor for them. The specifics of the monitoring will be established in the Phase I Groundwater Monitoring Plan that will require approval by USEPA and OEPA. This will become part of the O&M Plan required by the ROD. With four consecutive quarters of consistent results for barium, radium-226, and radium-228, DOE could petition USEPA and OEPA to decrease the sampling frequency.

Limited Field Investigations (References 21 and 22) indicate the nickel and chromium concentrations observed at wells 0400, 0319, 0399, and 0411 are the likely result of corrosion of the wellcasing and not the result of plant operations. Therefore, nickel and chromium are not considered contaminants of concern to be addressed in the proposed remedies. However, because the data set supporting this conclusion is limited, DOE will continue to monitor for nickel and chromium. The specifics of the monitoring will be established in the Phase I Groundwater Monitoring Plan that will require approval by USEPA and OEPA. With four consecutive quarters of consistent or decreasing nickel and chromium results, DOE could, with the concurrence of USEPA and OEPA, discontinue monitoring groundwater in Phase I for nickel and chromium."

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(continued)

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Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
BVA	Buried Valley Aquifer
CAS	Chemical Abstracts System
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COPCs	constituents of potential concern
CSF	cancer slope factor
DOE	Department of Energy
EPC	exposure point concentration
FOD	Frequency of Detection
FFA	Federal Facilities Agreement
GV	Guideline Value
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index

Acronyms
(continued)

HQ	Hazard Quotient
IRIS	Integrated Risk Information System
LOAEL	lowest observed adverse effects level
MEIMS	Mound Environmental Information Management System
MMCIC	Miamisburg Mound Community Improvement Corporation
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NOAEL	no observed adverse effect level
OEPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbon
pCi	picoCuries
PRS	Potential Release Site
RAGS	Risk Assessment Guidance for Superfund
R_fC	reference concentration factor
R_fD	reference dose factor
RME	reasonable maximum exposure
RRE	Residual Risk Evaluation
RREM	Residual Risk Evaluation Methodology
SVOCs	semi-volatile organic compounds
TCLP	Toxic Characteristic Leachate Procedure
UCL	upper confidence limit
USEPA	U.S. Environmental Protection Agency
UTL	upper tolerance limit
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

This report was prepared using the Mound 2000 Residual Risk Evaluation Methodology [(RREM) Reference 2] to quantify the potential for cancer and non-cancer health effects from long-term, low-level exposures to site-related contaminants in Phase I. A Residual Risk Evaluation (RRE) quantifies human health risks and non-cancer health effects associated with residual levels of contamination remaining within an area to ensure that current and future users of the land will not be exposed to contaminant levels that are unacceptable. In the future, Phase I may be used for commercial or industrial land use. In the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, USEPA 1990), the United States Environmental Protection Agency (USEPA) defines the acceptable risk range as 10^{-4} (increased cancer incidence of 1 in 10,000) to 10^{-6} (increased cancer incidence of 1 in 1,000,000) with a departure at 10^{-6}, and a Hazard Index (HI) of one is defined as the acceptable threshold for non-cancer health effects. The acceptable threshold for non-cancer constituents is a HI of less than or equal to one. Therefore, total risk, background risk, and incremental risk were calculated for current and future exposure scenarios for a Construction Worker and a Site Employee working in Phase I.

The terms "release block," "parcel," and "phase" are used in this report to designate portions of the Mound property to be evaluated for transfer. To streamline the transfer process, the Mound property was initially divided into 19 "release blocks", which were contiguous tracts of property designated for release. RREs must be completed before the transfer of a release block, parcel, or phase can be completed. RRE reports have been completed for Release Blocks D and H and Parcels 3 and 4. In 1997 - 1998 the remaining release blocks were reconfigured into 10 "parcels," and in 2002 into three "phases" to shorten the schedule for site transfer.

Overall total, background, and incremental cancer risks and non-cancer hazards are presented in Tables 34-36 (for convenience, these tables are also presented in this section). The risk values in the table are broken out by media (i.e., groundwater, air, and soil) and are the sum of risks for all pathways for the Construction Worker and Site Employee Scenarios. Overall cancer and non-cancer risks associated with exposure to soil and air in both the current and future use scenarios fall within the acceptable risk range of 10^{-4} to 10^{-6} and a HI of less than 1 for both potential receptors.

Cumulative incremental cancer risks are within the acceptable risk range for the current and future Construction Worker Scenario. Cumulative incremental non-cancer hazards for the current Construction Worker Scenario meet the acceptable level. Cumulative incremental non-cancer hazards exceed the acceptable HI of one for the future Construction Worker.

Cumulative incremental cancer risks are within the acceptable risk range for the current Site Employee Scenario. The cumulative incremental risk for the future Site Employee is at the limit of the acceptable risk range. Cumulative incremental non-cancer hazards for the current Site Employee Scenario meet the acceptable level. Cumulative incremental non-cancer hazards exceed the acceptable HI of one for the future Site Employee.

Where non-cancer hazards exceed acceptable levels, they are driven by exposure to groundwater and are most likely due to the conservative assumptions used in the flow tube model to assess future groundwater. These assumptions are likely to result in an overestimation of future groundwater risk. Details of the uncertainties associated with the assessment of future exposure to groundwater are provided in Section 6, Uncertainties. Given the conservative nature of the RRE and the associated uncertainties, the risks presented in Tables 34-36 represent the upper-bound plausible limit of risks (worst case scenario) for Phase I.

1.0 INTRODUCTION

The U.S. Department of Energy's (DOE) Mound Plant is located on a 306-acre parcel of land within the City of Miamisburg, Ohio, about 10 miles southwest of Dayton, Ohio. Figure 1 shows the vicinity of the Mound Plant. The plant is located approximately 2,000 feet east of the Great Miami River and partially overlies the Great Miami Buried Valley Aquifer (BVA). Since 1948, Mound has operated as a research, development, and production facility in support of DOE's weapons and energy programs. Mound's past weapons program mission included process development, production engineering, and manufacturing and surveillance of detonators, explosives, and nuclear components. Mound's current mission is to support DOE's efforts in environmental management and to transition the site, in cooperation with the City of Miamisburg, from a Cold War production facility to commercial or industrial use.

Phase I, the subject of this report, consists of an approximately 53.8-acre parcel of land. A map of Phase I is included as Figure 2. In this report residual risk at Phase I is evaluated for both current and future commercial/industrial use of the parcel.

During past operations at the Mound facility, the release of hazardous materials occurred. During subsequent facility investigations, over 400 Potential Release Sites (PRSs) have been identified. Since contamination at the Mound Plant occurred at discrete PRSs rather than being widespread across the site, a new decision-making process was formulated for Mound. The new process is known formally as the "removal site evaluation process" and informally as the "Mound 2000 Process". The Mound 2000 Process is consistent with the Federal Facilities Agreement (FFA) signed by DOE, the U. S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), in accordance with the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) as defined in the National Contingency Plan [NCP (Reference 1)].

This report was developed using the Mound 2000 Residual Risk Evaluation Methodology [RREM (Reference 2)] to quantify the potential for cancer and non-cancer health effects from long-term, low-level exposures to site-related contaminants in Phase I. A Residual Risk Evaluation (RRE) assesses human health risks associated with residual levels of contamination remaining within an area to ensure that future users of the land will not be exposed to contaminant levels that would pose unacceptable risks and/or adverse health effects. The Phase I RRE results will be used by risk managers, together with Applicable or Relevant and Appropriate Requirements

(ARARs), to determine the need for additional site remediation or to demonstrate that a parcel is ready for release and economic redevelopment.

1.1 Purpose of Residual Risk Evaluation

The purpose of the Phase I RRE is to assess risks associated with residual levels of contamination remaining after all necessary remedial actions within Phase I have been taken. Although the RRE method was developed specifically for use at Mound, the method is consistent with the CERCLA baseline risk assessment method to ensure that future users of the land will not be exposed to contaminant levels that would pose unacceptable risks.

1.2 Scope of the Phase I RRE

The Phase I RRE was completed using the Mound 2000 RREM (Reference 2) and includes an evaluation of human health risk for residual contamination in the parcel. Since commercial/industrial use of Phase I is anticipated, receptor scenarios were selected to represent reasonable maximum exposures (RMEs) in a commercial/industrial setting. RME exposure assumptions are conservative and are therefore, not likely to underestimate residual risk. Residual contaminants in Phase I were evaluated for two potential receptor groups: Construction Workers, who may be directly exposed to soil, groundwater, and air for an exposure duration of five years, and Site Employees, such as office workers, who may be exposed to soil, groundwater, and air for an exposure duration of 25 years. The Construction Worker and Site Employee were assumed to utilize groundwater from the Mound Plant production wells for their potable water supply while at work. Exposure assumptions for the Construction Worker and Site Employee Scenarios are site-specific adaptations of the standard scenarios presented in USEPA's Risk Assessment Guidance for Superfund (RAGS), Part A (Reference 3). The assumptions used in the evaluation are presented in Table 14.

Phase I residual risks were calculated as total, background, and incremental risk. Total risk was calculated using the total concentration of identified constituents of potential concern (COPCs) detected in Phase I. Background risk was calculated based on background levels of the COPCs as documented in the RREM (Reference 2) and incremental risk was calculated as total risk minus background risk. Incremental risk is used to assess the increase in risk above background levels due to contaminant releases from past Mound Plant operations.

1.3 Organization of Report

The RREM provides a framework for evaluating potential human health risks associated with residual levels of contamination. Although the RREM is similar to a traditional CERCLA baseline risk assessment, it serves a different purpose and, therefore, is not identical.

The RREM consists of five elements, including:

- identification of the contaminants to be evaluated,
- exposure assessment,
- toxicity assessment,
- risk characterization, and
- evaluation of potential cumulative risks.

The following sections describe each of these elements in more detail starting with Section 2.0, Data Compilation and Evaluation, which describes the methods used to compile Phase I data and identify contaminants to be evaluated in the RRE. Section 3.0, Exposure Assessment, summarizes the pathways through which hazardous substances may reach potential receptors and intake assumptions that will be used to quantify exposure. In Section 4.0, Toxicity Assessment, exposure point concentrations (EPCs), intake equations, and toxicological reference values are presented. Information from the exposure assessment is combined with information from the toxicity assessment to characterize human health risks in Section 5.0, Risk Characterization. Section 6.0, Uncertainties, presents some of the sources of uncertainty inherent in risk assessments and in the RRE. Section 7.0, References, contains a list of all documents cited in this report.

2.0 DATA COMPILATION AND EVALUATION

Identification of contaminants to be carried through the RRE calculations is a multi-step process. All available sampling data from within the Phase I boundaries were compiled from the Mound Environmental Information Management System (MEIMS). There were 58,950 soil measurement records and 47,819 groundwater measurement records. All available information and results were reviewed to ensure that only analytical data of sufficient quality and confidence were used in the quantitative portion of the risk assessment. Data determined to be of insufficient quality for use in the risk assessment were removed from the data set and segregated based on the following criteria. Quality assurance (field duplicates, field blanks) were segregated from the data set.

Measurements associated with soil that was subsequently removed from the site during remedial action were segregated from the data set. Measurement results that were qualified as "R" ("rejected" by the laboratory or data validator) were segregated from the data set. Parameters that do not contribute to risk calculations (pH, ion counts, anions, Toxic Characteristic Leachate Procedure (TCLP)) were segregated from the data set. Measurement records with inconsistencies in the database elements (problems in Chemical Abstracts System (CAS) name, unacceptable/inconsistent units of measure, non-numeric results) were segregated from the data set. Measurement results from the DOE Site Survey Project and results from Portable X-Ray Flouresence in the Other Soils project were judged to be lacking in quality for risk assessment purposes and segregated from the data set. Historical data that is no longer representative of current conditions, based on trends of subsequent analytical results, were segregated from the data set.

At some locations, multiple measurements were made of the same sample. One measurement was retained for risk calculations. For radionuclides, the following hierarchy was established, in order of preference:

1. Offsite laboratory, alpha spectrometry
2. Onsite laboratory, alpha spectrometry
3. Offsite laboratory, gamma spectrometry
4. Onsite laboratory, gamma spectrometry

For measurements of chemical concentrations, the result with the lowest detection limit was retained.

Analytical results not segregated were determined to be of sufficient quality for use in the risk assessment. This data was the basis for the risk calculations and can be found on the attached CD-Rom. Data that was segregated (based on the criteria discussed above) and was not used in the risk calculations can also be found on the CD-Rom.

Subsequent to the start of the Phase I risk evaluation process, several isolated locations were identified in Phase I with elevated radionuclide concentrations. Some of the historical analytical results from samples taken within the Phase I property area are elevated with respect to a risk-based comparison criterion. The specific comparison level used was three times the 10^{-5} RBGV plus background. Twenty-three sample locations were identified with results for Plutonium 238 (3 locations), Thorium 230 (1 location) and Thorium 232 (19 locations) above the comparison values. These results have been included in the Residual Risk Evaluation for this property and the report

indicates that the risk remains within acceptable levels. However, in some cases the results are significantly elevated above guideline values and warrant additional evaluation. The process followed to determine what locations warranted additional field activities and the results of those activities are summarized in Appendix J.

2.1 Data Quality Assessment

Samples collected for the Environmental Restoration Program were analyzed according to methods outlined in a Quality Assurance Project Plan (References 4, 5, 6, 7, and 8). Since some of the data used to characterize residual contaminant concentrations in Phase I were collected for other programs, not all data used in the risk assessment experienced the same level of rigor with respect to Quality Assurance/Quality Control evaluation and data validation. As described in Section 2.0, data judged to be of insufficient quality for the risk evaluation were separated from the data set and not used in the risk calculations.

2.2 Environmental Media Considered and Data Availability

Field investigations conducted for Phase I are listed in Table 1. Samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganic compounds, common anions, polychlorinated biphenyls, explosives, pesticides, and radionuclides. Environmental media that were evaluated include surface soil (0-2 ft below land surface), subsurface soil (greater than 2 feet below land surface), air, and groundwater. Phase I does not contain surface water in bodies or sediment.

Current groundwater exposures were estimated using data collected from the Mound Plant production wells (Wells 0271 and 0076), which are finished in the BVA. The concentration of constituents in future groundwater was estimated using a Flow Tube model that assumes all contaminants currently detected in the Bedrock Aquifer of the Mound Plant property migrate to the BVA. The concentrations of contaminants in future groundwater were estimated by adding modeled contaminant concentrations detected in the Bedrock Aquifer to the lower of the 95% upper confidence limit (UCL) or maximum detected concentration in the Mound Plant production wells. This method is described in more detail in Appendix B.

The approach used to estimate potential cumulative risk from exposure to air is the same method as was used for Release Blocks D and H and Parcels 3 and 4. Potential cumulative risks due to contaminants released to the air are discussed in more detail in Appendix A.

2.3 Data Analysis

For each constituent detected in Phase I soil and current groundwater, the 95% UCL of the mean was calculated to estimate the potential concentration that receptors in the area may be exposed to. The concentration used to calculate risk is known as the EPC.

The 95% UCL for each constituent was calculated in accordance with the Mound 2000 RREM (Reference 2), Gilbert's Statistical Methods for Environmental Pollution Monitoring (Reference 9), and the Supplemental Guidance to RAGS: Calculating the Concentration Term (Reference 10). Before calculating the 95% UCL, the distribution of the data set was determined. If data were found to be normally distributed, the EPC was calculated as the 95% UCL of the arithmetic mean of the data, using the Student's t-statistic (Reference 10). The 95% UCL of the arithmetic mean was calculated as follows:

$$95\%\ UCL = Mean + t(s/n^{1/2})$$

Where:

t = t-statistic (Table A2, Reference 9)
s = standard deviation
n = number of observations in the data set

If the data follows a lognormal distribution, the data must first be transformed using the natural log function. The 95% UCL is then calculated using the H-Statistic. The 95% UCL equation of the arithmetic mean for lognormal distributions was calculated as follows:

$$95\%\ UCL = e^{Mean + 0.5\, s^2 + H(s/(n-1)^{1/2})}$$

Where:

H = H statistic (Table A12, Reference 9)
s = standard deviation
n = number of observations in the data set
e = constant (base of the natural logarithm)
mean = mean of the transformed data

The 95% UCL for data sets in which the distribution is not normal or lognormal was determined by assuming a lognormal distribution. USEPA guidance states that most environmental data sets are log normally distributed; therefore, it is reasonable to assume a lognormal distribution (Reference 10).

If the 95% UCL exceeded the maximum value observed, the maximum value was used as the EPC. If a data set had less than twenty observations (n less than 20), the maximum detected concentration was used as the EPC. For both chemical and radiological constituents, "not detected" (ND, qualified as U or UJ) results were included in the calculations of the mean and 95% UCLs as one-half the detection limit. Samples reported as ND or zero with no detection limit were not utilized in calculating a 95% UCL.

Blind field duplicates are collected to assess variability in the sampling process. They are used in the data quality assessment but were not included in the calculation of the EPCs. For radionuclides, zero or negative results with no detection limits were excluded from the data set. For data qualified as "J", the reported value was used in the 95% UCL calculations. Data flagged with an "R", meaning rejected, were not used in the Phase I database. An explanation of the laboratory data qualifiers used in the Phase I database is presented in Appendix K.

2.4 Screening Process for the Selection of Contaminants of Potential Concern

The constituent screening methods described below were used to generate a final list of COPCs for each media and receptor. All constituents with a Frequency of Detection (FOD) greater than 5% were listed in a constituent table for each media and receptor. The constituent summary tables also provide minimum detected concentrations, maximum detected concentrations, frequency of detection, and the decision and rationale to include or exclude a constituent from further consideration in the RRE.

To make the COPC selection process easier to follow, separate tables are provided for each receptor and the respective exposure scenario (Construction Worker and Site Employee) for current/future soil, current groundwater, and future groundwater. The first table for each receptor and media identifies initial COPCs by comparing the maximum concentration detected in a given media to background values and Mound Guideline Values (GVs) for the given receptor. The second table identifies final COPCs to be carried through the RRE by comparing the EPCs for the COPCs carried through from the first screening table to background values. Tables 2 and 3 identify the COPCs in soil

for the Construction Worker Scenario and Tables 4 and 5 identify COPCs in soil for the Site Employee Scenario. Tables 6 and 7 identify the COPCs in current groundwater for the Construction Worker Scenario and Table 8 and 9 identify COPCs in current groundwater for the Site Employee Scenario. Tables 10 and 11 identify the COPCs in future groundwater for the Construction Worker Scenario, and Tables 12 and 13 identify the COPCs in future groundwater for the Site Employee Scenario.

For the future groundwater screening process, the final Flow Tube modeled concentrations for COPCs were compared to background concentrations. If the modeled concentrations were less than background, the COPC was not carried through the RRE process. Nitrate, arsenic, manganese, thorium-232, and uranium-238 had future concentrations less than background and were screened out of the risk calculations.

2.4.1 Screening Constituents Based on Frequency of Detection

Constituents were evaluated for their frequency of detection. Frequency of detection was evaluated as the number of detections divided by the total number of samples analyzed for a constituent. Infrequent detection was defined as five percent or less. This is equivalent to one detect in 20 samples. If there were an insufficient number of samples (e.g. less than 20) to determine whether the frequency of detection is five percent or less, the contaminant was not eliminated on the basis of frequency of detection. A listing of all Phase I constituents and the frequency of detection analysis is provided in Appendix I.

2.4.2 Screening Constituents Based on Background

Site-specific background concentrations described as the 95% Upper Tolerance Limit (UTL) of the background sample results for each constituent were calculated for Mound Plant soil and groundwater, and presented in Tables 37 and 38. Constituents with a maximum detected concentration exceeding their level in background were identified as initial COPCs and carried to the next screening step of the RRE. Constituents with maximum concentrations less than their background concentration were not carried though the RRE. These background concentrations were also used to quantify background risk. If no background value was available for a particular constituent (e.g., many organic compounds), the constituent was carried through to the next screening step of the RRE.

For COPCs carried through from the first screening table, the 95% UCL was compared

to background to determine whether the 95% UCL was below background. If the 95% UCL was below the background value for the constituent, the constituent was not identified as a COPC in the RRE. Eliminating these constituents is consistent with the Mound 2000 RREM and focuses the RRE on constituents detected above background.

2.4.3 Screening Constituents Based on Guideline Values

Soil and groundwater constituents with maximum detected concentrations greater than background values were compared to risk-based guideline values (GVs) for the Mound Facility (Reference 11). GVs are media-specific concentrations of constituents that correspond to specific human health risk levels for specified exposure scenarios. GVs were developed for Construction Worker and Site Employee Scenarios (see References 11and 12 for the detailed derivation of GVs). Detected constituents were screened against Construction Worker and Site Employee GVs to determine COPCs to be retained for the quantitative risk assessment for each of the identified receptors.

The GVs used to screen COPCs were developed specifically for Mound, and were approved by DOE, USEPA, and OEPA after a public review. The GVs correspond to the $1x10^{-6}$ risk level for carcinogens and radionuclides. A $1x10^{-6}$ risk level represents the probability of an incremental increase of one person in one million people developing cancer as a result of exposure to the GV concentrations. Since the acceptable risk level for cancer constituents specified in the NCP is a range of $1x10^{-4}$ to $1x10^{-6}$ (increased cancer risk of 1 human in 10,000 to 1 human in 1 million), screening COPCs against the whole GV is protective. The acceptable threshold for non-cancer constituents is a Hazard Index (HI) of less than or equal to one. The GVs were calculated for a HI of one.

A Hazard Quotient (HQ) of 1 indicates an EPC below which no adverse effects to humans are expected. To account for the possibility of more than one non-cancer constituent, COPCs were screened using 1/10 the GV. Cancer-causing constituents that exceed their GVs and non-cancer constituents that exceed one-tenth of their GV were carried to the next step of the risk calculations.

Some of the radionuclides are designated as +D to indicate that cancer risk estimates and GVs include contributions from the radionuclide's short-lived decay products, or daughters. (This practice is consistent with USEPA Health Effects Assessment Summary Tables (HEAST)) Some of the radionuclides are designated "long-lived

decay." The GVs for these radionuclides include contributions from all of the radionuclides' decay products to a stable isotope. These calculations assumed equal activity concentrations (i.e. secular equilibrium) with the principal or parent nuclide in the environment. Data demonstrating secular equilibrium are presented in Appendix H.

2.4.4 Screening Constituents Based on Essential Human Nutrients

According to RAGS Part A (Reference 3): "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the site) need not be considered further in the quantitative risk assessment." Calcium, chloride, iron, magnesium, potassium, and sodium are considered essential nutrients to humans. These compounds were detected in the Phase I area at levels below or slightly elevated above background levels and are toxic only at very high doses. Concentrations of these compounds in onsite media would not be expected to result in intakes associated with a toxic response. Therefore, these compounds were eliminated as COPCs for Phase I.

2.4.5 Additional Screening Procedures

In accordance with the RREM, additional screening procedures were used to evaluate Phase I constituents. For example, in accordance with USEPA's Functional Guideline for Organics (Reference 13), if a blank contains measurable levels of a common laboratory contaminant, then the associated sample results were considered as positive results only if concentration in the samples exceeded ten times the concentration in the blank. If the concentration of a common laboratory contaminant was less than ten times the blank concentration, the constituent was considered to be an artifact of laboratory handling and was not included in the RRE. Common laboratory contaminants include acetone, 2-butanone, methylene chloride, toluene, and phthalate esters.

2.4.6 Screening Procedures for Future Groundwater

To estimate the future concentration of groundwater COPCs, the Flow Tube model was applied to bedrock well data based on the maximum concentration detected. This procedure is discussed in detail in Appendix B. In accordance with the RREM, an initial screen was necessary to determine which constituents were to be carried through the Flow Tube model. All constituents detected in bedrock wells were screened for frequency of detection as well as a comparison to background and GVs. Constituents

that exceeded these criteria were retained for Flow Tube modeling. In addition, constituents that were identified as COPCs in the current groundwater RRE were retained for Flow Tube modeling. To obtain a final estimated future groundwater concentration for each COPC, the maximum concentrations detected in a given bedrock Flow Tube were modeled for future contribution to the BVA and added to the EPC (lower of the 95% UCL or the maximum concentration) detected in the production wells. The estimated future maximum constituent concentrations in the BVA are presented in Appendix B.

An additional screening step was required to determine the final COPCs to carry through the RRE process for future groundwater. The future modeled concentration for each identified COPC was compared to background. Nitrate, arsenic, manganese, thorium-232,and uranium-238 had future modeled concentrations less than the respective background concentrations. These constituents were screened out and not evaluated in the risk calculations.

3.0 EXPOSURE ASSESSMENT

The goal of the RRE exposure assessment is to estimate the type and magnitude of contaminant exposures for specific receptors that may occur under current conditions and in the future. The information gathered in the exposure assessment is integrated with toxicity information to characterize potential risks associated with exposure to residual contamination in Phase I.

3.1 Characterization of Exposure Setting

Phase I includes thirteen existing buildings and explosives magazines and twenty-five former production-era building sites including buildings, explosives storage magazines, and an electrical generator. The properties in Phase I have supported a number of operations: explosives testing and production-related activities, administrative activities (i.e. offices and site security operations), utilities operations, waste processing operations (the Burn Area), and cleanup waste storage operations.

Phase I also includes building sites for around nine buildings constructed in 1947 to support the construction of the original site buildings. An additional building location includes the site of a building that was transferred from Dayton Unit III to the Mound Site in 1949. This building was later moved to another location on the Mound site and is known as "Building 19". The building sites dating from the construction era include a

storage warehouse, an explosives and detonator storage operation for construction-related explosives, a quonset-type building, and some additional temporary buildings.

Phase I lands have also been used for various waste and non-waste storage activities including waste container management, equipment management, and other general plant uses.

General information on the Mound Plant, as well as specific information on buildings and PRSs within Phase I, is included in Appendices F and G.

3.2 Identifying Exposure Pathways

Although many exposure pathways are possible, the RRE focuses on those pathways that are likely to occur and are likely to contribute significantly to the overall risk. When identifying exposure pathways, it is important to keep in mind the four elements of an exposure pathway. An exposure pathway consists of (1) a source of chemical release; (2) transport media, (3) a point of potential human contact with the contaminant or contaminated media, and (4) an exposure route (e.g. ingestion). If any of these elements is missing or eliminated, the pathway will be incomplete and exposure will not occur.

A pictorial representation of the exposure pathways identified for potential receptors is included in a conceptual site model for Phase I (Figure 3). The conceptual site model summarizes the pathways that hazardous substances may take to reach potential receptors. Exposure assumptions used to evaluate potential exposure pathways were drawn from the Mound Plant Risk-Based Guideline Values (Reference 11) and the Mound 2000 RREM (Reference 2). Exposure assumptions used to quantify contaminant exposures are summarized in Table 14.

3.3 Identifying Exposure Scenarios

DOE, its regulators, and its stakeholders have agreed that the future use of the Mound Plant property will be commercial/industrial. Receptor scenarios were selected that represent reasonable exposures in a commercial/industrial setting. Consistent with the RREM, two scenarios are presented in this RRE: the Construction Worker Scenario and the Site Employee Scenario.

Residual contamination in Phase I was evaluated for two potential use scenarios for adult Construction Workers and adult Site Employees. It was assumed that

Construction Workers and Site Employees could potentially be exposed to soil, air, and groundwater. The evaluation of risk associated with exposure to residual contamination in Phase I for these receptors will indicate whether economic redevelopment can be safely conducted in the area.

3.3.1 Construction Worker Scenario

Since it is reasonable to assume that construction activities could occur within Phase I, adult Construction Workers were identified as potential receptors. During construction activities, these receptors could be exposed to residual contamination present in soil at or below the land surface. Potential exposure pathways include incidental soil ingestion, dermal contact, external radiation exposure, and inhalation of airborne dust and vapors.

It was also assumed that Construction Workers would use the BVA groundwater for a drinking water supply and for showering. Exposure pathways include ingestion and inhalation of vapors and dermal contact with groundwater while showering.

Exposure pathways evaluated for the Construction Worker for both current and future scenarios, include:

- incidental ingestion of soil at or below land surface,
- external exposure to ionizing radiation from radionuclides in soil at or below land surface,
- inhalation of airborne contaminated dust,
- inhalation of volatile emissions from soil,
- dermal contact with contaminated soil,
- ingestion of contaminated groundwater as drinking water,
- inhalation of volatile contaminants from groundwater while showering at work, and
- dermal contact with contaminated groundwater while showering at work.

The following are potential exposure pathways that were judged to be not as significant as those above and are therefore not quantitatively addressed:

- incidental ingestion of groundwater,
- inhalation of volatile emissions from groundwater, and
- dermal contact with groundwater.

If these exposure pathways were found to be significant, the risks would be managed.

The parameters used to evaluate these pathways and their references are provided in

Table 14. Construction Workers were assumed to be on the property eight hours per day, 250 days per year over a 5-year period. Since Construction Workers are assumed to be adults, a body weight of 70-kilograms was used to assess exposure to chemical contaminants.

3.3.2 Site Employee Scenario

Although exposures will vary depending on the type of work performed, it is reasonable to assume that a Site Employee at Phase I will be exposed to residual contamination left on the property. Such occupations are not expected to involve direct work with surrounding soil, as would be expected with the Construction Worker. The exposure routes evaluated for the Site Employee Scenario are similar to those evaluated for the Construction Worker except the Site Employee is assumed to work indoors and therefore have less exposure to site soil. Potential soil exposure pathways include incidental soil ingestion, external radiation exposures, and inhalation of airborne dust and vapors. Site Employees were assumed to use BVA groundwater for potable water supply, but are not expected to shower at work. The exposure pathways evaluated for the future Site Employee Scenario include:

- incidental ingestion of soil 0-2 feet below land surface,
- external exposure to ionizing radiation from radionuclides in soil 0-2 feet below land surface,
- inhalation of airborne contaminated dust,
- inhalation of volatile emissions from soil, and
- ingestion of contaminated groundwater as drinking water.

The site employee scenario assumes that a worker will be employed in an office or commercial setting, with the majority of working hours spent indoors. Such occupations are not expected to involve direct work with surrounding soils, as would be expected with the construction worker scenario. As a result, potential dermal exposure to soils would be minimal or non-existent. Hence, it can reasonably be assumed that dermal contact is not a viable pathway for the site employee scenario.

The parameters used to evaluate these pathways and their references are provided in Table 14. Site Employees were assumed to be on the property eight hours per day, 250 days per year over a 25-year period. Since Site Employees were assumed to be adults, a body weight of 70-kilograms was used to assess exposure to chemical contaminants.

3.4 Human Intake Equations and Assumptions

This section presents the exposure equations and assumptions used to derive contaminant-specific intake estimates for the populations and exposure pathways evaluated in the risk assessment. The use of the intake equations presented in this section is in accordance with methods presented by USEPA in RAGS Part A (Reference 3) and the RREM (Reference 2). Exposure assumptions have been developed to represent high-end RME conditions. Exposure assumptions for each of the potential receptors, and corresponding guidance or rationale used in this assessment are presented in Table 14.

For chemicals, exposure generally refers to the intake (e.g., inhalation, ingestion, dermal absorbed dose) of the chemical, expressed in units of mg/kg-day. Toxicity values for chemicals are generally expressed in these terms; therefore, the product of the intake estimate with the toxicity value yields a risk value.

The approach used to estimate intake for chemical contaminants largely applies to radionuclides. However, there are a few key differences in the methods. For example, in addition to the ingestion, inhalation, and direct contact pathways considered for chemical contaminants, external exposure to penetrating radiation was also evaluated for radionuclides. Equations for estimating the intake of radionuclides have been modified by omitting the body weight and averaging time from the denominator. The slope factors for radionuclides are expressed as the average risk per unit intake or exposure for an individual in a stationary population; therefore, radionuclide intakes and slope factors are not expressed as a function of body weight and time.

Another key difference in the method used to assess radiological risk is the inclusion of short-lived decay products, or daughter products, for radionuclides designated with the suffix "+D". The calculation of risk for radioactive decay chain products assumed equal activity concentrations (i.e., secular equilibrium) with the principal or parent nuclide. Risk calculations for decay chain products were assessed by summing the ingestion, inhalation, and external slope factors for the parent radionuclide and decay members of continuous decay chains (Reference 15 and Appendix H).

Chemical intakes from oral and inhalation exposure are expressed as the amount of chemical at the exchange boundary (e.g., skin, lungs, intestine) that is available for absorption. These intakes are not equivalent to the absorbed dose (the amount of chemical actually absorbed into the blood stream). Dermal doses are expressed as

estimates of absorbed dose. The toxicological reference values used to calculate risk have been adjusted to account for this difference, which is a source of uncertainty when comparing or combining dermal doses with intakes from other exposure routes.

3.4.1 Soil Exposure Pathways

Exposure to soil through incidental ingestion was evaluated for Construction Workers and Site Employees under current and future land use scenarios. Intake estimates for the chemical contaminants in the soil ingestion pathway were estimated by means of the following equation:

$$\text{Intake (mg / kg – day)} = \frac{C_{so} \times IR \times EF \times ED \times CF}{BW \times AT}$$

Where:

C_{so}	=	Contaminant concentration in soil (mg/kg)
IR	=	Ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (10^{-6} kg/mg)
BW	=	Body weight (kg)
AT	=	Averaging time for cancer and non-cancer effects (days)

Radionuclide intake estimates for the soil via incidental ingestion were estimated by means of the following equation:

$$\text{Intake (picoCuries (pCi))} = C_{so} \times IR \times EF \times ED \times CF$$

Where:

C_{SO}	=	Radiological activity in soil (pCi/g)
IR	=	Ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (10^{-3} g/mg)

Unlike inhalation and ingestion exposure to soil, the external radiation exposure term is defined as an equivalent radionuclide concentration in soil that an onsite receptor would be exposed to for a particular duration. This exposure term is adjusted for exposure time and shielding. For the Phase I area RRE a default-shielding factor of 20% for the Site Employee and 10% for the Construction Worker Scenarios was assumed. These assumptions provide for a conservative estimate of external radiation exposure.

The intake equation for radionuclide contaminants via the external exposure pathway

was estimated using the following equation:

$$IR_{ext} \text{ (pCi/g-year)} = C_{so} \times ED_{ex} \times (1\text{-}Se) \times Te$$

Where:

IR_{ext}	=	External exposure contact rate (pCi-year/g)
C_{so}	=	Radiological activity of soil (pCi/g)
ED_{ex}	=	Exposure Duration x 0.685 (days worked/days in a year= 250/365) (year)
Se	=	Gamma Shielding Factor (unitless)
Te	=	Gamma Exposure Time Factor (unitless)

Intake of soil (fugitive dust) via inhalation was evaluated for Construction Workers and Site Employees under current and future use scenarios. The intake equation for chemical contaminants by this means is provided below:

$$\text{Intake (mg / kg – day)} = \frac{C_{so} \times IR_{air} \times EF \times ED}{PEF \times BW \times AT}$$

Where:

C_{so}	=	Contaminant concentration in soil (mg/kg)
IR_{air}	=	Inhalation rate (m^3/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
PEF	=	Particulate emission factor (1.32×10^9 m^3/kg, USEPA default value)
BW	=	Body weight (kg)
AT	=	Averaging time for cancer and non-cancer effects (days)

The intake equation for radionuclide contaminants via inhalation of fugitive dust was estimated using the following equation:

$$\text{Intake (pCi)} = \frac{C_{so} \times IR_{air} \times EF \times ED \times CF}{PEF}$$

Where:

C_{so}	=	Radiological activity in soil (pCi/g)
IR_{air}	=	Inhalation rate (m^3/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (1,000 g/kg)

PEF = Particulate emission factor (1.32×10^9 m^3/kg, USEPA default value)

The PEF relates the concentration of the contaminant in soil to the concentration of respirable particles in the air from fugitive dust emissions. These emissions result from wind erosion. The default value of 1.32×10^9 m^3/kg was taken from Risk-Based Guideline Values (Reference 12).

The absorbed dose from dermal exposure to soil was estimated using the following equation:

$$\text{Dermally absorbed dose (mg/kg-day)} = \frac{DA_{event} \times EF \times SA \times ED}{BW \times AT}$$

$$DA_{event} = C_{soil} \times AF \times ABS \times CF$$

Where:

C_{soil}	=	contaminant concentration in soil (mg/kg)
AF	=	adherence factor of soil to skin (mg/m^2 – event)
SA	=	skin surface area available for contact (m^2)
ABS	=	chemical-specific absorption factor (dimensionless)
EF	=	exposure frequency (events/year)
ED	=	exposure duration (year)
BW	=	body weight (kg)
AT	=	averaging time (yrx365day/year)
CF	=	conversion factor (10^{-6} kg/mg)

This pathway applies only to the current and future Construction Worker. The dermally absorbed dose was calculated for those chemicals with an ABS available.

Volatilization of chemical contaminants from soil may result in exposures via inhalation for Construction Workers and Site Employees; however, no volatile COPCs were identified in the Phase I area. Therefore, this pathway was not evaluated for chemical constituents.

3.4.2 Groundwater Exposure Pathways

Intake from the ingestion of groundwater was evaluated for Construction Workers and Site Employees under current and future use scenarios. The current concentration of contaminants in groundwater was derived from concentrations detected in two of the Mound Plant production wells (Wells 0271 and 0076). The method for estimating the future concentration of contaminants in groundwater assumes that all contaminants

detected in the bedrock wells will migrate to the BVA and be withdrawn at the Mound Plant production wells. Historical and current bedrock well data were screened and modeled to predict future contribution to the BVA from bedrock using a Flow Tube Model. This future bedrock estimated concentration for each final COPC was then added to the respective EPC (lower of 95% UCL or maximum detected concentration) in the Mound Plant production wells to provide the estimated future contaminant concentrations in groundwater used to calculate future groundwater risk. The Flow Tube Model and future bedrock estimated concentrations and total future estimated groundwater concentrations are presented in Appendix B. Risk was then calculated for current and future intake of groundwater under the Construction Worker and Site Employee Scenarios. The following equation was used to estimate current and future intake of chemical COPCs from the ingestion of groundwater as a drinking water source for both the Construction Worker and the Site Employee:

$$\text{Constituent Intake (mg / kg – day)} = \frac{C_w \times IR_w \times EF \times ED}{BW \times AT}$$

Where:

C_w	=	constituent concentration in water (mg/L)
IR_w	=	ingestion rate (L/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)

In addition to groundwater ingestion, the Construction Worker was assumed to shower at work. While showering, workers were assumed to have dermal exposure to contaminants in groundwater and to inhale volatile contaminants. The dermal absorbed dose from dermal contact with constituents in groundwater was calculated as follows:

$$\text{Constituent DAD (mg / kg – day)} = \frac{DA_{event} \times EV \times EF \times SA \times ED}{BW \times AT}$$

Where:

DAD	=	dermal absorbed dose (mg/kg-day)
DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
EV	=	events per day (day^{-1})
EF	=	exposure frequency (days/year)
SA	=	surface area of skin exposed (cm^2)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)

For inorganics, DA_{event} (mg/cm^2-event) was calculated as follows:

$$DA_{event} = K_p \times C_w \times t_{event} \times 10^{-3}\ L/cm^3$$

Where:

DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
K_p	=	chemical-specific permeability coefficient (cm/hr)
C_w	=	concentration of chemical in water (mg/L)
t_{event}	=	duration of event (hr/event)

For organics, DA_{event} (mg/cm^2-event) was calculated as follows:

$$DA_{event} = 2 \times K_p \times C_w\ 10^{-3}\ L/cm^3 \times (6 \times T \times t_{event}/\pi)^{1/2}$$

Where:

DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
K_p	=	chemical-specific permeability coefficient (cm/hr)
C_w	=	concentration of chemical in water (mg/cm^3 = 10^{-3} mg/L)
t_{event}	=	duration of event (hr/event)
T	=	lag time (hour)
π	=	constant (3.14159)

Constituent-specific permeability coefficient values (K_p) and the formula for the calculation of K_p were taken from Chapter 5 of Dermal Exposure Assessment: Principles and Applications (Reference 16). If a K_p was not found, it was calculated using the following formula:

$$\log K_p = -2.72 + 0.71 \log (K_{o/w}) - 0.0061\ MW$$

Where:

$\log K_p$	=	log of the constituent-specific permeability coefficient
$K_{o/w}$	=	octanol/water coefficient (constituent-specific)

MW = molecular weight (g/mole)

The following equation was used to calculate the intake of radionuclides from ingestion of water:

$$\text{Intake (pCi)} = C_w \times IR \times ED \times EF$$

Where:

C_w = radionuclide concentration in water (pCi/L)
IR = ingestion rate (L/day)
ED = exposure duration (year)
EF = exposure frequency (day/year)

The following equation was used to calculate the intake of radionuclides from dermal contact with water:

$$\text{Intake (pCi)} = C_w \times SA \times K_p \times EF \times ED \times Et_s \times 1000 \times L/m^3$$

Where:

C_w = concentration of contaminant in water (pCi/L)
SA = surface area of skin exposed (cm^2)
K_p = chemical-specific permeability constant (cm/hour)
EF = exposure frequency (days/year)
ED = exposure duration (years)
ET_s = duration of event (hours/day)

The following equation was used to calculate chemical contaminant intake from inhalation during showering:

$$\text{Intake (mg/kg – day)} = \frac{C_w \times K \times IR_{air} \times EF \times ED \times ET \times CF}{BW \times AT}$$

Where:

C_w = contaminant concentration in water (mg/L)
K = volatilization factor (L/m^3)
IR_{air} = inhalation rate (m^3/day)
EF = exposure frequency (day/year)
ED = exposure duration (year)
ET = exposure time (hour/day)
CF = conversion factor (1day/24 hr)
BW = body weight (kg)
AT = averaging time (year x 365 day/year)

Tritium is the only radionuclide present at the Mound Plant that is volatile enough that its vapor needs to be considered for the inhalation pathway. The following equation was used to calculate tritium intake from inhalation during showering:

$$\text{Intake (pCi)} = C_w \times IR_{air} \times EF \times ED \times M_{total} \times ET_s \times L/1000g$$

Where:

C_w	=	Tritium concentration in water (pCi/L)
IR_{air}	=	inhalation rate (m^3/day)
EF	=	exposure frequency (day/year)
ED	=	exposure duration (year)
M_{total}	=	airborne mass concentration of water in shower (66.96 g/m^3, Reference 11)
ET_s	=	shower duration (hour/day)

4.0 TOXICITY ASSESSMENT

The objectives of the toxicity assessment are to identify and select toxicological values for use in estimating the significance of the exposure and to evaluate potential adverse effects associated with exposure to compounds detected in Phase I. The RRE for Phase I evaluated chronic exposures. The RRE utilized methods recommended by USEPA for evaluating human cancer and non-cancer effects resulting from exposure to the COPCs. Cancer and non-cancer toxicity assessments for COPCs in soil and groundwater were conducted as part of the Phase I RRE. Risks due to exposures to groundwater, soil, and air are summed in Tables 34 through 36.

The toxicity criteria used in the RRE were obtained from the most current update of the USEPA Integrated Risk Information System (IRIS) or, if the information was not available in IRIS, the USEPA HEAST. IRIS is an electronic database containing the most current descriptive and quantitative USEPA regulatory information on chemical and radiological constituents. Constituent files maintained in IRIS contain information related to non-cancer and cancer health effects of constituents. HEAST is a published reference, updated periodically by USEPA. HEAST contains slope factors needed to evaluate the cancer risk due to radionuclides. The National Center for Environmental Assessment (NCEA) was another possible source for toxicity values not available from IRIS or HEAST. Table 15 presents a summary of toxicological criteria used to calculate risk for soil and groundwater COPCs, along with the chemical-specific characteristics used to estimate dermal absorbed dose and the concentrations present in vapors or dust.

In assessing the potential for non-cancer health effects, USEPA assumes that there is a

threshold below which no adverse toxic effects are expected. For example, a toxic threshold would exist if a substance had no toxic effect at a certain level of exposure, but did have a toxic effect at a higher level. USEPA derives and publishes and reference concentrations (R_fCs) for use in evaluating adverse non-cancer effects. These are estimates (with uncertainty spanning an order of magnitude or greater) of daily human exposures, including sensitive sub-populations, which may go without appreciable deleterious effects during a lifetime (Reference 3). USEPA derives reference doses (R_fDs) and R_fCs for humans, based on estimates of the no-observable-adverse-effect-level (NOAEL) or lowest-observable-adverse-effect-level (LOAEL) observed in test organisms.

USEPA classifies all radionuclides as carcinogens and the process of carcinogenesis is generally thought to be a phenomenon without a threshold for effect (Reference 3). The basis for this presumption is that an extremely low level of exposure to some carcinogens may result in chromosomal or enzyme changes leading to uncontrolled cellular proliferation or cancer. USEPA does not, therefore, estimate an effective threshold for cancer chemicals. USEPA uses a two-part evaluation for carcinogens. First the constituent is assigned a weight-of-evidence classification based on both epidemiological evidence of cancer effects and laboratory tests conducted with animals. Then a CSF is calculated. HEAST lists ingestion, inhalation, and external exposure CSFs for radionuclides in the units of risk per picocuries (risk/pCi). Ingestion and inhalation slope factors are central estimates in a linear model of the age-averaged, lifetime-attributable radiation cancer incidence (fatal and nonfatal) risk per unit of activity inhaled or ingested. The slope factor is a plausible upper-bound estimate of the slope of the dose-response curve in the low dose range. In risk assessment, the CSF is used to estimate the excess lifetime probability of a cancer effect occurring in exposed receptors.

4.1 Toxicity Values for Evaluating the Dermal Pathway

Toxicological reference values are available only for the oral and inhalation pathways and the majority of these values are based on intake (i.e., administered dose) rather than an absorbed dose. Because the intake equation for the dermal contact pathway calculates absorbed dose (by incorporating a dermal absorption factor or a permeability coefficient), it is necessary to convert the administered dose toxicity value to an absorbed dose toxicity value in order to calculate risk or hazard index. For the Phase I RRE, oral administered-dose toxicity values were adjusted by using compound-specific gastrointestinal absorption factors. For non-carcinogens, the administered dose toxicity

value (i.e., the R_fD) was multiplied by the gastrointestinal absorption factor. For carcinogens, the slope factor was divided by the gastrointestinal absorption factor.

5.0 RISK CHARACTERIZATION

This section presents the risk characterization for Phase I. In risk characterization, information from the exposure assessment (Section 3) combined with information from the toxicity assessment (Section 4) is used to characterize human health risks.

5.1 Risk Characterization Methods

Risk characterization integrates the exposure and toxicity assessments by comparing estimates of intake or dose with appropriate toxicity values. This in turn provides an indication of the potential for adverse effects to exposed receptors. The objective of the risk characterization is to determine if exposure to contaminants associated with the site poses risks that exceed USEPA acceptable levels for human health effects. The results of a risk assessment may support the determination of site release or the need for site remediation.

The RRE reports the incremental risk, total risk, and risk from background for each contaminant evaluated. The incremental risk is the risk posed by site-related contamination above the risk posed by background levels. Background risk is the risk resulting from sources other than the Mound-related residual contamination. Total risk is the sum of the background and incremental risk. This risk characterization presents a separate evaluation of non-cancer and cancer effects. Quantification methods for cancer and non-cancer effects are discussed separately in the following sections.

5.1.1 Quantification of Cancer Risk

Cancer risks are probabilistic estimates of the excess lifetime cancer risk for an individual specifically attributable to long-term exposure to site-related chemicals. The procedure for calculating risk associated with exposure to cancer compounds has been established by USEPA (Reference 3). A non-threshold, dose-response model was used to calculate a cancer slope (potency) factor for each COPC. To derive an estimate of risk, the cancer slope factor was multiplied by the estimated chronic daily intake experienced by the exposed individual:

$$\text{Risk} = \text{CDI} \times \text{CSF}$$

Where:

Risk= High end estimate of the excess lifetime cancer risk to an individual (unitless probability)
CDI= Chronic daily intake averaged over a 70-year period (mg/kg body weight-day)
CSF= Cancer slope factor (95% upper-bound estimate of the slope of the dose-response curve) expressed as (mg/kg body weight-day)$^{-1}$

To evaluate the risk of exposure to more than one cancer COPC, the risk estimate for each COPC was summed to provide an overall estimate of total cancer risk (Reference 3).

$$Risk_t = \sum_{i=1}^{n} Risk_i$$

Where:

$Risk_t$= The combined excess lifetime cancer risk across chemical carcinogens
$Risk_i$= Risk estimate for the ith chemical of n chemicals under evaluation.

5.1.2 Quantification of Non-cancer Hazard

The traditionally accepted practice of evaluating exposure to non-cancer compounds has been to experimentally determine a NOAEL and to divide this by a safety factor to establish an acceptable human dose, for example, acceptable daily intake or R_fD. The R_fD is then compared to the average daily intake experienced by the exposed population to obtain a measure of concern for adverse non-cancer effects:

$$HQ = Intake/R_fD$$

Where:

HQ= Hazard Quotient: potential for adverse non-cancer effects

Intake= Average daily intake for subchronic or chronic exposure (mg/kg body weight-day)

R_fD= Acceptable intake for subchronic or chronic exposure (mg/kg body weight-day)

To evaluate exposure to multiple non-cancer COPCs the HQs for all COPCs were summed to obtain the HI.

$$HI = \sum_{i=1}^{n} HQ$$

Where:

HI= Hazard Index

HQ= Hazard quotient estimate for the ith chemical of n chemicals under evaluation

For non-cancer effects, USEPA has set the acceptable HQ at one. If the HQ is greater than 1, there is the potential for adverse health effects at the given exposure/dose level, but the HQ value is not an indication of the severity of the effects. For multiple non-carcinogens, the HQs for all of the chemicals under evaluation are summed resulting in the Hazard Index (HI). If the HI is greater than 1, the potential also exists for adverse health effects resulting from exposure to mixtures of chemicals. In cases where the HQ for individual substances is below 1 yet several HQs sum to greater than 1, USEPA recommends segregating the compounds into groups with like or common toxicological effects and re-evaluating the potential for the various adverse health effects. In cases where HQs for individual substances are greater than 1, this step is not necessary or useful.

5.2 Risk Characterization Results

The following sections present the risk characterization results for Phase I by potential receptor. Risk estimates for individual soil COPCs for all scenarios and pathways are presented in Tables 16 through 21. Tables 16 through 18 present soil risk estimates based on Construction Worker exposure parameters, and Tables 19 through 21 present soil risk estimates based on Site Employee exposure parameters. Total risk was calculated using the total concentration of the COPCs detected in Phase I. Background risk was based on background levels of the COPCs and incremental risk was calculated using the difference between total and background levels. Incremental risk can be used to assess the increase in risk above background levels due to Mound Plant operations. Tables 34 through 36 present summaries of the risk results for all scenarios and media for exposure pathways assessed in the RRE.

Current groundwater risk was assessed using the EPC for each COPC and the risk equations presented in Section 3.5.2. Appendix B presents the methodology for

calculation and EPC values of the future groundwater COPCs that were then applied to equations presented in Section 3.5.2. Risks due to exposure to current and future groundwater are presented in Tables 22 through 33.

In Tables 34 through 36, risk estimates that are at or above the non-cancer HI of one and the cancer acceptable risk level of 10^{-6} are bolded to identify them for evaluation. The NCP acceptable risk range is 10^{-4} to 10^{-6}.

5.2.1 Construction Worker Risk Results

Soil. Tables 16 through 18 present total, background, and incremental risk and hazard for the Construction Worker Scenario in Phase I, respectively. Total (0.17), background (0.027), and incremental (0.14) non-cancer hazards are below the acceptable HI of one. Total residual cancer risk from soil for the Construction Worker Scenario is 5.1×10^{-5}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. Background residual risk from soil for the Construction Worker Scenario in Phase I is 3.4×10^{-5} and is based on background concentrations of thorium-232 long-lived decay and uranium-238 long-lived decay chains. Incremental residual soil risk is 1.7×10^{-5}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. The external exposure pathway contributes 56% of the incremental residual cancer risk for the Construction Worker Scenario in Phase I. The oral exposure pathway contributes 44% of the incremental residual cancer risk for the Construction Worker in Phase I. The uranium-238 long-lived decay chain contributes 45% of the incremental residual cancer risk. Plutonium-238 contributes 25% of the incremental residual cancer risk.

Current Groundwater. Total, background, and incremental risks and hazards for a Construction Worker exposed to current groundwater are presented in Tables 22 through 24. Total (0.87), background (0.015), and incremental (0.86) non-cancer residual hazards from current groundwater for the current Construction Worker Scenario are below the acceptable HI of one. Total residual cancer risk from current groundwater for the Construction Worker Scenario is 6.4×10^{-6}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. Background residual risk from current groundwater for the Construction Worker Scenario is 1.6×10^{-6} and is based on the background concentration for the uranium-238 long-lived decay chain. Incremental residual risk from current groundwater is 4.8×10^{-6}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. The oral exposure pathway contributes 73% of the incremental residual cancer

risk. The uranium-238 long-lived decay chain contributes 67% of the incremental residual cancer risk. TCE contributes 33% of the incremental residual cancer risk.

Future Groundwater. Final COPCs for future groundwater for the Construction Worker Scenario are identified in Table 11. Total, background, and incremental risks for the Construction Worker Scenario are presented in Tables 28, 29, and 30, respectively. Total residual non-cancer hazard from future groundwater for the Construction Worker Scenario was 6.1. Background residual non-cancer hazard from future groundwater for the Construction Worker Scenario was 0.62 and incremental residual non-cancer hazard from future groundwater was 5.5. Total and incremental non-cancer hazard for the Construction Worker Scenario exceed the acceptable HI of one. Chromium contributes 64% of the incremental HI. Future total and incremental cancer residual risk from groundwater for the Construction Worker Scenario were 2.6×10^{-5} and 2.2×10^{-5}, respectively. Both are within the acceptable risk range of 10^{-4} to 10^{-6}. Several contaminants contribute to the future incremental cancer risk. The uranium-238 long-lived decay chain is the largest contributor (33%). Background residual cancer risk from future groundwater for the Construction Worker Scenario was 2.6×10^{-6}.

Air. Potential cumulative total and incremental cancer risks due to exposure to contaminants in air are 2.1×10^{-7} and 2.0×10^{-7} respectively, which is less than the acceptable risk range. None of the COPCs identified in air have non-cancer hazard criteria so a HI was not calculated for exposure to contaminants in air.

5.2.2 Site Employee Risk Results

Soil. Total, background, and incremental residual soil risks for the Site Employee Scenario in Phase I are presented in Tables 19, 20, and 21, respectively. Total (0.0145), background (0.014), and incremental (0.0005) residual non-cancer hazard are below the acceptable HI of one. Total residual cancer risk from soil for the Site Employee Scenario in Phase I is 5.3×10^{-5}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. Background residual risk from soil for the Site Employee Scenario in Phase I is 3.7×10^{-5} and is based on background concentrations of the thorium-232 and uranium-238 long-lived decay chains. Incremental residual soil risk is 1.6×10^{-5}. The external exposure pathway contributes 75% of the incremental residual cancer risk for the Site Employee Scenario from Phase I soil. The uranium-238 long-lived decay chain contributes 52% of the incremental residual risk. The thorium-232 long-lived decay chain contributes 28% of the incremental residual risk.

Current Groundwater. Total, background, and incremental residual current groundwater risks and hazards for the Site Employee Scenario in Phase I are presented in Tables 25, 26, and 27, respectively. The total and incremental non-cancer hazard from current groundwater for the Site Employee Scenario are 0.57 and 0.55, respectively, which do not exceed the acceptable HI of one. The current groundwater background non-cancer hazard for the Site Employee Scenario is 0.014. Total and incremental cancer risks for the Site Employee exposed to current groundwater are 3.1×10^{-5} and 2.6×10^{-5}, respectively. These values fall within the acceptable risk range of 10^{-4} to 10^{-6}. The thorium-232 long-lived decay chain contributes 65% of the incremental risk via the ingestion (oral) pathway. The uranium-238 long-lived decay chain contributes 19% of the incremental cancer risk via the oral pathway. Current background cancer risk to the Site Employee presents a risk of 1.1×10^{-5}.

Future Groundwater. Final COPCs for future groundwater for the Site Employee Scenario are identified in Table 13. Total, background, and incremental risks for the Site Employee Scenario are presented in Tables 31, 32, and 33, respectively. Future total and incremental non-cancer residual hazard from groundwater for the Site Employee Scenario were 5.2 and 4.6, respectively. Both of these values exceed the acceptable HI of one. Chromium contributes 67% of the incremental HI. Future background non-cancer residual hazard in groundwater for the Site Employee Scenario is 0.61. Future total and incremental cancer residual risks from groundwater for the Site Employee Scenario were 1.2×10^{-4} and 9.3×10^{-5}, respectively. The incremental cancer risk associated with exposure to groundwater falls within the acceptable risk range of 10^{-4} to 10^{-6} for the Site Employee Scenario. Background cancer residual risk from future groundwater for the Site Employee Scenario was 2.1×10^{-5}.

Air. Potential cumulative total and incremental cancer risks due to Site Employee exposure to contaminants in air are 1.0×10^{-6} and 9.8×10^{-7}, respectively, which are less than or within the acceptable risk range. None of the COPCs identified in air have non-cancer risk criteria so a HI was not calculated for exposure to contaminants in air.

5.2.3 Overall Summary of Risk Results

Overall total, background, and incremental cancer and non-cancer risks are presented in Tables 34 through 36. The values in the tables are the sum of all of the media and associated pathways for the Construction-Worker and Site Employee Scenarios.

The cumulative incremental current hazard (1) for the Construction Worker Scenario is at the acceptable limit (1). The cumulative incremental current risk (2.2×10^{-5}) is

acceptable (10^{-4} to 10^{-6}). The cumulative incremental future hazard for the Construction Worker Scenario (5.7) exceeds the acceptable level (1). The cumulative incremental future risk ($4x10^{-5}$) is acceptable (10^{-4} to 10^{-6}). The exceedance is due to the modeled future groundwater.

The cumulative incremental current risk ($4.3x10^{-5}$) and hazard (0.55) for the Site Employee are acceptable. The cumulative incremental future risk for the Site Employee ($1.1x10^{-4}$) is at the limit of the acceptable risk range (10^{-4} to 10^{-6}). The cumulative incremental future hazard (4.6) exceeds the acceptable level (1). This exceedance is due to the modeled future groundwater.

6.0 UNCERTAINTY IN THE RISK ASSESSMENT

In the following section, an evaluation is presented of the sources of uncertainty in the Phase I RRE and the relative influence of these sources on the results of the evaluation. Uncertainty is inherent in the selection of input parameters and in every step of the risk assessment process. Risk assessment of contaminated sites must not be viewed as yielding single value, invariant results. Rather, the results of risk assessment are estimates that span a range of possible values, and which must be understood only in light of the assumptions and methods used in the evaluation.

The results of the RRE are presented in terms of the potential for adverse effects based upon a number of conservative assumptions. The tendency to be conservative is an effort to err toward protecting health. Uncertainty can be found at all phases in the risk assessment: in the analytical data, the exposure assessment, the toxicity assessment, and the risk characterization. Where uncertainty does exist, the RRE uses conservative assumptions to ensure that the outcome will be protective.

6.1 Uncertainty in Analytical Data

Uncertainty is introduced to the RRE when sample locations are selected and when samples are collected and analyzed. In the RRE, the long-term exposure concentrations were upper estimates of site concentrations (e.g., maximum detect or 95% UCL); therefore, a conservative bias to overestimate potential exposure has been incorporated into the risk estimates. The uncertainty associated with the statistical analysis of environmental data is low, with little introduction of bias. However, it is possible that contaminated areas of Phase I were not sampled.

Data for the RRE were collected over a 20-year period, during which analytical detection limits and methods have changed. This has resulted in current lower detection limits and presents uncertainty in the data by adding potential bias to the EPC for a constituent. The earlier data with higher detection limits resulted in non-detected concentrations that were higher, in some cases, than current maximum detected concentrations. Substitution of one-half the detection limit for non-detected concentration limits tends to bias the EPC high. For groundwater, the historical and current groundwater data were collected and used to develop the EPC by a conservative approach and model presented in Mound 2000 RREM. Uncertainty is introduced because the analytical results for constituents in the groundwater, collected over a 20-year time period, may not meet the DQOs currently in place for data collection at Mound. The long time frame also means that contaminants detected in the production wells and bedrock wells may have degraded. For example, 20 years is greater than one half-life for tritium. The concentration of tritium in groundwater is reduced by half every 12 years.

To estimate future maximum constituent concentrations in the BVA, the EPC (lower of maximum detected concentration or 95% UCL) in the production wells was added to the Flow Tube modeled maximum detected concentration found in the bedrock wells. The Flow Tube Model includes an assumption that the maximum concentration of a constituent detected in each of the twenty bedrock Flow Tubes impacts the BVA in the future. The model does not take into account chemical and physical processes such as dilution, dispersion, and adsorption, which may reduce contaminant levels by the time they reach the BVA. As a result of this methodology, the future groundwater EPCs are biased high and conservative. This added conservatism helps to compensate for the uncertainties in the characterization of the bedrock aquifer (data gaps over time, changing analytical techniques, limited sample locations, and limited flow). It was agreed through the implementation of the Mound 2000 Process and the RREM, that extensive characterization of the bedrock groundwater was not needed due to the following: 1. A restriction on the use of the aquifer would be implemented; 2. The groundwater yield from the bedrock is low (i.e. one gallon per minute); and 3. Characterization and remediation of fractured bedrock is technically difficult and costly. It is important to recognize the uncertainties of the assumptions, but it is also important to maintain the conservative nature of the assumptions.

6.2 Uncertainty in Exposure Assessment

Exposure assessment may introduce considerable uncertainty in the risk assessment process. The RREM presents exposure and intake calculations based on USEPA procedures that were used in the Phase I RRE. Exposure assumptions were also used to develop site-specific risk-based guideline values for the Mound Plant which were approved by OEPA and USEPA after public review. Exposure assumptions are based on speculation regarding potential land use, assumptions concerning contaminant fate and transport, and receptor behavior. The uncertainty associated with the exposure assumptions used in the risk assessment is moderate, and most likely overestimates the actual risks.

One of the exposure assumptions used in the Phase I RRE is that future site users would utilize the production wells for potable water supplies. The Miamisburg Mound Community Improvement Corporation (MMCIC) intends to tap future site users into the municipal water supply system in the near future, therefore exposure to bedrock or BVA groundwater is unlikely. Using the production well and bedrock well data to estimate future risk is a conservative estimate of future risk, but appropriate because the production wells are located in a productive portion of the BVA and could be used in the future as a water resource.

The chromium data introduce another uncertainty in the analytical data. Chromium can exist in two different states: chromium III or chromium VI. Chromium VI is highly reactive and, as a result, has a very short holding time. Of the 180 measurements of chromium in groundwater that contribute to this risk evaluation, four are measurements of chromium VI. All four results are at the detection limit of 0.02 mg/l. The EPC for chromium is 0.964 mg/l. All chromium was assumed to be chromium VI. (R_fD_o = 0.003 mg/kg-day). The resulting future total groundwater hazard index for the Construction Worker was 3.6. If the chromium is assumed to be chromium III (R_fD_o = 1.5 mg/kg-day), the resultant HI for the same scenario is 0.007.

Another source of uncertainty in the Phase I RRE involves external exposure to gamma-emitting radionuclides. External exposure refers to the irradiation of tissues by radiation emitted by radionuclides located outside the body either dispersed in air, on skin surfaces, or deposited on ground surfaces. Gamma and x-rays are the most penetrating of the emitted radiation and comprise the primary contribution to radiation dose from external exposures. The calculation of risk from external radiation exposure assumes that any gamma-emitting radionuclide in soil is uniformly distributed in soil.

The calculation of external radiation exposure risk includes a gamma-shielding factor (S_e) to account for attenuation of radiation by structures, terrain or engineered barriers. S_e is expressed as a fractional value between 0 and 1, representing the possible risk reduction range from 0% to 100% due to shielding. For the Phase I RRE a default value of 0.2 or 20% shielding for the Site Employee and 0.1 or 10% shielding for the Construction Worker Scenarios was used in the risk calculations. The shielding default values are consistent with values previously used in the calculation of the GVs by DOE.

6.3 Uncertainties Related to Toxicity Information

Although USEPA approved toxicity values were used for the RRE; a significant amount of uncertainty may surround these values. Identification of the sources of this uncertainty enables the risk assessor to establish the degree of confidence associated with the toxicity measures.

Uncertainty is inherent within the toxicity assessment and is primarily due to differences in study design, species, sex, routes of exposure, or dose-response relationships. A major source of uncertainty involves using toxicity values based on experimental studies that substantially differ from typical human exposure scenarios. The derivation of the toxicity values must take into account such differences as 1) using dose-response information from animal studies to predict effects in humans, 2) extrapolating dose-response information from high-dose studies to predict adverse health effects from low doses, 3) using data from short-term studies to predict chronic effects, and 4) extrapolating from uniform animal populations to variable human populations.

The cancer slope factors in particular are based on studies that may differ greatly from realistic situations. Experimental cancer bioassays typically expose animals to very high levels of chemicals (i.e., the maximum tolerated dose) for their entire lifetime. After appropriate studies have been identified, the slope factor is calculated as the upper 95th percent confidence limit of the slope of the dose-response curve. This introduces conservatism into the risk assessment. In addition, carcinogens are assumed to be human carcinogens regardless of USEPA's weight-of-evidence classification.

The derivation of reference doses involves the use of animal studies. Uncertainty factors ranging from 1 to 1,000 are incorporated into the reference dose to provide an extra level of health protection. The factors used depend on the type of study from which the value has been derived (e.g., animal or human, chronic or acute, study design). The scientific basis for this practice is somewhat subjective. In general, high

uncertainty factors are meant to bias the results conservatively so that exposures at the reference dose level will not result in adverse health effects.

Toxicity values derived from oral administered dose studies have been converted to absorbed dose toxicity values for use in evaluating the dermal contact pathway. This is considered a more accurate approach than using unadjusted oral toxicity values for the dermal pathway. Uncertainty is introduced in the use of the gastrointestinal absorption factors. Limited information is available on the gastrointestinal absorption of some analytes and many have no information at all. In addition, no adjustments have been made for the medium of exposure (e.g., when the medium of exposure in the site differs from the medium of exposure assumed by the toxicity value). The uncertainty associated with using the absorbed dose toxicity values for the dermal pathway is moderate and the bias unknown.

There are some chemicals for which no toxicity value exists and for which little information is available. Therefore, a quantitative risk estimate cannot be calculated for these chemicals. For example, many chemicals are not evaluated for the inhalation pathway because of limited inhalation-based toxicological information. The lack of toxicity information for some chemicals contributes to the underestimation of risks. The following constituents in Phase I do not have toxicity criteria accepted by HEAST or IRIS: VOCs (bromochloromethane, fluorobenzene, O-chloroflurobenzene), pesticides (chlordane), SVOCs (benzo(g,h,i)perylene, phenanthrene), and inorganics (bismuth, lead, and lithium).

Although the USEPA has developed toxicity values for the oral and inhalation routes of exposure for many chemicals, they have not developed toxicity criterion for all chemicals and all exposure routes that were evaluated for Phase I. For this reason, acceptable literature databases (ATSDR, Sax's Dangerous Properties of Industrial Materials, Chemfinder.com, Risk Assessment Information System Website) were reviewed to determine if toxicological information on other COPCs is available. Information obtained in this fashion is discussed qualitatively.

Bromochloromethane is a poison—it is mildly toxic by ingestion and inhalation (Reference 17). Fluorobenzene is also mildly toxic by ingestion and inhalation (Reference 17).

Benzo(g,h,i)perylene is a polycyclic aromatic hydrocarbon (PAH). PAHs generally occur as complex mixtures (for example, as part of combustion products such as soot). The USEPA and International Agency for Research on Cancer have determined that

benzo(g,h,i)perylene is not classifiable as to human carcinogenicity (Reference 18). Bismuth has been reported as poisonous to humans (Reference 17).

Unlike most other chemicals, the hazard posed by inorganic lead is based on levels of lead in blood rather than on toxicity values. The USEPA has developed mathematical models for predicting concentrations of lead in the blood of children and adults resulting from exposure to soil, air, drinking water, food, and other sources. The USEPA compares the predicted blood-lead concentrations with a concentration of 10 micrograms of lead per deciliter of blood to decide whether lead presents a health risk. The USEPA has estimated that the concentration of lead in blood could exceed 10 ug/dL if the concentration of lead in soil at residences exceeds 400 mg of lead per kg of soil. In work areas, USEPA has estimated that the concentration of lead in soil should not exceed 750 to 1,750 mg/kg. In Phase I, the concentration of lead in soil was 16.7 mg/kg for the Construction Worker and 0.013 mg/kg for the Site Employee. Although certain lead compounds have been shown to cause cancer in animals, the risk of cancer is not typically evaluated for lead because people are more sensitive to lead's non-cancer effects than to its cancer effects. For radioactive isotopes of lead, the cancer risks were included in the risks from the appropriate long-lived decay chains in Phase I (Reference 19).

To estimate potential impact associated with simultaneous exposure to multiple chemicals, cancer risks were summed for all COPCs and hazard indexes were summed for all COPCs. USEPA classifies carcinogens according to the weight of evidence from epidemiological and animal studies as follows:

Class A – Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Class B – Probable Human Carcinogen (limited evidence of carcinogenicity in humans or sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)

Class C – Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

In the case of carcinogens, this gives carcinogens with a class B or class C weight-of-evidence the same weight as carcinogens with a class A weight-of-evidence. It also equally weights slope factors derived from animal data with those derived from human data. Uncertainties in the combined risks are also compounded because R_fDs and cancer slope factors do not have equal accuracy or levels of confidence and are not

based on the same severity of effect.

6.4 Uncertainties in Risk Characterization

Uncertainties in any phase of the risk analysis are reflected in the risk estimates. Some uncertainty is associated with the summation of risks and HQs for multiple chemical contaminants. As stated in RAGS (Reference 3), "The assumption of dose additivity ignores possible synergistic or antagonistic effects among chemicals, and assumes similarity in mechanisms of action and metabolism." However, summing risks and HQs for multiple substances in this risk assessment provides a conservative estimate.

6.5 Conclusions

The current incremental risk in Phase I is within the acceptable risk range. The future incremental risk for the Construction Worker Scenario is within the acceptable risk range. The future incremental risk for the Site Employee is at the limit of the acceptable risk range and is primarily driven by the conservative groundwater analysis (see section 6.1). Incremental risk due to soil and air contaminants is within acceptable risk range for industrial/commercial reuse.

The current incremental HI for the Site Employee is within the acceptable range (less than 1). The current incremental HI for the Construction Worker Scenario is at the limit of the acceptable range (1). The future incremental HI for the Construction Worker and Site Employee Scenarios exceeds the acceptable level (1) and is driven by the conservative groundwater analysis (see Section 6.1). Incremental HI due to soil and air contaminants is within the acceptable range for industrial/commercial use.

7.0 REFERENCES

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Reference 3 "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A, Interim Final," USEPA, Office of Emergency and Remedial Response, Washington, DC. 1989

Reference 4 Operable Unit 9, Remedial Investigation/Feasibility Study, Quality Assurance Project Plan, June 1993

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Reference 7 Operable Unit 3, Limited Field Investigation Activities, Quality Assurance Project Plan, October 1991

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Reference 11 Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. Prepared by Hazardous Waste Remedial Actions Program managed by Lockheed Martin Energy Systems, Inc. March 1997

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Reference 14 Introduction to Region 9 PRG Document from web site. www.epa.gov/region09/waste/sfund/prg

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Reference 16 "Dermal Exposure Assessment: Principles and Applications," EPA/600/8-91/011b, Office of Health and Environmental Assessment, Washington, DC. 1992

Reference 17 Sax's Dangerous Properties of Industrial Materials, tenth Edition, John Wiley & Sons, 1999

Reference 18 ATSDR ToxProfiles Website: www.atsdr.cdc.gov

Reference 19 Lead Human Health Sheet, ANL website: www-unix.mcs.anl.gov/mpi/index.html

APPENDIX A

Evaluation of Potential Cumulative Risk due to Exposure to Contaminants in Air

A1.1 EVALUATION OF POTENTIAL CUMULATIVE EXPOSURE – AIR

Potential exposure to contaminants originating from outside Phase I that may reach a receptor in the phase are termed potential cumulative exposures. This appendix presents potential cumulative exposures that may come from air.

Airborne contaminant concentrations were measured at the Mound Facility in 1994 during various site restoration activities (DOE, 1994). Both radiological and non-radiological data were collected. These data are shown in Table A1-1. It is assumed that the measured concentrations would represent an upper-bound air concentration. Trends in air COPCs have not increased since this evaluation was conducted; therefore, the measured concentrations are representative of current exposure and are assumed to be representative of future exposures.

Risks due to inhalation of the radionuclides by construction workers and site employees were calculated and are also presented in Table A1-1. The calculated risks attributable to the potential upper-bound exposure of airborne contaminants would total 2.0E-07 for the construction worker and 9.8E-07 for the site employee. Note that the potential exposures and associated risks are based on the assumption of long-term consumption of this upper-bound concentration that was measured during site restoration activities.

Table A1-1 Concentration of Radionuclides in Air in 1994 (EG&G Mound Applied Technologies- Mound Site Environmental Report for Calendar Year 1994, pg. 4-15 to 4-17) MLM-3814

Radionuclide	Maximum Concentration* (μCi/mL)	Risks to Construction Worker*	Risks to Site Employees**
Tritium oxide (H-3)	7.54 ± 4.61E-12	1.8E-08	9.0E-08
Plutonium-238	259.65 ± 289.58E-18	1.75E-07	8.8E-07
Plutonium-239/240	3.50 ±2.75E-18	2.5E-09	1.2E-08
Total		2.0E-07	9.8E-07

* Error limits are estimates of the standard error of the estimated means at the 95% confidence level. Values given are from the location on the site with the highest concentration (based on the average of two or more samples).

** Calculated risks assumed that the maximum concentration shown here was the C_{air} value needed for the calculation of risk by inhalation for construction workers and site employees.

APPENDIX B

Methodology and Evaluation of Groundwater Exposure for Mound RRE

Potential Future Maximum Concentrations of COPCs in Groundwater

This Appendix describes the steps completed to estimate the potential future concentration of contaminants in the Mound Plant Production Wells. In summary, very conservative estimates of future contaminant concentrations were developed by assuming all contaminants currently detected in the Bedrock Aquifer of the Mound Property would migrate to the Buried Valley Aquifer (BVA), from which the Mound Plant Production Wells withdraw potable water for Mound facility use. The calculated potential bedrock contaminant concentrations were then added to the current contaminant concentrations in the Mound Plant Production Wells to obtain the estimated future contaminant concentrations.

The techniques used to forecast future contaminant concentrations were purposely designed to represent the most conservative (worst-case) future scenario possible. This overly conservative approach assures no significant chemical of concern would be prematurely removed from the risk evaluation process. The steps completed to develop this initial "model" of the future contaminant concentrations in the Mound Plant Production Wells are summarized as follows.

1. Using established groundwater flow net analysis techniques, a topographic map of the bedrock surface underlying the Mound facility was used to create 20 evaluation areas of similar size termed "flow tubes." Groundwater flow within the Bedrock Aquifer was assumed to generally follow the topography of the bedrock surface. The flow tubes were delineated based on drainage patterns suggested by the bedrock topographic map (see Figure B-1). Within each flow tube it is assumed groundwater flows in the same general direction, on a slope of the same general gradient. Based on topography and gradient, groundwater from the majority of these flow tubes will eventually flow into the BVA. Although several of the flow tubes do not appear to contribute to the BVA directly, they were considered to contribute to the BVA to make the future scenario as conservative as possible.

2. All contaminant concentration data from bedrock wells currently maintained or archived in the MEIMS database were examined for each

flow tube. The maximum concentration of each analyte for any of the bedrock wells or selected bedrock seeps was assumed to be representative of the contamination within the flow tube. This maximum concentration was multiplied by the volume of water per unit time that flows within each flow tube in order to determine the mass of each contaminant that could be contributed to the BVA production wells.

3. The total flow of each tube was determined by measuring the width and gradient of the flow tube from the bedrock topographic map. These were multiplied by the assumed thickness of the bedrock aquifer (40 feet), and by the assumed hydraulic conductivity (0.1 feet/day). The product of these values is the volume of groundwater flow per tube per unit time.

4. The maximum concentration of each analyte from each flow tube was applied to the total flow of each tube to determine a potential mass of contaminant entering the BVA per year per flow tube.

5. The contaminant mass from each flow tube was summed to provide the total potential mass of each contaminant contributed by the bedrock aquifer to the BVA per year.

6. The total mass of each contaminant was divided by an assumed Mound Plant water use of 260,000 gallons per day (94,900,000 gallons per year) to obtain the theoretical concentration of the bedrock contribution for all bedrock contaminants. Therefore, the very conservative assumption is made that the masses of all contaminants that enter the BVA from the bedrock contribute to the production wells without any dilution or degradation.

7. This theoretical concentration was added to the current concentration of contaminants observed in the Mound Plant Production wells to obtain the theoretical worst-case future groundwater concentration.

This approach represents the most conservative scenario possible using currently available groundwater data. A more realistic estimate of the future groundwater concentrations would require consideration of dilution and

degradation of contaminants within the bedrock and the BVA aquifers, quantification of the actual amounts of bedrock water intercepted by the Mound production wells, and replacement of the maximum contaminant concentrations with more representative values.

Table B-1 lists all contaminants of potential concern detected in either a bedrock well, see, or a Mound Plant production well, their respective concentrations, and the calculated combined estimated future maximum concentration.

Antimony – An Example

The wells and seeps selected to best represent the water quality of the consolidated lithologic units beneath the Mound are summarized in Table B-2. Upon review of the data in the MEIMS database for these monitoring locations, antimony was detected in the bedrock monitoring wells and seeps in 47 out of 158 analyses for this parameter. All designated wells and seeps were assigned to specific flow tubes. The highest concentration measured in each monitoring well or seep within a flow tube was used to calculate a potential annual contribution of antimony to the groundwater. Table B-3 summarizes the water volume and concentrations used to project antimony to the Mound production wells.

As shown in Table B-1, the calculated COPC concentration obtained from the flow tube model is added to the existing concentration measured in the production wells. It is this potential future maximum constituent concentration that is the RRE modeling process.

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
630-20-6	1,1,1,2-Tetrachloroethane	0.000112017	0	0.000112017
71-55-6	1,1,1-Trichloroethane	0.00048027	0.000898	0.00137827
79-34-5	1,1,2,2-Tetrachloroethane	0.00048027	0	0.00048027
79-00-5	1,1,2-Trichloroethane	0.000459043	0	0.000459043
75-34-3	1,1-Dichloroethane	0.000468441	0.000341	0.000809441
75-35-4	1,1-Dichloroethene	0.000481229	0.00039	0.000871229
96-18-4	1,2,3-Trichloropropane	0.000112017	0	0.000112017
120-82-1	1,2,4-Trichlorobenzene	0.001231584	0	0.001231584
156-59-2	1,2-cis-Dichloroethene	0.000618206	0.00108	0.001698206
95-50-1	1,2-Dichlorobenzene	0.000864843	0	0.000864843
107-06-2	1,2-Dichloroethane	0.000459916	0	0.000459916
540-59-0	1,2-Dichloroethene		0.0072	0.0072
78-87-5	1,2-Dichloropropane	0.000462048	0	0.000462048
135-01-3	1,2-Diethylbenzene	0.000303543	0	0.000303543
156-60-5	1,2-trans-Dichloroethene	0.000492922	0.000388	0.000880922
99-35-4	1,3,5-Trinitrobenzene	0.000265123	0	0.000265123
10061-01-5	1,3-cis-Dichloropropene	0.000525984	0.000553	0.001078984
541-73-1	1,3-Dichlorobenzene	0.00091014	0	0.00091014
141-93-5	1,3-Diethylbenzene	0.000112017	0	0.000112017
99-65-0	1,3-Dinitrobenzene	0.000155904	0	0.000155904
10061-02-6	1,3-trans-Dichloropropane	0.000525984	0	0.000525984
106-46-7	1,4-Dichlorobenzene	0.000885431	0	0.000885431
105-05-5	1,4-Diethylbenzene	0.000112017	0	0.000112017
544-10-5	1-Chlorohexane	0.000112017	0	0.000112017
108-60-1	2,2'-oxybis(1-chloropropane)	0.001862313	0	0.001862313
95-95-4	2,4,5-Trichlorophenol	0.004912268	0	0.004912268
88-06-2	2,4,6-Trichlorophenol	0.001231584	0	0.001231584
118-96-7	2,4,6-Trinitrotoluene	0.000145622	0	0.000145622
120-83-2	2,4-Dichlorophenol	0.001231584	0	0.001231584
105-67-9	2,4-Dimethylphenol	0.001231584	0	0.001231584
51-28-5	2,4-Dinitrophenol	0.004912268	0	0.004912268
121-14-2	2,4-Dinitrotoluene	0.00120126	0	0.00120126
606-20-2	2,6-Dinitrotoluene	0.001108858	0	0.001108858
35572-78-2	2-Amino-4,6-Dinitrotoluene	8.90831E-05	0	8.90831E-05
120-32-1	2-Benzyl-4-Chlorophenol	0.001231584	0	0.001231584
78-93-3	2-Butanone	0.002895276	0.041	0.043895276
110-75-8	2-Chloroethylvinylether	0.000652447	0	0.000652447
91-58-7	2-Chloronaphthalene	0.001231584	0	0.001231584
95-57-8	2-Chlorophenol	0.001231584	0	0.001231584
95-49-8	2-Chlorotoluene	0.000112017	0	0.000112017
591-78-6	2-Hexanone	0.001120167	0	0.001120167

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
91-57-6	2-Methylnaphthalene	0.001241754	0	0.001241754
95-48-7	2-Methylphenol	0.001231584	0	0.001231584
88-74-4	2-Nitroaniline	0.004912268	0	0.004912268
88-75-5	2-Nitrophenol	0.001231584	0	0.001231584
91-94-1	3,3'-Dichlorobenzidine	0.001962855	0	0.001962855
99-09-2	3-Nitroaniline	0.004912268	0	0.004912268
72-54-8	4,4'-DDD	1.15404E-05	0	1.15404E-05
72-55-9	4,4'-DDE	1.15404E-05	0	1.15404E-05
50-29-3	4,4'-DDT	1.15404E-05	0	1.15404E-05
534-52-1	4,6-Dinitro-o-Cresol	0.004912268	0	0.004912268
101-55-3	4-Bromophenyl-phenyl Ether	0.001231584	0	0.001231584
59-50-7	4-Chloro-3-Methylphenol	0.001231584	0	0.001231584
106-47-8	4-Chloroaniline	0.001231584	0	0.001231584
7005-72-3	4-Chlorophenyl-Phenylether	0.001231584	0	0.001231584
106-43-4	4-Chlorotoluene	0.000112017	0	0.000112017
108-10-1	4-Methyl-2-pentanone	0.001013606	0	0.001013606
106-44-5	4-Methylphenol	0.002044743	0	0.002044743
100-01-6	4-Nitroaniline	0.004912268	0	0.004912268
100-02-7	4-Nitrophenol	0.004912268	0	0.004912268
83-32-9	Acenaphthene	0.001344013	0	0.001344013
208-96-8	Acenaphthylene	0.001422283	0	0.001422283
67-64-1	Acetone	0.002547214	0.012	0.014547214
75-05-8	Acetonitrile	0.005429501	0	0.005429501
107-13-1	Acrylonitrile	0.005429501	0	0.005429501
7440-34-8	Actinium-227	3.561494238		3.561494238
309-00-2	Aldrin	5.79147E-06	0	5.79147E-06
5103-71-9	Alpha Chlordane	3.3283E-05	0	3.3283E-05
319-84-6	Alpha-BHC	5.79147E-06	0	5.79147E-06
7429-90-5	Aluminum	1.875810437	0.148	2.023810437
14596-10-2	Americium-241	0.808115673	0	0.808115673
7664-41-7	Ammonia	1.038369547	0.58	1.618369547
120-12-7	Anthracene	0.001231584	0	0.001231584
7440-36-0	Antimony	0.003983868	0.0144	0.018383868
12674-11-2	Aroclor-1016	5.91352E-05	0	5.91352E-05
11104-28-2	Aroclor-1221	6.1576E-05	0	6.1576E-05
11141-16-5	Aroclor-1232	5.91352E-05	0	5.91352E-05
53469-21-9	Aroclor-1242	5.91352E-05	0	5.91352E-05
12672-29-6	Aroclor-1248	5.91352E-05	0	5.91352E-05
11097-69-1	Aroclor-1254	8.62573E-05	0	8.62573E-05
11096-82-5	Aroclor-1260	8.62573E-05	0	8.62573E-05
7440-38-2	Arsenic	0.018391503	0	0.018391503
7440-39-3	Barium	0.08931148	0.0936	0.18291148
71-43-2	Benzene	0.000518324	0	0.000518324

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
56-55-3	Benzo(a)anthracene	0.001231584	0	0.001231584
50-32-8	Benzo(a)pyrene	0.001231584	0	0.001231584
205-99-2	Benzo(b)fluoranthene	0.001231584	0	0.001231584
191-24-2	Benzo(g,h,i)perylene	0.001231584	0	0.001231584
207-08-9	Benzo(k)fluoranthene	0.001231584	0	0.001231584
65-85-0	Benzoic Acid	0.018876741	0	0.018876741
100-51-6	Benzyl Alcohol	0.001231584	0	0.001231584
100-44-7	Benzyl Chloride	0.000112017	0	0.000112017
7440-41-7	Beryllium	0.000290252	0	0.000290252
319-85-7	Beta-BHC	5.79147E-06	0	5.79147E-06
111-91-1	Bis(2-chloroethoxy)methane	0.001231584	0	0.001231584
111-44-4	Bis(2-chloroethyl)ether	0.001231584	0	0.001231584
117-81-7	Bis(2-ethylhexyl)phthalate	0.017553582	0	0.017553582
7440-69-9	Bismuth	0.024087072	0	0.024087072
14331-79-4	Bismuth-210	1.552696539	0.39	1.942696539
7440-42-8	Boron	0.020762697		0.020762697
74-97-5	Bromochloromethane	0.005824867	0	0.005824867
75-27-4	Bromodichloromethane	0.000474835	0.000379	0.000853835
75-25-2	Bromoform	0.000496147	0	0.000496147
74-83-9	Bromomethane	0.001120167	0	0.001120167
85-68-7	Butyl Benzyl Phthalate	0.001231584	0	0.001231584
7440-43-9w	Cadmium	0.001469976	0.00656	0.008029976
7440-70-2	Calcium	77.49407787	110	187.4940779
86-74-8	Carbazole	0.001231584	0	0.001231584
75-15-0	Carbon Disulfide	0.000560083	0	0.000560083
56-23-5	Carbon Tetrachloride	0.000479097	0	0.000479097
10045-97-3	Cesium-137	1.628165373	0	1.628165373
108-90-7	Chlorobenzene	0.000496147	0	0.000496147
75-00-3	Chloroethane	0.001120167	0	0.001120167
67-66-3	Chloroform	0.000464179	0.000416	0.000880179
74-87-3	Chloromethane	0.001120167	0	0.001120167
25168-05-2	Chlorotoluene	0.000112017	0	0.000112017
218-01-9	Chrysene	0.001231584	0	0.001231584
7440-47-3	Chromium	0.944047832	0.0202	0.964247832
7440-48-4	Cobalt	0.009465879	0	0.009465879
10198-40-0	Cobalt-60	1.770258695	0	1.770258695
7440-50-8	Copper	0.01409079	0.0416	0.05569079
57-12-5	Cyanide	0.001290095	0	0.001290095
319-86-8	Delta-BHC	5.79147E-06	0	5.79147E-06
53-70-3	Dibenz(a,h)anthracene	0.001231584	0	0.001231584
132-64-9	Dibenzofuran	0.001231584	0	0.001231584
124-48-1	Dibromochloromethane	0.000472704	0	0.000472704
74-95-3	Dibromomethane	0.000314634	0	0.000314634

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
75-71-8	Dichlorodifluoromethane	0.000191343	0	0.000191343
60-57-1	Dieldrin	1.15404E-05	0	1.15404E-05
84-66-2	Diethyl Phthalate	0.001231584	0	0.001231584
131-11-3	Dimethyl Phthalate	0.001231584	0	0.001231584
84-74-2	Di-n-butyl Phthalate	0.001231584	0	0.001231584
117-84-0	Di-n-octyl Phthalate	0.001231584	0	0.001231584
959-98-8	Endosulfan I	5.79147E-06	0	5.79147E-06
33213-65-9	Endosulfan II	1.15404E-05	0	1.15404E-05
1031-07-8	Endosulfan Sulfate	1.15404E-05	0	1.15404E-05
72-20-8	Endrin	1.15404E-05	0	1.15404E-05
7421-93-4	Endrin Aldehyde	1.15404E-05	0	1.15404E-05
53494-70-5	Endrin Ketone	1.15404E-05	0	1.15404E-05
100-41-4	Ethylbenzene	0.000529606	0.000482	0.001011606
206-44-0	Fluoranthene	0.001231584	0	0.001231584
86-73-7	Fluorene	0.001231584	0	0.001231584
462-06-6	Fluorobenzene	0.008737301		0.008737301
76-13-1	FREON-113	0.000385419	0.034	0.034385419
5103-74-2	Gamma Chlordane	3.3283E-05	0	3.3283E-05
58-89-9	Gamma-BHC (Lindane)	5.79147E-06	0	5.79147E-06
76-44-8	Heptachlor	5.79147E-06	0	5.79147E-06
1024-57-3	Heptachlor Epoxide	5.79147E-06	0	5.79147E-06
118-74-1	Hexachlorobenzene	0.001231584	0	0.001231584
87-68-3	Hexachlorobutadiene	0.001231584	0	0.001231584
77-47-4	Hexachlorocyclopentadiene	0.001231584	0	0.001231584
67-72-1	Hexachloroethane	0.001231584	0	0.001231584
110-54-3	Hexane	0.001120167		0.001120167
2691-41-0	HMX	0.000235872	0	0.000235872
193-39-5	Indeno(1,2,3-cd)pyrene	0.001231584	0	0.001231584
74-88-4	Iodomethane	0.000784134		0.000784134
7439-89-6	Iron	9.438456297	0.437	9.875456297
78-59-1	Isophorone	0.001231584	0	0.001231584
7439-92-1	Lead	0.006409627	0.013	0.019409627
7439-93-2	Lithium	0.148116009	0.0029	0.151016009
7439-95-4	Magnesium	33.49199549	34.5	67.99199549
7439-96-5w	Manganese	0.188464291	0.0269	0.215364291
7439-97-6	Mercury	4.40536E-05	0	4.40536E-05
72-43-5	Methoxychlor	5.79147E-05	0	5.79147E-05
75-09-2	Methylene Chloride	0.014699676	0.000697	0.015396676
7439-98-7	Molybdenum	0.01215327	0.0027	0.01485327
91-20-3	Naphthalene	0.001344013	0	0.001344013
13994-20-2	Neptunium-237	26.47635152	0	26.47635152
7440-02-0	Nickel	0.261572678	0.0163	0.277872678
14797-55-8	Nitrate	0.63263791	2.55	3.18263791

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
14797-65-0	Nitrite	0.003928125		0.003928125
14797-55-8nn	Nitrate/Nitrite	1.609755573	4.9	6.509755573
98-95-3	Nitrobenzene	0.000854054	0	0.000854054
7727-37-9	Nitrogen	0.911888948	0.62	1.531888948
621-64-7	N-Nitroso-di-n-propylamine	0.001231584	0	0.001231584
86-30-6	N-Nitrosodiphenylamine	0.001231584	0	0.001231584
348-51-6	O-Chloroflurobenzene	0.007169067		0.007169067
87-86-5	Pentachlorophenol	0.004912268	0	0.004912268
78-11-5	PETN	0.000112017	0	0.000112017
85-01-8	Phenanthrene	0.001231584	0	0.001231584
108-95-2	Phenol	0.001231584	0	0.001231584
108-86-1	Phenyl bromide, Monobromob	0.000224033	0	0.000224033
14265-44-2	Phosphate	0.187355687	0.22	0.407355687
13981-16-3	Plutonium-238	0.077661245	0.181	0.258661245
15117-48-3	Plutonium-239	0.001604465	0	0.001604465
PU-239/240	Plutonium-239/240	0.042182144	2	2.042182144
13982-10-0	Plutonium-242	0.022723533	#N/A	#N/A
7440-09-7	Potassium	9.811226641	3.65	13.46122664
13966-00-2	Potassium-40	48.3051639	0	48.3051639
13981-14-1	Protactinium-233	6.197215267	0	6.197215267
129-00-0	Pyrene	0.001231584	0	0.001231584
13982-63-3	Radium-226	1.16493353	0.52	1.68493353
15262-20-1	Radium-228	0.417873369		0.417873369
121-82-4	RDX	0.000120628	0	0.000120628
7782-49-2	Selenium	0.001281403	0.0015	0.002781403
7440-22-4	Silver	0.005213044	0.018	0.023213044
7440-23-5	Sodium	279.6337996	66.4	346.0337996
10098-97-2	Stronium-90	0.91727463	0.5	1.41727463
100-42-5	Styrene	0.000560083	0	0.000560083
127-18-4	Tetrachloroethene	0.000561683	0.000963	0.001524683
479-45-8	Tetryl	0.00033605	0	0.00033605
7440-28-0	Thallium	0.001649558	0.002	0.003649558
15623-47-9	Thorium-227	20.67086777	0.23	20.90086777
14274-82-9	Thorium-228	75.33339736	2.17	77.50339736
15594-54-4	Thorium-229		#N/A	#N/A
14269-63-7	Thorium-230	0.144156019	0.476	0.620156019
7440-29-1	Thorium-232	0.080276175	0.1	0.180276175
7440-31-5	Tin	0.011059047	0.0087	0.019759047
108-88-3	Toluene	0.000592599	0.000503	0.001095599
8001-35-2	Toxaphene	0.000579147	0	0.000579147
79-01-6	Trichloroethene	0.001578957	0.00231	0.003888957
75-69-4	Trichlorofluoromethane	0.000239418	0.000432	0.000671418
10028-17-8w	Tritium	65998.95738	799	66797.95738

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
13968-55-3	Uranium-233	1.361946326		1.361946326
U-233/234	Uranium-233/234	0.108421116	0.246	0.354421116
13966-29-5	Uranium-234	0.581258098	2.02	2.601258098
15117-96-1	Uranium-235	1.682512969	0.466	2.148512969
U-235/236	Uranium-235/236	0.018390817	0	0.018390817
7440-61-1	Uranium-238	0.14342314	0.409	0.55242314
7440-62-2	Vanadium	0.011081055	0.0146	0.025681055
108-05-4	Vinyl Acetate	0.000970982	0	0.000970982
75-01-4	Vinyl Chloride	0.000928358	0	0.000928358
1330-20-7	Xylenes, Total	0.000559569	0.000556	0.001115569
7440-66-6	Zinc	0.020243241	0.0577	0.077943241

Table B-2
Locations and Details of Water Quality Monitoring Sites
Used in Bedrock Flow Tube Calculations

Well / Seep I.D.	Parcel	Flow Tube	Well Depth (feet)	Screen Length (feet)	Depth into Bedrock (feet)	Comments
Bedrock Monitoring Wells						
0034 (a)	8	11	20.61	3	7.5	Abandoned – Historical Data Only. Use in flow Tube 11
0035 (a)	8	12	20+	2	6.0	Abandoned – Historical Data Only. Use in flow Tube 12
0012	7	11	36.70	10	13.0	Use in Flow Tube 11
0013	6	Recharge Area	55.72	3 (upper) 3 (lower)	56.5	Use in Flow Tube 15. At top of recharge area
0014	8	Recharge Area	51.31	3 (upper) 3 (lower)	39.5	Use in Flow Tube 15. At top of recharge area
0015	8	15	40.25	10	27.5	Use in Flow Tube 15. At top of recharge area
0116	8	Recharge Area	81.95	10	69.5	Use in Flow Tube 15. At top of recharge area
0117	8	12	18.10	10	15.0	Use in Flow Tube 12
0120	8	12	32.86	10	28.5	Use in Flow Tube 12
0227 (a)	8	13	35.29	2	3.0	Abandoned – Historical Data Only. Use In Flow Tube 13
0242 (a)	8	12	15.36	2	11.5	Abandoned – Historical Data Only. Use in flow Tube 12
0312	8	13	34.50	10	6.5	Use in Flow Tube 13
0318	7	9	31.07	10	17.0	Use in Flow Tube 9
0322	7	20	56.27	10	12.5	Use in Flow Tube 20
0323	8	13	17.53	5	8.0	Use in Flow Tube 13
0324	8	13	19.82	5	19.0	Use in Flow Tube 13
0325	7	7	31.93	10	26.0	Use in Flow Tube 7
0326	7	8	35.06	10	19.0	Use in Flow Tube 8
0332	MMCIC	20	31.56	10	19.0	Use in Flow Tube 20
0335	Off Site	15	54.51	5	33.0	Use in Flow Tube 15. In discharge area
0351	MMCIC	4	21.39	10	16.7	Use in Flow Tube 4. At top of recharge area
0354	4	4	26.06	10	11.5	Use in Flow Tube 4
0372	8	6	64.16	10	12.0	Use in Flow Tube 6
0380	8	6	63.08	10	28.0	Use in Flow Tube 6. At base of Flow Tube in discharge area
0381	8	6	39.59	10	12.0	Use in Flow Tube 6
0382	8	6	37.25	10	17.8	Use in Flow Tube 6
0399	4	3	34.93	10	29.0	Use in Flow Tube 3
0411	5	5	39.70	10	24.0	Use in Flow Tube 5
0442	Phase I	3	33.45	10	28.5	Use in Flow Tube 3
0443	Phase I	6	37.86	10	36.5	Use in Flow Tube 6
0444	Phase I	5	30.68	10	29.5	Use in Flow Tube 5
0445	Phase I	5	40.53	10	38.5	Use in Flow Tube 5
P004	8	6	64.51	10	12.4	Use in Flow Tube 6
P021	7	12	33.08	5	8.0	Use in Flow Tube 12
P024	9	6	42.58	5	5.0	Use in Flow Tube 6

Table B-2
Locations and Details of Water Quality Monitoring Sites
Used in Bedrock Flow Tube Calculations

Well / Seep I.D.	Parcel	Flow Tube	Well Depth (feet)	Screen Length (feet	Depth into Bedrock (feet)	Comments
Interface Monitoring Wells – Partially Screened into Bedrock						
0314	8	6	45.47	10	65.5	Use in Flow Tube 6. At base of Flow Tube in discharge area
0353	8	5	22.12	5	2.0	Use in Flow Tube 5, although very Shallow
Bedrock Seeps with Annual Flow						
601	8	14	NA	NA	NA	Use in Flow Tube 14
607	3	18	NA	NA	NA	Use in Flow Tube 18
Production Wells						
0076	All	All	64	15.5	NA	Use as Receptor Well
0271	All	All	59	15.5	NA	Use as Receptor Well

a - abandoned

Table B-3
Contribution of Antimony to Bedrock-derived Groundwater for the Future Maximum Concentration Evaluation

Flow Tube (#)	Flow Tube Discharge (liters/yr)	Parameter Max. Conc. (mg/L)	Annual Bdrk Contribution (mg)
1	3158986	0.0067	21165
2	2622525	0.0067	17571
3	2986588	0.0067	20010
4	3497913	0.0063	22037
5	5926541	0.0117	69341
6	5179894	0.0111	57497
7	4577574	0.0102	46691
8	5311033	0.0128	67981
9	3438297	0.0085	29226
10	4286151	0.009	36432
11	3020572	0.0055	16613
12	4278420	0.03	128353
13	3684327	0.0176	64844
14	1624763	0.0302	49068
15	3136537	0.0031	9723
16	3742041	0.003	11600
17	8624724	0.0416	358788
18	5031433	0.0416	209308
19	4424896	0.0416	184076
20	1925159	0.0056	10781
Averages	4098873	0.015455	71555
Totals	81977457		***1431105***

Mound Water Use:

260000 gallons/day
94900000 gallons/year
359224970 liters/year

Projected to the BVA: Antimony contribution from bedrock 0.003984 mg/L

Figure B-1. Flow tube designations for calculating future constituents concentrations at the Mound Facility.

APPENDIX C

Tables

Table 1: Data Source Summary

Project Code	Description	Status	Matrix
BURNAREA	Burn Area Sampling	Used	Soil
WASTEBURI	Characterization of Waste Burial Areas	Used	Soil
BLDG21	D & D Building 21 and Surrounding Soils	Used	Soil
BLDG21-97	D & D Building 21 and Surrounding Soils Jul 97	Used	Soil
HWSF	Hazardous Waste Storage Facility	Used	Soil
MND20	Mound - Operable Unit 9	Used	Soil
DOEES	Mound Plant Environmental Survey	Filtered Out	Soil
SCRDATA	Mound Plant Screening Data	Used	Soil
34896	New Property	Used	Soil
34897	New Property Extended Phase	Used	Soil
MND33	Operable Unit 3 LFI	Used	Soil
2680	Operational Area Investigation (OU5)	Used	Soil
MND17	Other Soils Areas	Filtered Out	Soil
RSS	Radiological Site Survey - OU9 Site Scoping Report	Used	Soil
OU6RECON	Reconnaissance Sampling OU6 D&D Areas	Used	Soil
04-2768	Regional Soils Investigation	Used	Soil
SGCSP	Soil Gas Confirmation Sampling	Used	Soil
SGS	Soil Gas Survey Area K	Filtered Out	Soil
PRS280	PRS 280	Used	Soil
PRS407VERF	PRS 407 Verfication Sampling	Used	Soil
P4P5BOUND	Parcel 4, Parcel 5 Boundary	Used	Soil
PRS421	PRS 421 Sample Data	Used	Soil
TF2001	Test Fire Valley (PRS 72, 73 & 87)	Used	Soil
PRS274	PRS 274/275 Characterization (one borehole B103 at edge of PRS)	Used	Soil
PRS276V	PRS 276 Verification	Used	Soil
WELL0411	Well 0411 Additional Work	Used	Soil
PRS421V	PRS 421 Verification 2002	Used	Soil
PRS276C	PRS 276 Characterization	Used	Soil
BDB2002	Bio degredation Barn Petrol Sampling	Used	Soil
GWMDR	Cum. GW Monitoring Data Report 4th Qtr FY'92	Used	Water
GWSW	GW and Seep Water Reports 91	Used	Water
GWMDR2	GW Monitoring and Mapping Results Dec 92	Used	Water
GWMDR6	GW Monitoring and Mapping Results Dec 95	Used	Water

Table 1: Data Source Summary

Project Code	Description	Status	Matrix
GWMDR5	GW Monitoring and Mapping Results Jun 95	Used	Water
GWMDR3	GW Monitoring and Mapping Results Mar 93	Used	Water
GWQDR	GW Quality Data Sampling Hits 2/84 thru 9/91	Used	Water
GWPMPP398	GWPMPP & OU1 Qtr Mon Mar 98	Used	Water
GWPMPP1297	GWPMPP Annual & OU1 Qtr Mon DEC. 97	Used	Water
GWPMPP	GWPMPP Dec 96 Annual Sampling	Used	Water
GWPMPP697	GWPMPP Semi-Annual & OU1 Qtr Mon Jun 97	Used	Water
GWPMPP997	GWPMPP Semi-Annual & OU1 Qtr Mon Sep 97	Used	Water
GWPMPP0698	GWPMPP Semi-Annual Jun 98	Used	Water
MHSEEP	Main Hill Seep Sampling	Used	Water
MAR97GWP	Mar 1997 Quarterly Groundwater Monitoring	Used	Water
DOEES	Mound Plant Environmental Survey	Filtered Out	Water
34897	New Property Extended Phase	Used	Water
OU1PTBASE	OU-1 Pump & Treat Baseline, Spring Qtr 97	Used	Water
SWEEPS	OU9 Groundwater Sweeps	Used	Water
MND01	Operable Unit 1	Used	Water
MND23	PAW Soils - Operable Unit 1(RIR)	Used	Water
PRS111	PRS 111 Sampling	Used	Water
04-2768	Regional Soils Investigation	Used	Water
SPRFLG	Spring Fling Tritium Water Sampling (Pre Weston)	Used	Water
SWSD	Surface Water and Sediment	Used	Water
GWPMPP1098	GWPMPP QTR MON.OCT. 98	Used	Water
GWPMPP0199	GWPMPP ANNUAL MON. JAN. 99	Used	Water
GWPMPP4_99	GWPMPP QUARTERLY MONITORING APRIL 1999	Used	Water
GWPMPP6_99	GWPMPP SEMI-ANNUAL MONITORING JUNE 1999	Used	Water
GWPMPP9_99	GWPMPP Fall 1999 Quarterly Groundwater Monitoring	Used	Water
GWPMPP1_00	GWPMPP Annual Monitoring January 2000	Used	Water
DWRAPC91	Drinking Water Risk Assessment Project Chemical 91	Used	Water
DWRAPC92	Drinking Water Risk Assessment Project Chemical 92	Used	Water
DWRAPC93	Drinking Water Risk Assessment Project Chemical 93	Used	Water
DWRAPC94	Drinking Water Risk Assessment Project Chemical 94	Used	Water
DWRAPC95	Drinking Water Risk Assessment Project Chemical 95	Used	Water
DWRAPC96	Drinking Water Risk Assessment Project Chemical 96	Used	Water

Table 1: Data Source Summary

Project Code	Description	Status	Matrix
DWRAPC97	Drinking Water Risk Assessment Project Chemical 97	Used	Water
DWRAPC98	Drinking Water Risk Assessment Project Chemical 98	Used	Water
DWRAPC99	Drinking Water Risk Assessment Project Chemical 99	Used	Water
DWRAPC00	Drinking Water Risk Assessment Project Chemical 00	Used	Water
DWRAPR99	Drinking Water Risk Assessment Project Rad 99	Used	Water
GWPMPP4_00	GWPMPP Quarterly GW Monitoring - April 2000	Used	Water
GWPMPP6_00	GWPMPP Semiannual GW Monitoring June 2000	Used	Water
GWPMPP9_00	GWPMPP Quarterly Monitoring - September 2000	Used	Water
GWPMPP1_01	GWPMPP Quarterly GW Monitoring - Jan 2001	Used	Water
GWPMPP4_01	GWPMPP Quarterly Monitoring April 2001	Used	Water
GWPMPP7_01	GWPMPP Semiannual GW Monitoring - July 2001	Used	Water
GWPMPP1001	GWPMPP Quarterly Monitoring - October 2001	Used	Water
GWPMPP4_02	GWPMPP Quarterly Monitoring April 2002	Used	Water
DWRAPC01	Drinking Water Risk Assessment Project Chemical 01	Used	Water
DWRAPC02	Drinking Water Risk Assessment Project Chemical 02	Used	Water

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Inorganics (mg/kg)									
Aluminum	7429-90-5	589.000	23000.000	N	145/ 146	23000.000	19000.000	21291.667	YES
Antimony	7440-36-0	0.210	44.500	D	64/ 209	44.500		8.517	YES
Arsenic	7440-38-2	0.490	19.500	X	137/ 143	19.500	8.600	1.987	YES
Barium	7440-39-3	4.400	604.000	X	226/ 227	604.000	180.000	1490.417	NO:2
Beryllium	7440-41-7	0.050	3.600	X	220/ 226	3.600	1.300	42.118	NO:2
Bismuth	7440-69-9	0.820	72.700	X	33/ 59	72.700			YES
Cadmium	7440-43-9s	0.250	11.700	D	69/ 227	11.700	2.100	21.292	NO:2
Calcium	7440-70-2	1420.000	342000.000	X	145/ 146	342000.000	310000.000		NO:4
Chromium	7440-47-3	1.100	37.000	X	226/ 227	37.000	20.000	31937.500	NO:2
Chromium VI	18540-29-9	1.100	37.000	X	226/ 227	37.000	20.000	63.664	NO:2
Cobalt	7440-48-4	0.790	25.000	X	145/ 146	25.000	19.000	1277.500	NO:2
Copper	7440-50-8	1.800	1100.000	X	143/ 146	1100.000	26.000	851.667	YES
Cyanide	57-12-5	0.100	8.900	D	35/ 162	8.900		425.833	NO:2
Iron	7439-89-6	23.000	43000.000	N	145/ 146	43000.000	35000.000		NO:4
Lead	7439-92-1	1.600	220.000	X	242/ 256	220.000	48.000		YES
Lithium	7439-93-2	2.300	34.100	N	53/ 55	34.100	26.000		YES
Magnesium	7439-95-4	12.000	120000.000	X	145/ 146	120000.000	40000.000		NO:4
Manganese	7439-96-5s	65.200	8190.000	X	137/ 138	8190.000	1400.000	2276.586	YES
Mercury	7439-97-6	0.030	1.400	D	61/ 139	1.400		6.387	NO:2
Molybdenum	7439-98-7	0.220	9.700	L	49/ 54	9.700	27.000	106.458	NO:2,3
Nickel	7440-02-0	2.300	247.000	X	224/ 227	247.000	32.000	425.833	NO:2
Potassium	7440-09-7	305.000	326000.000	X	142/ 147	326000.000	1900.000		NO:4
Selenium	7782-49-2	0.460	2.300	D	19/ 131	2.300		106.458	NO:2
Silver	7440-22-4	0.110	20.800	D	65/ 227	20.800	1.700	106.458	NO:2
Sodium	7440-23-5	41.700	3450.000	X	136/ 146	3450.000	240.000		NO:4
Thallium	7440-28-0	0.200	3.500	D	29/ 142	3.500	0.460	1.703	YES
Tin	7440-31-5	0.670	3.300	D	22/ 54	3.300	20.000	12775.000	NO:2,3
Vanadium	7440-62-2	1.700	42.700	X	145/ 146	42.700	25.000	149.042	NO:2
Zinc	7440-66-6	5.500	463.000	X	145/ 146	463.000	140.000	6387.500	NO:2

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Pesticides (mg/kg)									
4,4'-DDE	72-55-9	0.000	0.002	D	7/ 121	0.002	0.004	8.767	NO:2,3
Chlordane	57-74-9	0.019	0.098	D	2/ 23	0.098			YES
SVOCs (mg/kg)									
Anthracene	120-12-7	0.022	2.800	D	13/ 174	2.800		6387.500	NO:2
Benzo(a)anthracene	56-55-3	0.023	4.200	D	31/ 174	4.200		4.083	YES
Benzo(a)pyrene	50-32-8	0.023	3.600	D	29/ 174	3.600		0.408	YES
Benzo(b)fluoranthene	205-99-2	0.025	2.800	D	35/ 174	2.800		4.083	NO:2
Benzo(g,h,i)perylene	191-24-2	0.027	2.100	D	16/ 174	2.100			YES
Benzo(k)fluoranthene	207-08-9	0.021	3.400	D	27/ 174	3.400		40.833	NO:2
Bis(2-ethylhexyl)phthalate	117-81-7	0.019	6.500	D	59/ 159	6.500		212.917	NO:2
Chrysene	218-01-9	0.020	1.700	D	30/ 159	1.700		408.328	NO:2
Di-n-butyl Phthalate	84-74-2	0.021	2.000	D	61/ 240	2.000		2129.167	NO:2
Fluoranthene	206-44-0	0.023	11.000	D	48/ 174	11.000		851.667	NO:2
Indeno(1,2,3-cd)pyrene	193-39-5	0.025	1.900	D	18/ 174	1.900		4.083	NO:2
N-Nitrosodiphenylamine	86-30-6	0.057	0.210	D	8/ 159	0.210		608.333	NO:2
Phenanthrene	85-01-8	0.027	11.000	D	32/ 174	11.000			YES
Pyrene	129-00-0	0.026	9.700	D	45/ 174	9.700		638.750	NO:2
VOCs (mg/kg)									
2-Butanone	78-93-3	0.001	0.031	D	18/ 177	0.031		2279.081	NO:2
4-Methyl-2-pentanone	108-10-1	0.001	0.007	D	9/ 177	0.007		1703.333	NO:2
Acetone	67-64-1	0.004	0.170	D	48/ 177	0.170		2129.167	NO:2
Dichloromethane (Methylene Chloride)	75-09-2	0.003	0.068	D	96/ 200	0.068		82.665	NO:2
Naphthalene	91-20-3	0.001	0.006	D	3/ 6	0.006		425.520	NO:2
Tetrachloroethene	127-18-4	0.002	0.041	D	13/ 200	0.041		38.005	NO:2
Toluene	108-88-3	0.001	0.051	D	35/ 200	0.051		200.348	NO:2
Xylenes, Total	1330-20-7	0.001	0.039	D	16/ 177	0.039		42583.333	NO:2
mp-Xylene	mp-Xylene	0.005	0.006	X	23/ 23	0.006		276.987	NO:2

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Radionuclides (pCi/g)									
Actinium-227	14952-40-0	0.050	2.110	D	37/ 282	2.110		4.368	NO:2
Actinium-227 +D	14952-40-0(+D)	0.050	2.110	D	37/ 282	2.110		0.453	YES
Actinium-227 long lived decay	14952-40-0L	0.050	2.110	D	37/ 282	2.110		0.453	YES
Actinium-228	14331-83-0	0.762	1.380	D	7/ 7	1.380		0.215	YES
Bismuth-214	14733-03-0	0.699	0.926	N	10/ 10	0.926		0.130	YES
Cesium-137	10045-97-3	0.021	1.600	D	276/ 564	1.600	0.420	37.698	NO:2
Cesium-137 +D	10045-97-3(+D)	0.021	1.600	D	276/ 564	1.600	0.420	0.378	YES
Cesium-137 long lived decay	10045-97-3L	0.021	1.600	D	276/ 564	1.600	0.420	0.378	YES
Lead-210	14255-04-0	0.487	3.730	X	180/ 344	3.730		0.905	YES
Lead-210+D	14255-04-0(+D)	0.487	3.730	X	180/ 344	3.730		0.625	YES
Lead-210 long lived decay	14255-04-0L	0.487	3.730	X	180/ 344	3.730		0.625	YES
Lead-212	15092-94-1	0.843	1.220	L	10/ 10	1.220		1.776	NO:2
Lead-214	15067-28-4	0.570	1.120	N	20/ 20	1.120		0.991	YES
Plutonium-238	13981-16-3	0.012	396.400	D	665/1545	396.400	0.130	6.125	YES
Plutonium-239	15117-48-3	0.004	1.270	X	83/ 90	1.270	0.180	6.031	NO:2
Plutonium-239/240	PU-239/240	0.004	1.010	D	79/ 254	1.010	0.180		YES
Potassium-40	13966-00-2	7.180	36.600	X	122/ 126	36.600	37.000	1.168	NO:3
Radium-224	13233-32-4	0.073	6.270	X	190/ 190	6.270		3.238	YES
Radium-226	13982-63-3	0.179	3.700	X	494/ 567	3.700	2.000	2.170	YES
Radium-226+D	13982-63-3(+D)	0.179	3.700	X	494/ 567	3.700	2.000	0.109	YES
Radium-226 long lived decay	13982-63-3L	0.179	3.700	X	494/ 567	3.700	2.000	0.093	YES
Radium-228	15262-20-1	0.309	1.990	N	80/ 81	1.990		0.731	YES
Radium-228+D	15262-20-1(+D)	0.309	1.990	N	80/ 81	1.990		0.166	YES
Radium-228 long lived decay	15262-20-1L	0.309	1.990	N	80/ 81	1.990		0.069	YES
Thallium-208	14913-50-9	0.156	0.401	N	10/ 10	0.401		0.055	YES
Thorium-227	15623-47-9	0.060	0.440	L	17/ 33	0.440		2.125	NO:2
Thorium-228	14274-82-9	0.037	4.520	X	342/ 384	4.520	1.500	5.582	NO:2
Thorium-228+D	14274-82-9(+D)	0.037	4.520	X	342/ 384	4.520	1.500	0.118	YES
Thorium-228 long lived decay	14274-82-9L	0.037	4.520	X	342/ 384	4.520	1.500	0.118	YES
Thorium-230	14269-63-7	0.100	7.510	X	340/ 595	7.510	1.900	8.194	NO:2

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Thorium-230 long lived decay	14269-63-7L	0.100	7.510	X	340/ 595	7.510	1.900	0.092	YES
Thorium-232	7440-29-1	0.045	80.100	D	789/1805	80.100	1.400	7.197	YES
Thorium-232 long lived decay	7440-29-1L	0.045	80.100	D	789/1805	80.100	1.400	0.068	YES
Uranium-234	13966-29-5	0.375	1.560	N	46/ 54	1.560	1.100	10.520	NO:2
Uranium-235	15117-96-1	0.027	0.210	D	28/ 77	0.210	0.110	1.596	NO:2
Uranium-235+D	15117-96-1(+D)	0.027	0.210	D	28/ 77	0.210	0.110	1.525	NO:2
Uranium-235 long lived decay	15117-96-1L	0.027	0.210	D	28/ 77	0.210	0.110	0.310	NO:2
Uranium-238	7440-61-1	0.408	1.950	X	72/ 119	1.950	1.200	11.648	NO:2
Uranium-238+D	7440-61-1(+D)	0.408	1.950	X	72/ 119	1.950	1.200	4.113	NO:2
Uranium-238 long lived decay	7440-61-1L	0.408	1.950	X	72/ 119	1.950	1.200	0.089	YES

"+D" : incorporates daughter products within the risk calculations

CAS: Chemical Abstract Service

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index

VOC: volatile organic compound

SVOC: semivolatile organic compound

Dist.: distribution where:

N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and

X = significantly different from lognormal or normal distribution

COPC: Constituent of Potential Concern, evaluation based on maximum detect vs. background or RBGV

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

Tab[illegible]: Final Identification of Current and Future [illegible]il COPCs for the Construction Worker Sce[illegible]io

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Inorganics (mg/kg)									
Aluminum	7429-90-5	589.000	23000.000	N	145/ 146	15400.000	15400.000	19000.000	NO
Antimony	7440-36-0	0.210	44.500	D	64/ 209	8.460	8.460		YES
Arsenic	7440-38-2	0.490	19.500	X	137/ 143	8.220	8.220	8.600	NO
Bismuth	7440-69-9	0.820	72.700	X	33/ 59	133.000	72.700		YES
Copper	7440-50-8	1.800	1100.000	X	143/ 146	22.100	22.100	26.000	NO
Lead	7439-92-1	1.600	220.000	X	242/ 256	15.400	15.400	48.000	NO
Lithium	7439-93-2	2.300	34.100	N	53/ 55	18.300	18.300	26.000	NO
Manganese	7439-96-5s	65.200	8190.000	X	137/ 138	679.000	679.000	1400.000	NO
Thallium	7440-28-0	0.200	3.500	D	29/ 142	1.140	1.140	0.460	YES
Pesticides (mg/kg)									
Chlordane	57-74-9	0.019	0.098	D	2/ 23	0.016	0.016		YES
SVOCs (mg/kg)									
Benzo(a)anthracene	56-55-3	0.023	4.200	D	31/ 174	0.321	0.321		YES
Benzo(a)pyrene	50-32-8	0.023	3.600	D	29/ 174	0.316	0.316		YES
Benzo(g,h,i)perylene	191-24-2	0.027	2.100	D	16/ 174	0.304	0.304		YES
Phenanthrene	85-01-8	0.027	11.000	D	32/ 174	0.348	0.348		YES
Radionuclides (pCi/g)									
Actinium-227 +D	14952-40-0(+D)	0.050	2.110	D	37/ 282	0.304	0.304		YES:1
Actinium-227 long lived decay	14952-40-0L	0.050	2.110	D	37/ 282	0.304	0.304		YES
Actinium-228	14331-83-0	0.762	1.380	D	7/ 7	1.230	1.380		YES:3
Bismuth-214	14733-03-0	0.699	0.926	N	10/ 10	0.858	0.926		YES:2
Cesium-137 +D	10045-97-3(+D)	0.021	1.600	D	276/ 564	0.159	0.159	0.420	NO
Cesium-137 long lived decay	10045-97-3L	0.021	1.600	D	276/ 564	0.159	0.159	0.420	NO
Lead-210	14255-04-0	0.487	3.730	X	180/ 344	1.150	1.150		YES:2
Lead-210+D	14255-04-0(+D)	0.487	3.730	X	180/ 344	1.150	1.150		YES:2
Lead-210 long lived decay	14255-04-0L	0.487	3.730	X	180/ 344	1.150	1.150		YES:2
Lead-214	15067-28-4	0.570	1.120	N	20/ 20	0.921	0.921		YES:2
Plutonium-238	13981-16-3	0.012	396.400	D	665/1545	25.900	25.900	0.130	YES
Plutonium-239/240	PU-239/240	0.004	1.010	D	79/ 254	0.044	0.044	0.180	NO
Radium-224	13233-32-4	0.073	6.270	X	190/ 190	1.250	1.250		YES:3

Table 3: Final Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Radium-226	13982-63-3	0.179	3.700	X	494/ 567	1.240	1.240	2.000	NO
Radium-226+D	13982-63-3(+D)	0.179	3.700	X	494/ 567	1.240	1.240	2.000	NO
Radium-226 long lived decay	13982-63-3L	0.179	3.700	X	494/ 567	1.240	1.240	2.000	NO
Radium-228	15262-20-1	0.309	1.990	N	80/ 81	1.220	1.220		YES:3
Radium-228+D	15262-20-1(+D)	0.309	1.990	N	80/ 81	1.220	1.220		YES:3
Radium-228 long lived decay	15262-20-1L	0.309	1.990	N	80/ 81	1.220	1.220		YES:3
Thallium-208	14913-50-9	0.156	0.401	N	10/ 10	0.377	0.401		YES:3
Thorium-228+D	14274-82-9(+D)	0.037	4.520	X	342/ 384	1.640	1.640	1.500	YES:3
Thorium-228 long lived decay	14274-82-9L	0.037	4.520	X	342/ 384	1.640	1.640	1.500	YES:3
Thorium-230 long lived decay	14269-63-7L	0.100	7.510	X	340/ 595	2.830	2.830	1.900	YES:2
Thorium-232	7440-29-1	0.045	80.100	D	789/1805	0.832	0.832	1.400	NO
Thorium-232 long lived decay	7440-29-1L	0.045	80.100	D	789/1805	0.832	0.832	1.400	YES:4
Uranium-238 long lived decay	7440-61-1L	0.408	1.950	X	72/ 119	1.880	1.880	1.200	YES

"+D" : incorporates daughter products within the risk calculations
CAS: Chemical Abstract Service
UCL: upper confidence limit
EPC: Exposure Point Concentration
SVOCs: semivolatile organic compounds
Dist.: distribution where:
N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and
X = significantly different from lognormal or normal distribution
COPC: Constituent of Potential Concern, evaluation based on EPC vs. background
COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). See Appendix H for details. For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation.
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

Table 4: Initial Identification of Current and Future Soil COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Explosives (mg/kg)									
Nitrobenzene	98-95-3	0.3800	0.380	D	1/ 12	0.380		102.200	NO:2
Inorganics (mg/kg)									
Aluminum	7429-90-5	589.0000	23000.000	N	105/ 105	23000.000	19000.000	204400.000	NO:2
Antimony	7440-36-0	0.2100	44.500	D	42/ 146	44.500		81.760	NO:2
Arsenic	7440-38-2	0.4900	19.500	X	104/ 105	19.500	8.600	3.804	YES
Barium	7440-39-3	4.4000	453.000	X	158/ 158	453.000	180.000	14308.000	NO:2
Beryllium	7440-41-7	0.1200	3.600	X	155/ 158	3.600	1.300	369.600	NO:2
Bismuth	7440-69-9	12.6000	72.700	X	26/ 36	72.700			YES
Cadmium	7440-43-9s	0.2500	11.700	D	43/ 158	11.700	2.100	204.400	NO:2
Calcium	7440-70-2	1420.0000	312000.000	X	105/ 105	312000.000	310000.000		NO:4
Chromium	7440-47-3	1.1000	37.000	X	158/ 158	37.000	20.000	306600.000	NO:2
Chromium VI	18540-29-9	1.1000	37.000	X	158/ 158	37.000	20.000	449.680	NO:2
Cobalt	7440-48-4	0.7900	25.000	X	105/ 105	25.000	19.000	12264.000	NO:2
Copper	7440-50-8	2.6000	1100.000	X	103/ 105	1100.000	26.000	8176.000	NO:2
Cyanide	57-12-5	0.1000	8.900	D	31/ 126	8.900		4088.000	NO:2
Iron	7439-89-6	23.0000	43000.000	N	105/ 105	43000.000	35000.000		NO:4
Lead	7439-92-1	1.6000	220.000	X	179/ 186	220.000	48.000		YES
Lithium	7439-93-2	2.3000	26.900	N	31/ 31	26.900	26.000		YES
Magnesium	7439-95-4	12.0000	116000.000	X	105/ 105	116000.000	40000.000		NO:4
Manganese	7439-96-5s	65.2000	1280.000	X	104/ 104	1280.000	1400.000	7208.611	NO:2,3
Mercury	7439-97-6	0.0300	0.650	D	43/ 97	0.650		61.255	NO:2
Molybdenum	7439-98-7	0.4700	9.700	L	29/ 31	9.700	27.000	1022.000	NO:2,3
Nickel	7440-02-0	2.3000	247.000	X	157/ 158	247.000	32.000	4088.000	NO:2
Potassium	7440-09-7	305.0000	5230.000	X	103/ 105	5230.000	1900.000		NO:4
Selenium	7782-49-2	0.4900	2.300	D	18/ 96	2.300		1022.000	NO:2
Silver	7440-22-4	0.1100	20.800	D	47/ 158	20.800	1.700	1022.000	NO:2
Sodium	7440-23-5	41.7000	3450.000	X	100/ 105	3450.000	240.000		NO:4
Thallium	7440-28-0	0.2200	3.500	D	27/ 100	3.500	0.460	16.352	NO:2
Tin	7440-31-5	1.1000	2.200	D	7/ 31	2.200	20.000	122640.000	NO:2,3
Vanadium	7440-62-2	1.7000	40.000	X	105/ 105	40.000	25.000	1430.800	NO:2

Table 4: Initial Identification of Current and Future Soil COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Zinc	7440-66-6	5.5000	463.000	X	105/ 105	463.000	140.000	61320.000	NO:2
Pesticides (mg/kg)									
4,4'-DDE	72-55-9	0.0003	0.002	D	7/ 85	0.002		16.833	NO:2
Chlordane	57-74-9	0.0190	0.098	D	2/ 23	0.098			YES
SVOCs (mg/kg)									
Anthracene	120-12-7	0.0220	2.800	D	11/ 134	2.800		61320.000	NO:2
Benzo(a)anthracene	56-55-3	0.0280	4.200	D	24/ 134	4.200		7.839	NO:2
Benzo(a)pyrene	50-32-8	0.0240	3.600	D	22/ 134	3.600		0.784	YES
Benzo(b)fluoranthene	205-99-2	0.0250	2.800	D	28/ 134	2.800		7.839	NO:2
Benzo(g,h,i)perylene	191-24-2	0.0270	2.100	D	12/ 134	2.100			YES
Benzo(k)fluoranthene	207-08-9	0.0250	3.400	D	24/ 134	3.400		78.390	NO:2
Bis(2-ethylhexyl)phthalate	117-81-7	0.0200	6.500	D	44/ 119	6.500		408.800	NO:2
Chrysene	218-01-9	0.0200	1.700	D	23/ 119	1.700		783.900	NO:2
Di-n-butyl Phthalate	84-74-2	0.0210	2.000	D	48/ 172	2.000		20440.000	NO:2
Dibenzofuran	132-64-9	0.0320	0.580	D	6/ 119	0.580		817.600	NO:2
Diethyl Phthalate	84-66-2	0.0390	0.110	D	6/ 119	0.110		163520.000	NO:2
Fluoranthene	206-44-0	0.0230	11.000	D	40/ 134	11.000		8176.000	NO:2
Fluorene	86-73-7	0.0380	1.100	D	7/ 134	1.100		8176.000	NO:2
Indeno(1,2,3-cd)pyrene	193-39-5	0.0250	1.900	D	14/ 134	1.900		7.839	NO:2
Phenanthrene	85-01-8	0.0270	11.000	D	25/ 134	11.000			YES
Pyrene	129-00-0	0.0280	9.700	D	37/ 134	9.700		6132.000	NO:2
VOCs (mg/kg)									
2-Butanone	78-93-3	0.0010	0.017	D	7/ 86	0.017		2712.604	NO:2
4-Methyl-2-pentanone	108-10-1	0.0010	0.006	D	5/ 86	0.006		16352.000	NO:2
Acetone	67-64-1	0.0040	0.150	D	14/ 86	0.150		20440.000	NO:2
Dichloromethane (Methylene Chloride)	75-09-2	0.0030	0.068	D	49/ 109	0.068		20.319	NO:2
Naphthalene	91-20-3	0.0010	0.006	D	3/ 6	0.006		18.747	NO:2
Tetrachloroethene	127-18-4	0.0020	0.028	D	7/ 109	0.028		18.719	NO:2
Toluene	108-88-3	0.0010	0.051	D	18/ 109	0.051		209.164	NO:2
Xylenes, Total	1330-20-7	0.0010	0.039	D	7/ 86	0.039		408800.000	NO:2
mp-Xylene	mp-Xylene	0.0050	0.006	X	23/ 23	0.006		278.611	NO:2

Table 4: Initial Identification of Current and Future Soil COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Radionuclides (pCi/g)									
Actinium-227	14952-40-0	0.0500	2.110	D	36/ 219	2.110		7.487	NO:2
Actinium-227 +D	14952-40-0(+D)	0.0500	2.110	D	36/ 219	2.110		0.485	YES
Actinium-227 long lived decay	14952-40-0L	0.0500	2.110	D	36/ 219	2.110		0.485	YES
Actinium-228	14331-83-0	0.7620	1.380	D	7/ 7	1.380		0.193	YES
Bismuth-214	14733-03-0	0.6990	0.926	N	10/ 10	0.926		0.117	YES
Cesium-137	10045-97-3	0.0211	1.600	X	258/ 461	1.600	0.420	70.723	NO:2
Cesium-137 +D	10045-97-3(+D)	0.0211	1.600	X	258/ 461	1.600	0.420	0.342	YES
Cesium-137 long lived decay	10045-97-3L	0.0211	1.600	X	258/ 461	1.600	0.420	0.342	YES
Lead-210	14255-04-0	0.6300	3.730	X	146/ 262	3.730		1.733	YES
Lead-210+D	14255-04-0(+D)	0.6300	3.730	X	146/ 262	3.730		1.194	YES
Lead-210 long lived decay	14255-04-0L	0.6300	3.730	X	146/ 262	3.730		1.194	YES
Lead-212	15092-94-1	0.8430	1.220	L	10/ 10	1.220		1.661	NO:2
Lead-214	15067-28-4	0.8270	1.120	N	10/ 10	1.120		0.892	YES
Plutonium-238	13981-16-3	0.0122	396.400	D	592/1308	396.400	0.130	11.330	YES
Plutonium-239	15117-48-3	0.0035	1.270	X	83/ 90	1.270	0.180	11.157	NO:2
Plutonium-239/240	PU-239/240	0.0039	1.010	D	64/ 230	1.010	0.180		YES
Potassium-40	13966-00-2	7.4500	36.000	X	96/ 96	36.000	37.000	1.076	NO:3
Radium-224	13233-32-4	0.0730	6.270	X	186/ 186	6.270		5.424	YES
Radium-226	13982-63-3	0.1790	3.700	X	411/ 466	3.700	2.000	3.921	NO:2
Radium-226+D	13982-63-3(+D)	0.1790	3.700	X	411/ 466	3.700	2.000	0.101	YES
Radium-226 long lived decay	13982-63-3L	0.1790	3.700	X	411/ 466	3.700	2.000	0.093	YES
Radium-228	15262-20-1	0.5450	1.990	N	74/ 75	1.990		1.403	YES
Radium-228+D	15262-20-1(+D)	0.5450	1.990	N	74/ 75	1.990		0.170	YES
Radium-228 long lived decay	15262-20-1L	0.5450	1.990	N	74/ 75	1.990		0.067	YES
Thallium-208	14913-50-9	0.1560	0.401	N	10/ 10	0.401		0.050	YES
Thorium-227	15623-47-9	0.0600	0.440	L	17/ 33	0.440		2.093	NO:2
Thorium-228	14274-82-9	0.0370	4.520	X	319/ 356	4.520	1.500	9.158	NO:2
Thorium-228+D	14274-82-9(+D)	0.0370	4.520	X	319/ 356	4.520	1.500	0.110	YES
Thorium-228 long lived decay	14274-82-9L	0.0370	4.520	X	319/ 356	4.520	1.500	0.110	YES
Thorium-230	14269-63-7	0.1000	7.510	X	317/ 499	7.510	1.900	14.979	NO:2
Thorium-230 long lived decay	14269-63-7L	0.1000	7.510	X	317/ 499	7.510	1.900	0.092	YES

Table 4: Initial Identification of Current and Future Soil COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Thorium-232	7440-29-1	0.0450	80.100	D	675/1518	80.100	1.400	13.041	YES
Thorium-232 long lived decay	7440-29-1L	0.0450	80.100	D	675/1518	80.100	1.400	0.066	YES
Tritium	10028-17-8p	1.3500	1.350	D	1/ 16	1.350		14541.469	NO:2
Uranium-234	13966-29-5	0.3890	1.560	N	25/ 29	1.560	1.100	19.707	NO:2
Uranium-235	15117-96-1	0.0326	0.210	D	13/ 55	0.210	0.110	1.559	NO:2
Uranium-235+D	15117-96-1(+D)	0.0326	0.210	D	13/ 55	0.210	0.110	1.488	NO:2
Uranium-235 long lived decay	15117-96-1L	0.0326	0.210	D	13/ 55	0.210	0.110	0.332	NO:2
Uranium-238	7440-61-1	0.4760	1.950	X	50/ 91	1.950	1.200	21.917	NO:2
Uranium-238+D	7440-61-1(+D)	0.4760	1.950	X	50/ 91	1.950	1.200	5.085	NO:2
Uranium-238 long lived decay	7440-61-1L	0.4760	1.950	X	50/ 91	1.950	1.200	0.090	YES

"+D" : incorporates daughter products within the risk calculations
CAS: Chemical Abstract Service
RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
VOC: volatile organic compound
SVOC: semivolatile organic compound
Dist.: distribution where:
N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and
X = significantly different from lognormal or normal distribution
COPC: Constituent of Potential Concern, evaluation based on maximum detect vs. background or RBGV
COPC = YES indicates the analyte is retained as a COPC
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

Table 5: Final Identification of Current and Future Soil COPCs for the Site Employee Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Inorganics (mg/kg)									
Arsenic	7440-38-2	0.4900	19.500	X	9.9E-01	8.880	8.880	8.600	YES
Bismuth	7440-69-9	12.6000	72.700	X	26/ 36	104.000	72.700		YES
Lead	7439-92-1	1.6000	220.000	X	179/ 186	16.700	16.700	48.000	NO
Lithium	7439-93-2	2.3000	26.900	N	31/ 31	16.600	16.600	26.000	NO
Pesticides (mg/kg)									
Chlordane	57-74-9	0.0190	0.098	D	2/ 23	0.016	0.016		YES
SVOCs (mg/kg)									
Benzo(a)pyrene	50-32-8	0.0240	3.600	D	22/ 134	0.350	0.350		YES
Benzo(g,h,i)perylene	191-24-2	0.0270	2.100	D	12/ 134	0.333	0.333		YES
Phenanthrene	85 01-8	0.0270	11.000	D	25/ 134	0.398	0.398		YES
Radionuclides (pCi/g)									
Actinium-227 +D	14952-40-0(+D)	0.0500	2.110	D	36/ 219	0.354	0.354		YES
Actinium-227 long lived decay	14952-40-0L	0.0500	2.110	D	36/ 219	0.354	0.354		YES
Actinium-228	14331-83-0	0.7620	1.380	D	7/ 7	1.230	1.380		YES:3
Bismuth-214	14733-03-0	0.6990	0.926	N	10/ 10	0.858	0.926		YES:2
Cesium-137 +D	10045-97-3(+D)	0.0211	1.600	X	258/ 461	0.179	0.179	0.420	NO
Cesium-137 long lived decay	10045-97-3L	0.0211	1.600	X	258/ 461	0.179	0.179	0.420	NO
Lead-210	14255-04-0	0.6300	3.730	X	146/ 262	1.290	1.290		YES:2
Lead-210+D	14255-04-0(+D)	0.6300	3.730	X	146/ 262	1.290	1.290		YES:2
Lead-210 long lived decay	14255-04-0L	0.6300	3.730	X	146/ 262	1.290	1.290		YES:2
Lead-214	15067-28-4	0.8270	1.120	N	10/ 10	1.030	1.120		YES:2
Plutonium-238	13981-16-3	0.0122	396.400	D	592/1308	24.900	24.900	0.130	YES
Plutonium-239/240	PU-239/240	0.0039	1.010	D	64/ 230	0.044	0.044	0.180	NO
Radium-224	13233-32-4	0.0730	6.270	X	186/ 186	1.260	1.260		YES:3
Radium-226+D	13982-63-3(+D)	0.1790	3.700	X	411/ 466	1.250	1.250	2.000	NO
Radium-226 long lived decay	13982-63-3L	0.1790	3.700	X	411/ 466	1.250	1.250	2.000	NO
Radium-228	15262-20-1	0.5450	1.990	N	74/ 75	1.260	1.260		YES:3
Radium-228+D	15262-20-1(+D)	0.5450	1.990	N	74/ 75	1.260	1.260		YES:3
Radium-228 long lived decay	15262-20-1L	0.5450	1.990	N	74/ 75	1.260	1.260		YES:3
Thallium-208	14913-50-9	0.1560	0.401	N	10/ 10	0.377	0.401		YES:3
Thorium-228+D	14274-82-9(+D)	0.0370	4.520	X	319/ 356	1.700	1.700	1.500	YES:3

Table 5: Final Identification of Current and Future Soil COPCs for the Site Employee Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Thorium-228 long lived decay	14274-82-9L	0.0370	4.520	X	319/ 356	1.700	1.700	1.500	YES:3
Thorium-230 long lived decay	14269-63-7L	0.1000	7.510	X	317/ 499	2.700	2.700	1.900	YES:2
Thorium-232	7440-29-1	0.0450	80.100	D	675/1518	0.873	0.873	1.400	NO
Thorium-232 long lived decay	7440-29-1L	0.0450	80.100	D	675/1518	0.868	0.868	1.400	YES:4
Uranium-238 long lived decay	7440-61-1L	0.4760	1.950	X	50/ 91	2.030	1.950	1.200	YES

"+D" : incorporates daughter products within the risk calculations
CAS: Chemical Abstract Service
UCL: upper confidence limit
EPC: Exposure Point Concentration
SVOCs: semivolatile organic compounds
Dist.: distribution where:
N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and
X = significantly different from lognormal or normal distribution
COPC: Constituent of Potential Concern, evaluation based on EPC vs. background
COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). See Appendix H for details. For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation.

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or
4 = analyte is an essential human nutrient

Table 6: Initial Identification of Current Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Nitrate (Mound CAS 7697-37-2)	14797-55-8	0.7380	2.550	2/ 2	2.550	5.349	10.000	c	NO:2,3
Nitrate/Nitrite (Mound CAS 1497-55-8)	14797-65-0	0.6800	4.900	11/ 11	4.900	5.349	1.000	c	NO:2
Aluminum	7429-90-5	0.0688	0.148	6/ 22	0.148	0.038	10.187	b	NO:3
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.014	0.001	0.004	b	YES
Barium	7440-39-3	0.0750	0.115	20/ 22	0.115	0.310	0.713	b	NO:2,3
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.008		0.005	c	YES
Calcium	7440-70-2	94.3000	126.000	24/ 24	126.000	111.111			NO:4
Chromium	7440-47-3	0.0183	0.024	5/ 25	0.024	0.006	0.100	c	NO:3
Chromium VI	18540-29-9	0.0183	0.024	5/ 25	0.024	0.006	0.031	b	NO:3
Copper	7440-50-8	0.0016	0.593	15/ 25	0.593	0.001	0.407	b	YES
Iron	7439-89-6	0.0190	1.890	13/ 24	1.890	4.065			NO:4
Lead	7439-92-1	0.0034	0.040	5/ 25	0.040				YES
Lithium	7439-93-2	0.0029	0.003	2/ 4	0.003	0.056			NO:2
Magnesium	7439-95-4	29.1000	39.600	24/ 24	39.600	40.428			NO:4
Manganese	7439-96-5w	0.0028	0.224	22/ 24	0.224	0.230	0.479	b	NO:2,3
Molybdenum	7439-98-7	0.0020	0.003	2/ 4	0.003	0.006	0.051	b	NO:2,3
Nickel	7440-02-0	0.0021	0.027	5/ 25	0.027	0.035	0.204	b	NO:2,3
Potassium	7440-09-7	2.3900	3.650	20/ 26	3.650	4.461			NO:4
Silver	7440-22-4	0.0169	0.024	5/ 22	0.024		0.051	b	NO:3
Sodium	7440-23-5	46.6000	84.200	24/ 24	84.200	62.426			NO:4
Tin	7440-31-5	0.0087	0.009	1/ 4	0.009	0.034	6.112	b	NO:2,3
Vanadium	7440-62-2	0.0078	0.015	7/ 22	0.015	0.017	0.071	b	NO:2,3
Zinc	7440-66-6	0.0045	0.058	9/ 25	0.058	0.120	3.056	b	NO:2,3
Volatile Organic Compounds (mg/L)									
1,1,1-Trichloroethane	71-55-6	0.0003	0.003	91/ 215	0.003		0.200	c	NO:3
1,2-Dichloroethene *	540-59-0	0.0013	0.007	10/ 13	0.007		0.070	c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0005	0.004	102/ 182	0.004		0.070	c	NO:3
2-Butanone	78-93-3	0.0070	0.041	3/ 13	0.041		5.111	b	NO:3
Acetone	67-64-1	0.0020	0.012	6/ 11	0.012		1.022	b	NO:3
Chloroform (Trichloromethane)	67-66-3	0.0005	0.007	13/ 219	0.007		0.035	b	NO:3
FREON-113	76-13-1	0.0020	0.034	12/ 19	0.034		246.554	b	NO:3
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.002				YES
Tetrachloroethene	127-18-4	0.0003	0.002	114/ 218	0.002		0.003	a	NO:3

Table 6: Initial Identification of Current Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.006		0.001 b	YES
Radionuclides (pCi/L)								
Bismuth-210	14331-79-4	0.1100	0.390	2/ 18	0.390		89.686	NO:3
Plutonium-238	13981-16-3	0.0060	0.250	8/ 57	0.250	0.087	6.107	NO:3
Plutonium-238/239	PU-238/239	0.0100	0.010	1/ 6	0.010		5.926	NO:3
Plutonium-239/240	PU-239/240	0.0018	2.000	5/ 19	2.000	0.125	5.926	NO:3
Radium-226	13982-63-3	0.1000	0.520	6/ 18	0.520	0.996	2.078	NO:2,3
Radium-226+D	13982-63-3(+D)	0.1000	0.520	6/ 18	0.520	0.996	2.073	NO:2,3
Radium-226 long lived decay	13982-63-3L	0.1000	0.520	6/ 18	0.520	0.996	0.483	NO:2
Strontium-85	13967-73-2	25.0000	25.000	1/ 2	25.000		353.982	NO:3
Strontium-90	10098-97-2	0.5000	0.500	3/ 18	0.500		14.311	NO:3
Thorium-227	15623-47-9	0.0110	0.230	16/ 22	0.230		16.878	NO:3
Thorium-228	14274-82-9	0.0085	2.170	17/ 46	2.170	0.779	7.477	NO:3
Thorium-228+D	14274-82-9(+D)	0.0085	2.170	17/ 46	2.170	0.779	2.667	NO:3
Thorium-228 long lived decay	14274-82-9L	0.0085	2.170	17/ 46	2.170	0.779	2.667	NO:3
Thorium-230	14269-63-7	0.0075	1.990	19/ 43	1.990		8.791	NO:3
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	1.990		0.458	YES
Thorium-232	7440-29-1	0.0025	0.100	8/ 44	0.100	0.314	7.921	NO:2,3
Thorium-232 long lived decay	7440-29-1L	0.0025	0.100	8/ 44	0.100	0.314	0.555	NO:2,3
Tritium	10028-17-8w	30.0000	7200.000	123/ 139	7200.000	1485.470	15544.541	NO:3
Uranium-233/234	U-233/234	0.1670	0.361	36/ 36	0.361		1.334	NO:3
Uranium-234	13966-29-5	0.2000	8.140	19/ 24	8.140	0.792	11.315	NO:3
Uranium-235	15117-96-1	0.0063	2.300	30/ 53	2.300	0.814	11.494	NO:3
Uranium-235+D	15117-96-1(+D)	0.0063	2.300	30/ 53	2.300	0.814	11.142	NO:3
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	2.300	0.814	1.095	YES
Uranium-238	7440-61-1	0.1300	8.250	52/ 59	8.250	0.688	12.500	NO:3
Uranium-238+D	7440-61-1(+D)	0.1300	8.250	52/ 59	8.250	0.688	9.185	NO:3
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	8.250	0.688	0.420	YES

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Table 6: Initial Identification of Current Groundwater COPCs for the Construction Worker Scenario

footnotes

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
"+D": incorporates daughter products within the risk calculations
* 1,2-cis-dichloroethene isomer RBGV used for screening due to lack of criteria for 1,2-dichloroethene

COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 7: Final Identification of Current Groundwater COPCs for the Construction Worker Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	95% UCL	EPC	Background Concentration	COPC
Inorganics (mg/L)								
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.044	0.014	0.001	YES
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.007	0.007		YES
Copper	7440-50-8	0.0016	0.593	15/ 25	0.042	0.042	0.001	YES
Lead	7439-92-1	0.0034	0.040	5/ 25	0.013	0.013		YES
Volatile Organic Compounds (mg/L)								
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.001	0.001		YES
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.002	0.002		YES
Radionuclides (pCi/L)								
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	0.476	0.476		YES:2
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	0.466	0.466	0.814	NO
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	0.409	0.409	0.688	YES:5

EPC: exposure point concentration
UCL: upper confidence limit
CAS: Chemical Abstract Service

COPC: Constituent of Potential Concern
COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation.

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 8: Initial Identification of Current Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Nitrate (Mound CAS 7697-37-2)	14797-55-8	0.7380	2.550	2/ 2	2.550	5.349	10.000	c	NO:2,3
Nitrate/Nitrite (Mound CAS 1497-55-8)	14797-65-0	0.6800	4.900	11/ 11	4.900	5.349	1.000	c	NO:2
Aluminum	7429-90-5	0.0688	0.148	6/ 22	0.148	0.038	10.220	b	NO:3
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.014	0.001	0.004	b	YES
Barium	7440-39-3	0.0750	0.115	20/ 22	0.115	0.310	0.715	b	NO:2,3
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.008		0.005	c	YES
Calcium	7440-70-2	94.3000	126.000	24/ 24	126.000	111.111			NO:4
Chromium	7440-47-3	0.0183	0.024	5/ 25	0.024	0.006	0.100	c	NO:3
Chromium VI	18540-29-9	0.0183	0.024	5/ 25	0.024	0.006	0.031	b	NO:3
Copper	7440-50-8	0.0016	0.593	15/ 25	0.593	0.001	0.409	b	YES
Iron	7439-89-6	0.0190	1.890	13/ 24	1.890	4.065			NO:4
Lead	7439-92-1	0.0034	0.040	5/ 25	0.040				YES
Lithium	7439-93-2	0.0029	0.003	2/ 4	0.003	0.056			NO:2
Magnesium	7439-95-4	29.1000	39.600	24/ 24	39.600	40.428			NO:4
Manganese	7439-96-5w	0.0028	0.224	22/ 24	0.224	0.230	0.480	b	NO:2,3
Molybdenum	7439-98-7	0.0020	0.003	2/ 4	0.003	0.006	0.051	b	NO:2,3
Nickel	7440-02-0	0.0021	0.027	5/ 25	0.027	0.035	0.204	b	NO:2,3
Potassium	7440-09-7	2.3900	3.650	20/ 26	3.650	4.461			NO:4
Silver	7440-22-4	0.0169	0.024	5/ 22	0.024		0.051	b	NO:3
Sodium	7440-23-5	46.6000	84.200	24/ 24	84.200	62.426			NO:4
Tin	7440-31-5	0.0087	0.009	1/ 4	0.009	0.034	6.132	b	NO:2,3
Vanadium	7440-62-2	0.0078	0.015	7/ 22	0.015	0.017	0.072	b	NO:2,3
Zinc	7440-66-6	0.0045	0.058	9/ 25	0.058	0.120	3.066	b	NO:2,3
Volatile Organic Compounds (mg/L)									
1,1,1-Trichloroethane	71-55-6	0.0003	0.003	91/ 215	0.003		0.200	c	NO:3
1,2-Dichloroethene *	540-59-0	0.0013	0.007	10/ 13	0.007		0.070	c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0005	0.004	102/ 182	0.004		0.070	c	NO:3
2-Butanone	78-93-3	0.0070	0.041	3/ 13	0.041		6.132	b	NO:3
Acetone	67-64-1	0.0020	0.012	6/ 11	0.012		1.022	b	NO:3
Chloroform (Trichloromethane)	67-66-3	0.0005	0.007	13/ 219	0.007		0.102	b	NO:3
FREON-113	76-13-1	0.0020	0.034	12/ 19	0.034		306.600	b	NO:3
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.002				YES
Tetrachloroethene	127-18-4	0.0003	0.002	114/ 218	0.002		0.005	c	NO:3
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.006		0.001	a	YES

Table 8: Initial Identification of Current Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Radionuclides (pCi/L)								
Bismuth-210	14331-79-4	0.1100	0.390	2/ 18	0.390		17.937	NO:3
Plutonium-238	13981-16-3	0.0060	0.250	8/ 57	0.250	0.087	1.221	NO:3
Plutonium-238/239	PU-238/239	0.0100	0.010	1/ 6	0.010		1.185	NO:3
Plutonium-239/240	PU-239/240	0.0018	2.000	5/ 19	2.000	0.125	1.185	YES
Radium-226	13982-63-3	0.1000	0.520	6/ 18	0.520	0.996	0.416	NO:2
Radium-226+D	13982-63-3(+D)	0.1000	0.520	6/ 18	0.520	0.996	0.415	NO:2
Radium-226 long lived decay	13982-63-3L	0.1000	0.520	6/ 18	0.520	0.996	0.097	NO:2
Strontium-85	13967-73-2	25.0000	25.000	1/ 2	25.000		70.796	NO:3
Strontium-90	10098-97-2	0.5000	0.500	3/ 18	0.500		2.862	NO:3
Thorium-227	15623-47-9	0.0110	0.230	16/ 22	0.230		3.376	NO:3
Thorium-228	14274-82-9	0.0085	2.170	17/ 46	2.170	0.779	1.495	YES
Thorium-228+D	14274-82-9(+D)	0.0085	2.170	17/ 46	2.170	0.779	0.533	YES
Thorium-228 long lived decay	14274-82-9L	0.0085	2.170	17/ 46	2.170	0.779	0.533	YES
Thorium-230	14269-63-7	0.0075	1.990	19/ 43	1.990		1.758	YES
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	1.990		0.092	YES
Thorium-232	7440-29-1	0.0025	0.100	8/ 44	0.100	0.314	1.584	NO:2,3
Thorium-232 long lived decay	7440-29-1L	0.0025	0.100	8/ 44	0.100	0.314	0.111	NO:2,3
Tritium	10028-17-8w	30.0000	7200.000	123/ 139	7200.000	1485.470	3155.819	YES
Uranium-233/234	U-233/234	0.1670	0.361	36/ 36	0.361		0.267	YES
Uranium-234	13966-29-5	0.2000	8.140	19/ 24	8.140	0.792	2.263	YES
Uranium-235	15117-96-1	0.0063	2.300	30/ 53	2.300	0.814	2.299	YES
Uranium-235+D	15117-96-1(+D)	0.0063	2.300	30/ 53	2.300	0.814	2.228	YES
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	2.300	0.814	0.219	YES
Uranium-238	7440-61-1	0.1300	8.250	52/ 59	8.250	0.688	1.100	YES
Uranium-238+D	7440-61-1(+D)	0.1300	8.250	52/ 59	8.250	0.688	1.837	YES
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	8.250	0.688	0.084	YES

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index

a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)

CAS: Chemical Abstract Service

"+D": incorporates daughter products within the risk calculations

* 1,2-cis-dichloroethene isomer RBGV used for screening due to lack of criteria for 1,2-dichloroethene

COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 9: Final Identification of Current Groundwater COPCs for the Site Employee Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	95% UCL	EPC	Background Concentration	COPC
Inorganics (mg/L)								
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.0436	0.0144	0.0006	YES
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.0066	0.0066		YES
Copper	7440-50-8	0.0016	0.593	15/ 25	0.0416	0.0416	0.0012	YES
Lead	7439-92-1	0.0034	0.040	5/ 25	0.0130	0.0130		YES
Volatile Organic Compounds (mg/L)								
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.0006	0.0006		YES
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.0023	0.0023		YES
Radionuclides (pCi/L)								
Plutonium-239/240	PU-239/240	0.0018	2.000	5/ 19	9.6400	2.0000	0.1250	YES
Thorium-228	14274-82-9	0.0085	2.170	17/ 46	25.6000	2.1700	0.7790	YES:3
Thorium-228+D	14274-82-9(+D)	0.0085	2.170	17/ 46	25.6000	2.1700	0.7790	YES:3
Thorium-228 long lived decay	14274-82-9L	0.0085	2.170	17/ 46	25.6000	2.1700	0.7790	YES:3
Thorium-230	14269-63-7	0.0075	1.990	19/ 43	0.4760	0.4760		YES:2
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	0.4760	0.4760		YES:2
Thorium-232 long lived decay	7440-29-1L	0.0025	0.100	8/ 44	0.3380	0.1000	0.3140	YES:4
Tritium	10028-17-8w	30.0000	7200.000	123/ 139	799.0000	799.0000	1485.4700	NO
Uranium-233/234	U-233/234	0.1670	0.361	36/ 36	0.2460	0.2460		YES
Uranium-234	13966-29-5	0.2000	8.140	19/ 24	2.0200	2.0200	0.7920	YES:2
Uranium-235	15117-96-1	0.0063	2.300	30/ 53	0.4660	0.4660	0.8140	NO
Uranium-235+D	15117-96-1(+D)	0.0063	2.300	30/ 53	0.4660	0.4660	0.8140	NO
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	0.4660	0.4660	0.8140	NO
Uranium-238	7440-61-1	0.1300	8.250	52/ 59	0.4090	0.4090	0.6880	NO
Uranium-238+D	7440-61-1(+D)	0.1300	8.250	52/ 59	0.4090	0.4090	0.6880	NO
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	0.4090	0.4090	0.6880	YES:5

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Table 9: Final Identification of Current Groundwater COPCs for the Site Employee Scenario

footnotes

"+D" - incorporates daughter products within the risk calculations
EPC: exposure point concentration
UCL: upper confidence limit
CAS: Chemical Abstract Service
COPC: Constituent of Potential Concern
COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). See Appendix H for details. For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation.
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 10: Initial Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGV)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Aluminum	7429-90-5	0.0121	31.5000	141/ 151	31.500	0.038	10.187	b	YES
Antimony	7440-36-0	0.0004	0.0416	47/ 158	0.042	0.001	0.004	b	YES
Arsenic	7440-38-2	0.0003	0.9330	35/ 150	0.933	0.033	0.001	a	YES
Barium	7440-39-3	0.0176	3.1200	148/ 150	3.120	0.310	0.713	b	YES
Beryllium	7440-41-7	0.0000	0.0023	56/ 151	0.002		0.004	c	NO:3
Bismuth	7440-69-9	0.0008	0.2640	29/ 139	0.264				YES
Boron	7440-42-8	0.0570	0.1290	7/ 8	0.129		0.917	b	NO:3
Cadmium	7440-43-9w	0.0001	0.0131	17/ 161	0.013		0.005	c	YES
Calcium	7440-70-2	0.1160	1510.0000	198/ 198	1510.000	111.111			NO:4
Chromium	7440-47-3	0.0002	44.8000	106/ 155	44.800	0.006	0.100	c	YES
Cobalt	7440-48-4	0.0003	0.2950	63/ 151	0.295		0.611	b	NO:3
Copper	7440-50-8	0.0004	0.5140	118/ 153	0.514	0.001	0.407	b	YES
Cyanide	57-12-5	0.0055	0.0142	3/ 46	0.014		0.200	b	NO:3
Iron	7439-89-6	0.0002	192.0000	186/ 199	192.000	4.065			NO:4
Lead	7439-92-1	0.0004	0.0404	62/ 162	0.040				YES
Lithium	7439-93-2	0.0117	4.5900	123/ 138	4.590	0.056			YES
Magnesium	7439-95-4	0.0269	719.0000	199/ 199	719.000	40.428			NO:4
Manganese	7439-96-5w	0.0000	3.0300	190/ 199	3.030	0.230	0.479	b	YES
Molybdenum	7439-98-7	0.0004	0.4740	82/ 134	0.474	0.006	0.051	b	YES
Nickel	7440-02-0	0.0004	11.6000	114/ 154	11.600	0.035	0.204	b	YES
Nitrate	14797-55-8	0.1700	9.4000	5/ 10	9.400	5.349	10.000	c	NO:3
Nitrate/Nitrite	14797-65-0nn	0.0063	20.0000	76/ 113	20.000	5.349	1.000	c	YES
Nitrite	14797-65-0	0.0100	0.0700	2/ 21	0.070		1.000	c	NO:3
Potassium	7440-09-7	0.0021	214.0000	186/ 200	214.000	4.461			NO:4
Selenium	7782-49-2	0.0013	0.0091	11/ 149	0.009		0.050	c	NO:3
Silver	7440-22-4	0.0002	0.0294	13/ 153	0.029		0.051	b	NO:3
Sodium	7440-23-5	0.0682	7270.0000	197/ 197	7270.000	62.426			NO:4
Thallium	7440-28-0	0.0011	0.0069	10/ 147	0.007		0.001	b	YES
Tin	7440-31-5	0.0014	0.3572	29/ 136	0.357	0.034	6.112	b	NO:3
Vanadium	7440-62-2	0.0002	0.2770	72/ 151	0.277	0.017	0.071	b	YES
Zinc	7440-66-6	0.0006	0.3990	114/ 153	0.399	0.120	3.056	b	NO:3
SVOCs (mg/L)									

Table 10: Initial Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGV)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Bis(2-ethylhexyl)phthalate	117-81-7	0.0010	0.9500	12/ 66	0.950		0.006	c	YES
Di-n-butyl Phthalate	84-74-2	0.0006	0.0030	5/ 65	0.003		0.409	b	NO:3
VOCs (mg/L)									
1,1,1-Trichloroethane	71-55-6	0.0004	0.0070	20/ 264	0.007		0.200	c	NO:3
1,2-Dichloroethene *	540-59-0	0.0018	0.0350	10/ 33	0.035		0.070	c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0009	0.0170	46/ 166	0.017		0.070	c	NO:3
2-Butanone	78-93-3	0.0060	0.0650	12/ 130	0.065		5.111	b	NO:3
Acetone	67-64-1	0.0010	0.0170	23/ 75	0.017		1.022	b	NO:3
Bromochloromethane	74-97-5	0.0260	0.0260	1/ 1	0.026				YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0010	0.6100	46/ 264	0.610		0.005	c	YES
Fluorobenzene	462-06-6	0.0390	0.0390	1/ 1	0.039				YES
O-Chloroflurobenzene	348-51-6	0.0320	0.0320	1/ 1	0.032				YES
Tetrachloroethene	127-18-4	0.0003	0.0250	50/ 264	0.025		0.003	a	YES
Trichloroethylene (TCE)	79-01-6	0.0006	0.0460	139/ 273	0.046		0.005	c	YES
Radionuclides (pCi/L)									
Americium-241	14596-10-2	0.0675	0.1650	6/ 43	0.165	0.139	7.692		NO:3
Plutonium-238	13981-16-3	0.0090	1.8700	8/ 62	1.870	0.087	6.107		NO:3
Plutonium-239/240	PU-239/240	0.0030	0.1820	12/ 52	0.182	0.125	5.926		NO:3
Plutonium-242	13982-10-0	0.1110	0.1110	1/ 2	0.111		6.250		NO:3
Potassium-40	13966-00-2	129.0000	258.0000	5/ 54	258.000		32.389		YES
Radium-226	13982-63-3	0.1260	39.4700	50/ 66	39.470	0.996	2.078		YES
Radium-226 +D	13982-63-3(+D)	0.1260	39.4700	50/ 66	39.470	0.996	2.073		YES
Radium-226 long lived decay	13982-63-3L	0.1260	39.4700	50/ 66	39.470	0.996	0.483		YES
Radium-228	15262-20-1	0.5710	16.8000	8/ 8	16.800		0.769		YES
Radium-228 +D	15262-20-1(+D)	0.5710	16.8000	8/ 8	16.800		0.769		YES
Radium-228 long lived decay	15262-20-1L	0.5710	16.8000	8/ 8	16.800		0.597		YES
Strontium-90	10098-97-2	0.7480	42.4000	8/ 57	42.400	0.975	14.311		YES
Thorium-227	15623-47-9	0.0580	0.0580	1/ 5	0.058		16.878		NO:3
Thorium-228	14274-82-9	0.0200	8.5000	42/ 57	8.500	0.779	7.477		YES
Thorium-228+D	14274-82-9(+D)	0.0200	8.5000	42/ 57	8.500	0.779	2.667		YES
Thorium-228 long lived decay	14274-82-9L	0.0200	8.5000	42/ 57	8.500	0.779	2.667		YES
Thorium-230	14269-63-7	0.0044	4.0700	45/ 59	4.070		8.791		NO:3
Thorium-230 long lived decay	14269-63-7L	0.0044	4.0700	45/ 59	4.070		0.458		YES
Thorium-232	7440-29-1	0.0005	2.1100	33/ 66	2.110	0.314	7.921		NO:3
Thorium-232 long lived decay	7440-29-1L	0.0011	2.1100	32/ 66	2.110	0.314	0.555		YES

Table 10: Initial Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGV)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Tritium	10028-17-8w	2.9500	2816310.0000	4473/4488	2816310.000	1485.470	15544.541	YES
Uranium-233	13968-55-3	0.0272	16.1200	3/ 3	16.120		11.142	YES
Uranium-233 long lived decay	13968-55-3L	0.0272	16.1200	3/ 3	16.120		1.334	YES
Uranium-233/234	U-233/234	0.1540	0.9280	5/ 5	0.928		1.334	NO:3
Uranium-234	13966-29-5	0.0330	66.9000	61/ 70	66.900	0.792	11.315	YES
Uranium-235	15117-96-1	0.0078	8.2500	20/ 43	8.250	0.814	11.494	NO:3
Uranium-235+D	15117-96-1(+D)	0.0078	8.2500	20/ 43	8.250	0.814	11.142	NO:3
Uranium-235 long lived decay	15117-96-1L	0.0078	8.2500	20/ 43	8.250	0.814	1.095	YES
Uranium-235/236	U-235/236	0.0373	0.0471	2/ 26	0.047		1.095	NO:3
Uranium-238	7440-61-1	0.0290	6.5800	59/ 77	6.580	0.688	12.500	NO:3
Uranium-238+D	7440-61-1(+D)	0.0290	6.5800	59/ 77	6.580	0.688	9.185	NO:3
Uranium-238 long lived decay	7440-61-1L	0.0290	6.5800	59/ 77	6.580	0.688	0.420	YES

* used cis-1,2-dichloroethene values for screening due to lack of toxicity criteria
'+D' incorporates daughter products
CAS: Chemical Abstract Service
SVOCs: semivolatile organic compounds
VOCs: volatile organic compounds

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
a - carcinogen value
b - noncarcinogen value
c - maximum contaminant level (MCL)

COPC: Constituent of Potential Concern, evaluation based on maximum detect vs. background or RBGV
COPC = YES indicates the analyte is retained as a COPC
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

Table 11: Final Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Metals (mg/L)				
Aluminum	7429-90-5	2.0238	0.038	YES
Antimony	7440-36-0	0.0184	0.001	YES
Arsenic	7440-38-2	0.0184	0.033	NO
Barium	7440-39-3	0.1829	0.310	NO
Bismuth	7440-69-9	0.0241		YES
Cadmium	7440-43-9w	0.0080		YES
Chromium	7440-47-3	0.9642	0.006	YES
Copper	7440-50-8	0.0557	0.001	YES
Lead	7439-92-1	0.0194		YES
Lithium	7439-93-2	0.1510	0.056	YES
Manganese	7439-96-5w	0.2154	0.230	NO
Molybdenum	7439-98-7	0.0149	0.006	YES
Nickel	7440-02-0	0.2779	0.035	YES
Nitrate/Nitrite	14797-65-0nn	6.5098	5.3490	YES
Thallium	7440-28-0	0.0036		YES
Vanadium	7440-62-2	0.0257	0.017	YES
SVOCs (mg/L)				
Bis(2-ethylhexyl)phthalate	117-81-7	0.0176		YES
VOCs (mg/L)				
Bromochloromethane	74-97-5	0.0058		YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0154		YES
Fluorobenzene	462-06-6	0.0087		YES
O-Chloroflurobenzene	348-51-6	0.0072		YES
Tetrachloroethene	127-18-4	0.0015		YES
Tert-butyl methyl ether	1634-04-4	0.0006		YES
Trichloroethylene (TCE)	79-01-6	0.0039		YES
Radionuclides (pCi/L)				
Plutonium-238	13981-16-3	0.2587	0.087	YES
Potassium-40	13966-00-2	48.3052		YES
Radium-226	13982-63-3	1.6849	0.996	YES:2
Radium-226 +D	13982-63-3(+D)	1.6849	0.996	YES:2
Radium-226 long lived decay	13982-63-3L	1.6849	0.996	YES:2
Radium-228	15262-20-1	0.4179		YES:3
Radium-228 +D	15262-20-1(+D)	0.4179		YES:3
Radium-228 long lived decay	15262-20-1L	0.4179		YES:3
Strontium-90	10098-97-2	1.4173	0.975	YES
Thorium-228	14274-82-9	77.5034	0.779	YES:3
Thorium-228+D	14274-82-9(+D)	77.5034	0.779	YES:3
Thorium-228 long lived decay	14274-82-9L	77.5034	0.779	YES:3
Thorium-230	14269-63-7	0.6202		YES:2

Table 11: Final Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Thorium-230 long lived decay	14269-63-7L	0.6202		YES:2
Thorium-232	7440-29-1	0.1803	0.314	NO
Thorium-232 long lived decay	7440-29-1L	0.1803	0.314	YES:4
Tritium	10028-17-8w	66797.9574	1485.470	YES
Uranium-233	13968-55-3	1.3619		YES:6
Uranium-233 long lived decay	13968-55-3L	1.3619		YES
Uranium-234	13966-29-5	2.6013	0.792	YES:2
Uranium-235	15117-96-1	2.1485	0.814	YES:7
Uranium-235+D	15117-96-1(+D)	2.1485	0.814	YES:7
Uranium-235 long lived decay	15117-96-1L	2.1485	0.814	YES
Uranium-235/236	U-235/236	0.0184		YES:7
Uranium-238	7440-61-1	0.5524	0.688	NO
Uranium-238+D	7440-61-1(+D)	0.5524	0.688	NO
Uranium-238 long lived decay	7440-61-1L	0.5524	0.688	YES:5

'+D' incorporates daughter products
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds

COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation. Analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of U-233 (reference 6) and U-235 (reference 7).

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 12: Initial Identification of Future Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Aluminum	7429-90-5	0.0121	31.500	141/ 151	31.500	0.0375	10.2200	b	YES
Antimony	7440-36-0	0.0004	0.042	47/ 158	0.042	0.0006	0.0041	b	YES
Arsenic	7440-38-2	0.0003	0.933	35/ 150	0.933	0.0330	0.0002	a	YES
Barium	7440-39-3	0.0176	3.120	148/ 150	3.120	0.3102	0.7154	b	YES
Beryllium	7440-41-7	0.0000	0.002	56/ 151	0.002		0.0040	c	NO:3
Bismuth	7440-69-9	0.0008	0.264	29/ 139	0.264				YES
Boron	7440-42-8	0.0570	0.129	7/ 8	0.129		0.9198	b	NO:3
Cadmium	7440-43-9w	0.0001	0.013	17/ 161	0.013		0.0050	c	YES
Calcium	7440-70-2	0.1160	1510.000	198/ 198	1510.000	111.1107			NO:4
Chromium	7440-47-3	0.0002	44.800	106/ 155	44.800	0.0061	0.1000	c	YES
Cobalt	7440-48-4	0.0003	0.295	63/ 151	0.295		0.6132	b	NO:3
Copper	7440-50-8	0.0004	0.514	118/ 153	0.514	0.0012	0.4088	b	YES
Cyanide	57-12-5	0.0055	0.014	3/ 46	0.014		0.2044	b	NO:3
Iron	7439-89-6	0.0002	192.000	186/ 199	192.000	4.0649			NO:4
Lead	7439-92-1	0.0004	0.040	62/ 162	0.040				YES
Lithium	7439-93-2	0.0117	4.590	123/ 138	4.590	0.0557			YES
Magnesium	7439-95-4	0.0269	719.000	199/ 199	719.000	40.4281			NO:4
Manganese	7439-96-5w	0.0000	3.030	190/ 199	3.030	0.2296	0.4803	b	YES
Molybdenum	7439-98-7	0.0004	0.474	82/ 134	0.474	0.0056	0.0511	b	YES
Nickel	7440-02-0	0.0004	11.600	114/ 154	11.600	0.0350	0.2044	b	YES
Nitrate	14797-55-8	0.1700	9.400	5/ 10	9.400	5.3490	10.0000	c	NO:3
Nitrate/Nitrite	14797-65-0nn	0.0063	20.000	76/ 113	20.000	5.3490	1.0000	c	YES
Nitrite	14797-65-0	0.0100	0.070	2/ 21	0.070		1.0000	c	NO:3
Potassium	7440-09-7	0.0021	214.000	186/ 200	214.000	4.4611			NO:4
Selenium	7782-49-2	0.0013	0.009	11/ 149	0.009		0.0500	c	NO:3
Silver	7440-22-4	0.0002	0.029	13/ 153	0.029		0.0511	b	NO:3
Sodium	7440-23-5	0.0682	7270.000	197/ 197	7270.000	62.4256			NO:4
Thallium	7440-28-0	0.0011	0.007	10/ 147	0.007		0.0008	b	YES
Tin	7440-31-5	0.0014	0.357	29/ 136	0.357	0.0344	6.1320	b	NO:3
Vanadium	7440-62-2	0.0002	0.277	72/ 151	0.277	0.0171	0.0715	b	YES
Zinc	7440-66-6	0.0006	0.399	114/ 153	0.399	0.1196	3.0660	b	NO:3
SVOCs (mg/L)									

Table 12: Initial Identification of Future Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Bis(2-ethylhexyl)phthalate	117-81-7	0.0010	0.950	12/ 66	0.950		0.0060 c	YES
Di-n-butyl Phthalate	84-74-2	0.0006	0.003	5/ 65	0.003		1.0220 b	NO:3
VOCs (mg/L)								
1,1,1-Trichloroethane	71-55-6	0.0004	0.007	20/ 264	0.007		0.2000 c	NO:3
1,2-Dichloroethene *	540-59-0	0.0018	0.035	10/ 33	0.035		0.0700 c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0009	0.017	46/ 166	0.017		0.0700 c	NO:3
2-Butanone	78-93-3	0.0060	0.065	12/ 130	0.065		6.1320 b	NO:3
Acetone	67-64-1	0.0010	0.017	23/ 75	0.017		1.0220 b	NO:3
Bromochloromethane	74-97-5	0.0260	0.026	1/ 1	0.026			YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0010	0.610	46/ 264	0.610		0.0050 c	YES
Fluorobenzene	462-06-6	0.0390	0.039	1/ 1	0.039			YES
O-Chloroflurobenzene	348-51-6	0.0320	0.032	1/ 1	0.032			YES
Tetrachloroethene	127-18-4	0.0003	0.025	50/ 264	0.025		0.0050 c	YES
Trichloroethylene (TCE)	79-01-6	0.0006	0.046	139/ 273	0.046		0.0050 c	YES
Radionuclides (pCi/L)								
Americium-241	14596-10-2	0.0675	0.165	6/ 43	0.165	0.1390	1.5385	NO:3
Plutonium-238	13981-16-3	0.0090	1.870	8/ 62	1.870	0.0870	1.2214	YES
Plutonium-239/240	PU-239/240	0.0030	0.182	12/ 52	0.182	0.1250	1.1852	NO:3
Potassium-40	13966-00-2	129.0000	258.000	5/ 54	258.000		6.4777	YES
Radium-226	13982-63-3	0.1260	39.470	50/ 66	39.470	0.9960	0.4156	YES
Radium-226 +D	13982-63-3(+D)	0.1260	39.470	50/ 66	39.470	0.9960	0.4145	YES
Radium-226 long lived decay	13982-63-3L	0.1260	39.470	50/ 66	39.470	0.9960	0.0966	YES
Radium-228	15262-20-1	0.5710	16.800	8/ 8	16.800		0.1538	YES
Radium-228 +D	15262-20-1(+D)	0.5710	16.800	8/ 8	16.800		0.1538	YES
Radium-228 long lived decay	15262-20-1L	0.5710	16.800	8/ 8	16.800		0.1194	YES
Strontium-90	10098-97-2	0.7480	42.400	8/ 57	42.400	0.9750	2.8623	YES
Thorium-227	15623-47-9	0.0580	0.058	1/ 5	0.058		3.3755	NO:3
Thorium-228	14274-82-9	0.0200	8.500	42/ 57	8.500	0.7790	1.4953	YES
Thorium-228+D	14274-82-9(+D)	0.0200	8.500	42/ 57	8.500	0.7790	0.5333	YES
Thorium-228 long lived decay	14274-82-9L	0.0200	8.500	42/ 57	8.500	0.7790	0.5333	YES
Thorium-230	14269-63-7	0.0044	4.070	45/ 59	4.070		1.7582	YES
Thorium-230 long lived decay	14269-63-7L	0.0044	4.070	45/ 59	4.070		0.0916	YES
Thorium-232	7440-29-1	0.0005	2.110	33/ 66	2.110	0.3140	1.5842	YES

Table 12: Initial Identification of Future Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Thorium-232 long lived decay	7440-29-1L	0.0011	2.110	32/ 66	2.110	0.3140	0.1110	YES
Tritium	10028-17-8w	2.9500	2816310.000	4473/4488	2816310.000	1485.4700	3155.8185	YES
Uranium-233	13968-55-3	0.0272	16.120	3/ 3	16.120		2.2284	YES
Uranium-233 long lived decay	13968-55-3L	0.0272	16.120	3/ 3	16.120		0.2668	YES
Uranium-233/234	U-233/234	0.1540	0.928	5/ 5	0.928		0.2668	YES
Uranium-234	13966-29-5	0.0330	66.900	61/ 70	66.900	0.7920	2.2631	YES
Uranium-235	15117-96-1	0.0078	8.250	20/ 43	8.250	0.8140	2.2989	YES
Uranium-235+D	15117-96-1(+D)	0.0078	8.250	20/ 43	8.250	0.8140	2.2284	YES
Uranium-235 long lived decay	15117-96-1L	0.0078	8.250	20/ 43	8.250	0.8140	0.2189	YES
Uranium-235/236	U-235/236	0.0373	0.047	2/ 26	0.047		0.2189	NO:3
Uranium-238	7440-61-1	0.0290	6.580	59/ 77	6.580	0.6880	2.5000	YES
Uranium-238+D	7440-61-1(+D)	0.0290	6.580	59/ 77	6.580	0.6880	1.8370	YES
Uranium-238 long lived decay	7440-61-1L	0.0290	6.580	59/ 77	6.580	0.6880	0.0840	YES

* used cis-1,2-dichloroethene values for screening due to lack of toxicity criteria

'+D' incorporates daughter products

CAS: Chemical Abstract Service

VOCs: volatile organic compounds

SVOCs: semivolatile organic compounds

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index

a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)

COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 13: Final Identification of Future Groundwater COPCs for the Site Employee Scenario

(Future Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Inorganics (mg/L)				
Aluminum	7429-90-5	2.0238	0.0375	YES
Antimony	7440-36-0	0.0184	0.0006	YES
Arsenic	7440-38-2	0.0184	0.0330	NO
Barium	7440-39-3	0.1829	0.3102	NO
Bismuth	7440-69-9	0.0241		YES
Cadmium	7440-43-9w	0.0080		YES
Chromium	7440-47-3	0.9642	0.0061	YES
Copper	7440-50-8	0.0557	0.0012	YES
Lead	7439-92-1	0.0194		YES
Lithium	7439-93-2	0.1510	0.0557	YES
Manganese	7439-96-5w	0.2154	0.2296	NO
Molybdenum	7439-98-7	0.0149	0.0056	YES
Nickel	7440-02-0	0.2779	0.0350	YES
Nitrate/Nitrite	14797-65-0nn	6.510	5.3490	YES
Thallium	7440-28-0	0.0036		YES
Vanadium	7440-62-2	0.0257	0.0171	YES
SVOCs (mg/L)				
Bis(2-ethylhexyl)phthalate	117-81-7	0.0176		YES
VOCs (mg/L)				
Bromochloromethane	74-97-5	0.0058		YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0154		YES
Fluorobenzene	462-06-6	0.0087		YES
O-Chloroflurobenzene	348-51-6	0.0072		YES
Tert-butyl methyl ether	1634-04-4	0.0006		YES
Tetrachloroethene	127-18-4	0.0015		YES
Trichloroethylene (TCE)	79-01-6	0.0039		YES
Radionuclides (pCi/L)				
Plutonium-238	13981-16-3	0.2587	0.0870	YES
Potassium-40	13966-00-2	48.3052		YES
Radium-226	13982-63-3	1.6849	0.9960	YES:2
Radium-226 +D	13982-63-3(+D)	1.6849	0.9960	YES:2
Radium-226 long lived decay	13982-63-3L	1.6849	0.9960	YES:2
Radium-228	15262-20-1	0.4179		YES:3
Radium-228 +D	15262-20-1(+D)	0.4179		YES:3
Radium-228 long lived decay	15262-20-1L	0.4179		YES:3
Strontium-90	10098-97-2	1.4173	0.9750	YES
Thorium-228	14274-82-9	77.5034	0.7790	YES:3
Thorium-228+D	14274-82-9(+D)	77.5034	0.7790	YES:3
Thorium-228 long lived decay	14274-82-9L	77.5034	0.7790	YES:3
Thorium-230	14269-63-7	0.6202		YES:2
Thorium-230 long lived decay	14269-63-7L	0.6202		YES:2

Table 13: Final Identification of Future Groundwater COPCs for the Site Employee Scenario

(Future Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Thorium-232	7440-29-1	0.1803	0.3140	NO
Thorium-232 long lived decay	7440-29-1L	0.1803	0.3140	YES:4
Tritium	10028-17-8w	66797.9574	1485.4700	YES
Uranium-233	13968-55-3	1.3619		YES:6
Uranium-233 long lived decay	13968-55-3L	1.3619		YES
Uranium-234	13966-29-5	2.6013	0.7920	YES:2
Uranium-235	15117-96-1	2.1485	0.8140	YES:7
Uranium-235+D	15117-96-1(+D)	2.1485	0.8140	YES:7
Uranium-235 long lived decay	15117-96-1L	2.1485	0.8140	YES
Uranium-238	7440-61-1	0.5524	0.6880	NO
Uranium-238+D	7440-61-1(+D)	0.5524	0.6880	NO
Uranium-238 long lived decay	7440-61-1L	0.5524	0.6880	YES:5

'+D' incorporates daughter products
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)
COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation. Analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of U-233 (reference 6) and U-235 (reference 7).

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 14: Exposure Assumptions for the Construction Worker and Site Employee Scenarios

Parameter/Medium/Pathway	Units	Construction Worker Adult	Site-Employee Adult	Reference
Soil		**(All depths)**	**(0 - 2 ft.)**	
Incidental ingestion				
Soil ingestion rate	mg/day	480	50	a
Exposure frequency	days/year	250	250	b
Exposure duration	years	5	25	c
Body weight	kg	70	70	d
Carcinogen averaging time	days	25550	25550	e
Noncarcinogen averaging time	days	1825	9125	e
Conversion Factor	kg/mg	1.00E-06	1.00E-06	
Inhalation of VOCs and dust				
Inhalation rate	m^3/day	20	20	f
Exposure frequency	days/year	250	250	b
Exposure duration	years	5	25	c
Body weight	kg	70	70	d
Carcinogen averaging time	days	25550	25550	e
Noncarcinogen averaging time	days	1825	9125	e
Particle Emissions Factor	m^3/kg	1.32×10^9	1.32×10^9	k
Conversion Factor	days/hour	0.042	0.042	
Air Exchange Rate	air changes/hour	N/A	0.45	h
Dermal Exposure				
Adherence factor of soil to skin	mg/m^2-event	0.3	NA	l
Skin surface area available for contact	m^2	50	NA	m
External Exposure				
Gamma Shielding Factor		0.1	0.2	
Gamma Exposure Time Factor		1/3	1/12	
Exposure Duration 2	years	5 X 0.685	25 X 0.685	c
Exposure Frequency	day/year	250	250	b

Table 14: Exposure Assumptions for the Construction Worker and Site Employee Scenarios

Parameter/Medium/Pathway	Units	Construction Worker Adult	Site-Employee Adult	Reference
Groundwater				
Drinking water ingestion				
Drinking water ingestion rate	L/day	1	1	i
Exposure frequency	days/year	250	250	b
Exposure time	years	5	25	g
Body weight	kg	70	70	d
Carcinogen averaging time	days	25550	25550	e
Noncarcinogen averaging time	days	1825	9125	e
Dermal contact while showering				
Skin surface area available for contact	cm^2	19400	NA	j
Exposure time	hr/day	0.167	NA	g
Exposure frequency	days/year	250	NA	b
Exposure duration	years	5	NA	c
Body weight	kg	70	NA	d
Carcinogen averaging time	days	25550	NA	e
Noncarcinogen averaging time	days	1825	NA	e
Conversion factor	L/cm^3	0.001	NA	
Inhalation of VOCs while showering				
Inhalation rate	m^3/day	20	NA	f
Exposure time	hr/day	0.167	NA	g
Exposure frequency	days/year	250	NA	b
Exposure duration	years	5	NA	c
Body weight	kg	70	NA	d
Carcinogen averaging time	days	25550	NA	e
Noncarcinogen averaging time	days	1825	NA	e

bgs: below ground surface

VOCs: volatile organic compounds

NA: not applicable

numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 14 (continued)
Exposure Assumptions for the Construction Worker and Site Employee Scenario References

a	Soil ingestion rate	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and Risk Assessment Guidance for Superfund (RAGS) Part A
b	Exposure frequency	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
c	Exposure duration	Exposure duration for the construction worker and site employee is based on Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
d	Body weight	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
e	Averaging time	Carcinogenic averaging time = 70 yrs • 365 days/year. Non-carcinogenic averaging time = exposure duration (yrs) • 365 days/year.
f	Inhalation rate	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and Exposure Factors Handbook Volume I, Table 1-2.
g	Exposure time	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
h	Air exchange rate	Volume of residential homes, EFH, Volume III, Table 17-3. 50th percentile air exchange rate of 0.45 air changes per hour, Exposure Factors Handbook, Volume III, Table 17-10
i	Drinking water ingestion	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
j	Skin surface available for contact	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
k	Particulate emission factor	Soil Screening Guidance: User's Guide, Second Edition, Publication 9355.4-23, July 1996.
l	Adherence factor of soil to skin	EPA Dermal Risk Assessment Supplemental Guidance, August 1992.
m	Skin surface area available for contact	EPA Dermal Risk Assessment Supplemental Guidance, August 1992.

Table 15: Toxicity Criteria and Other Physical Chemical Values

	RfD (mg/kg-day)					CSF (Risk/mg/kg-day)									
	Oral			Inhalation		Oral			Inhalation						
			Adjusted					Adjusted							
Analyte	RfD_o	REF.	RfD_a	RfD_i	REF.	CSF_o	REF.	CSF_a	CSF_i	REF.	CSF_{ex}	GI Factor	Dermal Absorption Factor	Kp (cm/hr)	Lag Time (hr)
VOCs															
Bromochloromethane	---	---	---	---	---	---	---	---	---	---	NA	8.0E-01		3.1E-03	
Dichloromethane (Methylene Chloride)	6.0E-02	I	6.0E-02	8.6E-01	H	7.5E-03	I	7.5E-03	1.6E-03	I	NA	9.5E-01		4.5E-03	2.9E-01
Fluorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
O-Chloroflurobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Tert-butyl methyl ether	---	---	---	8.6E-01	I	---	---	---	---	---	NA	8.0E-01		2.6E-03	
Tetrachloroethene	1.0E-02	I	1.0E-02	---	---	5.2E-02	N	5.2E-02	2.0E-03	N	NA	1.0E+00		3.7E-01	9.0E-01
Trichloroethylene (TCE)	3.0E-04	N, 2002	3.0E-04	---	---	2.1E-01	N, 2002	2.1E-01	6.0E-03	N	NA	1.0E+00		2.3E-01	5.5E-01
Pesticides															
Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	#N/A			
SVOCs															
Benzo(a)anthracene	---	---	---	---	---	7.3E-01	EPA-93	7.3E-01	3.1E-01	EPA-93	NA	8.9E-01	1.3E-01		
Benzo(a)pyrene	---	---	---	---	---	7.3E+00	I	7.3E+00	3.1E+00	N	NA	8.9E-01	1.3E-01		
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---	---	---	NA	8.9E-01	1.3E-01		
Bis(2-ethylhexyl)phthalate	2.0E-02	I	3.8E-03	---	---	1.4E-02	I	7.4E-02	---	---	NA	1.9E-01		3.3E-02	
Phenanthrene	---	---	---	---	---	---	---	---	---	---	NA	8.9E-01	1.3E-01		
Inorganics															
Aluminum	1.0E+00	N	1.0E-01	---	---	---	---	---	---	---	NA	1.0E-01		1.0E-03	
Antimony	4.0E-04	I	6.0E-05	---	---	---	---	---	---	---	NA	1.5E-01		1.0E-03	
Arsenic	3.0E-04	I	3.0E-04	---	---	1.5E+00	I	---	1.5E+01	I	NA	9.5E-01	3.0E-02		
Bismuth	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Cadmium	5.0E-04	I	1.3E-05	---	---	---	---	---	6.3E+00	I	NA	2.5E-02		1.0E-03	
Chromium (used VI CAS #)	3.0E-03	I	7.5E-05	2.9E-05	I	---	---	---	4.2E+01	I	NA	2.5E-02		1.0E-03	
Copper	4.0E-02	N	4.0E-02	---	---	---	---	---	---	---	NA	5.7E-01		1.0E-03	
Lead	---	---	---	---	---	---	---	---	---	---	NA	1.5E-01		1.0E-03	
Lithium	---	---	---	---	---	---	---	---	---	---	NA	8.0E-01		1.0E-03	
Molybdenum	5.0E-03	I	1.9E-03	---	---	---	---	---	---	---	NA	3.8E-01		1.0E-03	
Nickel	2.0E-02	I	8.0E-04	---	---	---	---	---	1.7E+00	I	NA	4.0E-02		1.0E-03	
Thallium	8.0E-05	I	8.0E-05	---	---	---	---	---	---	---	NA	1.0E+00		1.0E-03	
Vanadium	7.0E-03	H	1.8E-04	---	---	---	---	---	---	---	NA	2.6E-02		1.0E-03	
Nitrate/Nitrite	1.0E-01	I	1.0E-01	---	---	---	---	---	---	---	NA	NA		1.0E-03	

Table 15: Toxicity Criteria and other Physical Chemical Values

	RfD (mg/kg-day)					CSF (Risk/pCi)									
	Oral			Inhalation		Oral			Inhalation						
			Adjusted					Adjusted				GI Factor	Dermal Absorption Factor	Kp (cm/hr)	Lag Time (hr)
Analyte	RfD_o	REF.	RfD_a	RfD_i	REF.	CSF_o	REF.	CSF_a	CSF_i	REF.	CSF_{ex}				
Radionuclides (Groundwater)															
Plutonium-238	---		---	---		1.3E-10	H	---	3.4E-08	H	7.2E-11	5.0E-04		NA	
Plutonium-239/240	---		---	---		1.4E-10	H	---	3.3E-08	H	2.0E-10	5.0E-04		NA	
Potassium-40	---		---	---		2.5E-11	H	---	1.0E-11	H	8.0E-07	1.0E+00		NA	
Strontium-90	---		---	---		5.6E-11	H	---	1.1E-10	H	4.8E-10	3.0E-01		NA	
Thorium-232 long lived decay	---		---	---		1.4E-09	H	---	1.9E-07	H	1.2E-05	5.0E-04		NA	
Tritium	---		---	---		5.1E-14	H	5.1E-14	5.6E-14	H	NA	1.0E+00		1.5E-05	
Uranium-233 long lived decay	---		---	---		6.0E-10	H	---	2.4E-07	H	1.2E-06	2.0E-02		NA	
Uranium-235 long lived decay	---		---	---		7.3E-10	H	---	2.6E-07	H	2.2E-06	2.0E-02		NA	
Uranium-238 long lived decay	---		---	---		1.9E-09	H	---	7.5E-08	H	8.6E-06	2.0E-02		NA	
Radionuclides (Soil)															
Actinium-227 long lived decay	---		---	---		1.2E-09	H	---	2.1E-07	H	1.5E-06	5.0E-04		NA	
Plutonium-238	---		---	---		2.7E-10	H	---	3.4E-08	H	7.2E-11	5.0E-04		NA	
Thorium-232 long lived decay	---		---	---		3.3E-09	H	---	1.9E-07	H	1.2E-05	5.0E-04		NA	
Uranium-238 long lived decay	---		---	---		4.0E-09	H	---	7.5E-08	H	8.6E-06	5.0E-04		NA	

numbers written as 1.0E-3 equal 1x10-3 and 0.001

a - Reference (Ref): H = HEAST, July, 1997 chemicals and April, 2002 for radionuclides; I = IRIS, as of March 28, 2002; N = NCEA; EPA-93 guidance for PAHs.

b - Dermal default values are from Dermal Guidance, EPA 1992

CAS: Chemical Abstract Services

CAS Numbers presented on previous tables

VOCs: volatile organic compounds

SVOCs: semivolatile organic compounds

NA: not applicable

Kp: permeability coefficient

GI: Gastorintestinal Absorption Factor

RfD: reference dose

CSF: cancer slope factor

Table 16: Total Residual Soil Risk for the Construction Worker Scenario

			CANCER EFFECTS						NON-CANCER EFFECTS					
			Route-Specific Risk					Total	Route-Specific HI					Total
Analyte	CAS No.	EPC	Oral	Dermal	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Dermal	Inhal. Dust	Inhal. VOCs	External	Non-Cancer Hazard
Metals (mg/kg)														
Antimony	7440-36-0	8.46	---	---	---	NAP	NAP	---	9.9E-02	1.5E-03	---	NAP	NAP	1.0E-01
Bismuth	7440-69-9	72.70	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Thallium	7440-28-0	1.14	---	---	---	NAP	NAP	---	6.7E-02	1.5E-04	---	NAP	NAP	6.7E-02
Pesticides (mg/kg)														
Chlordane	57-74-9	0.02	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
SVOCs (mg/kg)														
Benzo(a)anthracene	56-55-3	0.32	7.9E-08	3.2E-08	1.0E-12	NAP	NAP	1.1E-07	---	---	---	NAP	NAP	---
Benzo(a)pyrene	50-32-8	0.32	7.7E-07	3.1E-07	1.0E-11	NAP	NAP	**1.1E-06**	---	---	---	NAP	NAP	---
Benzo(g,h,i)perylene	191-24-2	0.30	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Phenanthrene	85-01-8	0.35	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Radionuclides (pCi/g)														
Actinium-227 L	14952-40-0L	0.30	2.1E-07	NAP	1.2E-09	NAP	4.6E-07	6.7E-07	---	---	---	NAP	---	---
Plutonium-238	13981-16-3	26.10	4.3E-06	NAP	1.7E-08	NAP	1.9E-09	**4.3E-06**	---	---	---	NAP	---	---
Thorium-232 L	7440-29-1L	1.64	3.3E-06	NAP	5.9E-09	NAP	2.1E-05	**2.4E-05**	---	---	---	NAP	---	---
Uranium-238 L	7440-61-1L	1.88	4.5E-06	NAP	2.7E-09	NAP	1.7E-05	**2.1E-05**	---	---	---	NAP	---	---
TOTAL			**1.3E-05**	3.5E-07	2.6E-08	---	**3.8E-05**	**5.1E-05**	1.7E-01	1.6E-03	0.0E+00	---	---	1.7E-01

bold values represent estimates that exceed acceptable thresholds
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters
Ext.: External
Inhal.: Inhalation
L: long lived decay
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds

Table 17: Background Residual Soil Risk for the Construction Worker Scenario

			CANCER EFFECTS						NON-CANCER EFFECTS					
			Route-Specific Risk					Total	Route-Specific HI					Total
Analyte	CAS No.	EPC	Oral	Dermal	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Dermal	Inhal. Dust	Inhal. VOCs	External	Non-Cancer Hazard
Metals (mg/kg)														
Antimony	7440-36-0		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Bismuth	7440-69-9		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Thallium	7440-28-0	0.46	---	---	---	NAP	NAP	---	2.7E-02	6.0E-05	---	NAP	NAP	2.7E-02
Pesticides (mg/kg)														
Chlordane	57-74-9		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
SVOCs (mg/kg)														
Benzo(a)anthracene	56-55-3		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Benzo(a)pyrene	50-32-8		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Benzo(g,h,i)perylene	191-24-2		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Phenanthrene	85-01-8		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Radionuclides (pCi/g)														
Actinium-227 L	14952-40-0L		---	NAP	---	NAP	---	---	---	---	---	NAP	---	---
Plutonium-238	13981-16-3	0.13	2.1E-08	NAP	8.3E-11	NAP	9.6E-12	**2.1E-08**	---	---	---	NAP	---	---
Thorium-232 L	7440-29-1L	1.40	2.8E-06	NAP	5.1E-09	NAP	1.8E-05	**2.0E-05**	---	---	---	NAP	---	---
Uranium-238 L	7440-61-1L	1.20	2.9E-06	NAP	1.7E-09	NAP	1.1E-05	**1.3E-05**	---	---	---	NAP	---	---
	TOTAL		**5.7E-06**	---	6.9E-09	---	**2.8E-05**	**3.4E-05**	2.7E-02	6.0E-05	---	---	---	2.7E-02

bold values represent estimates that exceed acceptable thresholds
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters
Ext.: External
Inhal.: Inhalation
L: long lived decay
EPC: Exposure Point Concentration
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semi-volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 18: Incremental Residual Soil Risk for the Construction Worker Scenario

			CANCER EFFECTS						NON-CANCER EFFECTS					
			Route-Specific Risk					Total	Route-Specific HI					Total
Analyte	CAS No.	EPC	Oral	Dermal	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Dermal	Inhal. Dust	Inhal. VOCs	Ext.	Non-Cancer Hazard
Metals (mg/kg)														
Antimony	7440-36-0	8.46	---	---	---	NAP	NAP	---	9.9E-02	1.5E-03	---	NAP	NAP	1.0E-01
Bismuth	7440-69-9	72.70	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Thallium	7440-28-0	0.68	---	---	---	NAP	NAP	---	4.0E-02	8.9E-05	---	NAP	NAP	4.0E-02
Pesticides (mg/kg)														
Chlordane	57-74-9	0.02	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
SVOCs (mg/kg)														
Benzo(a)anthracene	56-55-3	0.32	7.9E-08	3.2E-08	1.0E-12	NAP	NAP	1.1E-07	---	---	---	NAP	NAP	---
Benzo(a)pyrene	50-32-8	0.32	7.7E-07	3.1E-07	1.0E-11	NAP	NAP	**1.1E-06**	---	---	---	NAP	NAP	---
Benzo(g,h,i)perylene	191-24-2	0.30	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Phenanthrene	85-01-8	0.35	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Radionuclides (pCi/g)														
Actinium-227 L	14952-40-0L	0.30	2.1E-07	NAP	1.2E-09	NAP	4.6E-07	6.7E-07	---	---	---	NAP	---	---
Plutonium-238	13981-16-3	25.97	4.2E-06	NAP	1.7E-08	NAP	1.9E-09	**4.3E-06**	---	---	---	NAP	---	---
Thorium-232 L	7440-29-1L	0.24	4.8E-07	NAP	8.7E-10	NAP	3.0E-06	**3.5E-06**	---	---	---	NAP	---	---
Uranium-238 L	7440-61-1L	0.68	1.6E-06	NAP	9.6E-10	NAP	6.0E-06	**7.6E-06**	---	---	---	NAP	---	---
TOTAL			**7.4E-06**	3.5E-07	2.0E-08	---	**9.5E-06**	**1.7E-05**	1.4E-01	1.6E-03	---	---	---	1.4E-01

bold values represent estimates that exceed acceptable thresholds

Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Ext.: External

Inhal.: Inhalation

L: long lived decay

EPC: Exposure Point Concentration

HI: Hazard Index

NA: Not available; insufficient toxicity data

NAP: not an applicable pathway

VOCs: volatile organic compounds

SVOCs: semi-volatile organic compounds

CAS: Chemical Abstract Service

numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 19: Total Residual Soil Risk for the Site Employee Scenario

Analyte	CAS No.	EPC	CANCER EFFECTS					NON-CANCER EFFECTS			
			Route-Specific Risk				Total	Route-Specific HI			Total
			Oral	Inhalation Dust	Inhalation VOCs	External	Cancer Risk	Oral	Inhalation Dust	Inhalation VOCs	Non-Cancer Hazard
Metals (mg/kg)											
Arsenic	7440-38-2	8.9E+00	2.3E-06	7.1E-09	NAP	NAP	**2.3E-06**	1.4E-02	---	NAP	1.4E-02
Bismuth	7440-69-9	7.3E+01	---	---	NAP	NAP	---	---	---	NAP	---
Pesticides (mg/kg)											
Chlordane	57-74-9	1.6E-02	---	---	NAP	NAP	0.0E+00	---	---	NAP	---
SVOCs (mg/kg)											
Benzo(a)pyrene	50-32-8	3.5E-01	4.5E-07	5.7E-11	NAP	NAP	4.5E-07	---	---	NAP	---
Benzo(g,h,i)perylene	191-24-2	3.3E-01	---	---	NAP	NAP	---	---	---	NAP	---
Phenanthrene	85-01-8	4.0E-01	---	---	NAP	NAP	---	---	---	NAP	---
Radionuclides (pCi/g)											
Actinium-227 long lived decay	14952-40-0L	3.5E-01	1.3E-07	7.0E-09	NAP	5.9E-07	7.3E-07	---	---	NAP	---
Plutonium-238	13981-16-3	2.5E+01	2.1E-06	7.9E-08	NAP	2.1E-09	**2.2E-06**	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.7E+00	1.8E-06	3.1E-08	NAP	2.4E-05	**2.6E-05**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	2.0E+00	2.4E-06	1.4E-08	NAP	1.9E-05	**2.2E-05**	---	---	NAP	---
TOTAL			**9.2E-06**	1.4E-07	---	**4.4E-05**	**5.3E-05**	1.4E-02	---	---	1.4E-02

bold values represent estimates that exceed acceptable thresholds
HI: Hazard Index
Inhal.: inhalation
SVOCs: semivolatile organic compounds
EPC: Exposure Point Concentration
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 20: Background Residual Soil Risk for the Site Employee Scenario

Analyte	CAS No.	EPC	CANCER EFFECTS					NON-CANCER EFFECTS			
			Route-Specific Risk				Total	Route-Specific HI			Total
			Oral	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Inhal. Dust	Inhal. VOCs	Non-Cancer Hazard
Metals (mg/kg)											
Arsenic	7440-38-2	8.6E+00	2.3E-06	6.9E-09	NAP	NAP	**2.3E-06**	1.4E-02	---	NAP	1.4E-02
Bismuth	7440-69-9		---	---	NAP	NAP	---	---	---	NAP	---
Pesticides (mg/kg)											
Chlordane	57-74-9		---	---	NAP	NAP	---	---	---	NAP	---
SVOCs (mg/kg)											
Benzo(a)pyrene	50-32-8		---	---	NAP	NAP	---	---	---	NAP	---
Benzo(g,h,i)perylene	191-24-2		---	---	NAP	NAP	---	---	---	NAP	---
Phenanthrene	85-01-8		---	---	NAP	NAP	---	---	---	NAP	---
Radionuclides (pCi/g)											
Actinium-227 long lived decay	14952-40-0L	---	---	---	NAP	---	---	---	---	NAP	---
Plutonium-238	13981-16-3	1.3E-01	1.1E-08	4.1E-10	NAP	1.1E-11	1.1E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.4E+00	1.5E-06	2.5E-08	NAP	2.0E-05	**2.1E-05**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	1.2E+00	1.5E-06	8.5E-09	NAP	1.2E-05	**1.3E-05**	---	---	NAP	---
TOTAL			**5.2E-06**	4.1E-08	---	**3.1E-05**	**3.7E-05**	1.4E-02	---	---	1.4E-02

bold values represent estimates that exceed acceptable thresholds
Inhal.: inhalation
HI: Hazard Index
SVOCs: semivolatile organic compounds
EPC: Exposure Point Concentration
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 21: Incremental Residual Soil Risk for the Site Employee Scenario

			CANCER EFFECTS					NON-CANCER EFFECTS			
			Route-Specific Risk				Total	Route-Specific HI			Total
Analyte	CAS No.	EPC	Oral	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Inhal. Dust	Inhal. VOCs	Non-Cancer Hazard
Metals (mg/kg)											
Arsenic	7440-38-2	2.8E-01	7.3E-08	2.2E-10	NAP	NAP	7.4E-08	4.6E-04	---	NAP	4.6E-04
Bismuth	7440-69-9	7.3E+01	---	---	NAP	NAP	---	---	---	NAP	---
Pesticides (mg/kg)											
Chlordane	57-74-9	1.6E-02	---	---	NAP	NAP	---	---	---	NAP	---
SVOCs (mg/kg)											
Benzo(a)pyrene	50-32-8	3.5E-01	4.5E-07	5.7E-11	NAP	NAP	4.5E-07	---	---	NAP	---
Benzo(g,h,i)perylene	191-24-2	3.3E-01	---	---	NAP	NAP	---	---	---	NAP	---
Phenanthrene	85-01-8	4.0E-01	---	---	NAP	NAP	---	---	---	NAP	---
Radionuclides (pCi/g)											
Actinium-227 long lived decay	14952-40-0L	3.5E-01	1.3E-07	7.0E-09	NAP	5.9E-07	**7.3E-07**	---	---	NAP	---
Plutonium-238	13981-16-3	2.5E+01	2.1E-06	7.9E-08	NAP	2.0E-09	**2.2E-06**	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	3.0E-01	3.1E-07	5.4E-09	NAP	4.2E-06	**4.5E-06**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	7.5E-01	9.3E-07	5.3E-09	NAP	7.4E-06	**8.3E-06**	---	---	NAP	---
TOTAL			**4.0E-06**	9.7E-08	---	**1.2E-05**	**1.6E-05**	4.6E-04	---	---	4.6E-04

bold values represent estimates that exceed acceptable thresholds
Inhal.: inhalation
SVOCs: semivolatile organic compounds
VOCs: volatile organic compounds
EPC: Exposure Point Concentration
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 22: Current Total Residual Groundwater Risk for the Construction Worker Scenario

			CANCER EFFECTS				NON-CANCER EFFECTS			
			Route-Specific Risk			Total	Route-Specific HI			Total
Analyte	CAS No.	Total EPC	Oral	Dermal	Inhalation VOC(shower)	Cancer Risk	Oral	Dermal	Inhalation VOCs	Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	---	---	---	---	---	4.8E-07	4.8E-07
Trichloroethylene (TCE)	79-01-6	0.002	3.4E-07	1.3E-06	6.7E-10	1.6E-06	7.5E-02	2.8E-01	---	3.6E-01
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	---	NAP	NA	3.5E-01	7.6E-03	NAP	3.6E-01
Cadmium	7440-43-9w	0.007	---	---	NAP	NA	1.3E-01	1.7E-02	NAP	1.5E-01
Copper	7440-50-8	0.042	---	---	NAP	NA	1.0E-02	3.3E-05	NAP	1.0E-02
Lead	7439-92-1	0.013	---	---	NAP	NA	---	---	NAP	---
Radionuclides (pCi/L)										
Uranium-238 long lived decay	7440-61-1L	2.020	4.8E-06	---	---	4.8E-06	---	---	NAP	---
TOTAL			**5.1E-06**	**1.3E-06**	6.7E-10	**6.4E-06**	5.7E-01	3.1E-01	4.8E-07	**8.7E-01**

* the CAS Number and toxicity criteria for cis- isomer used for risk calculations to be conservative.
bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 23: Current Background Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4		---	---	---	---	---	---	---	---
Trichloroethylene (TCE)	79-01-6		---	---	---	---	---	---	---	---
Inorganics (mg/L)										
Antimony	7440-36-0	0.001	---	---	NAP	---	1.4E-02	3.1E-04	NAP	1.4E-02
Cadmium	7440-43-9w		---	---	NAP	---	---	---	NAP	---
Copper	7440-50-8	0.001	---	---	NAP	---	2.9E-04	9.2E-07	NAP	2.9E-04
Lead	7439-92-1		---	---	NAP	---	---	---	NAP	---
Radionuclides (pCi/L)										
Uranium-238 long lived decay	7440-61-1L	0.688	1.6E-06	NA	NAP	1.6E-06	---	---	NAP	---
TOTAL			**1.6E-06**	---	---	**1.6E-06**	1.4E-02	3.1E-04	---	1.5E-02

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 24: Current Incremental Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation $VOC_{(shower)}$	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	---	---	---	---	---	4.8E-07	4.8E-07
Trichloroethylene (TCE)	79-01-6	0.002	3.4E-07	1.3E-06	6.7E-10	1.6E-06	7.5E-02	2.8E-01	---	3.6E-01
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	---	NAP	---	3.4E-01	7.3E-03	NAP	3.5E-01
Cadmium	7440-43-9w	0.007	---	---	NAP	---	1.3E-01	1.7E-02	NAP	1.5E-01
Copper	7440-50-8	0.040	---	---	NAP	---	9.9E-03	3.2E-05	NAP	9.9E-03
Lead	7439-92-1	0.013	---	---	NAP	---	---	---	NAP	---
Radionuclides (pCi/L)										
Uranium-238 long lived decay	7440-61-1L	1.332	3.2E-06	NA	NAP	3.2E-06	---	---	NAP	---
TOTAL			**3.5E-06**	**1.3E-06**	6.7E-10	**4.8E-06**	5.5E-01	3.1E-01	4.8E-07	**8.6E-01**

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 25: Current Total Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation $VOC_{(shower)}$	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6	0.002	1.7E-06	NAP	NAP	**1.7E-06**	7.5E-02	NAP	NAP	7.5E-02
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	NAP	NAP	---	3.5E-01	NAP	NAP	3.5E-01
Cadmium	7440-43-9w	0.007	---	NAP	NAP	---	1.3E-01	NAP	NAP	1.3E-01
Copper	7440-50-8	0.042	---	NAP	NAP	---	1.0E-02	NAP	NAP	1.0E-02
Lead	7439-92-1	0.013	---	NAP	NAP	---	---	NAP	NAP	---

Radionuclides (pCi/L)										
Plutonium-239/240	PU-239/240	2.000	1.7E-06	NA	NAP	**1.7E-06**	---	NAP	NAP	---
Uranium-233/234	U-233/234	0.246	9.2E-07	NA	NAP	9.2E-07	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.170	2.0E-05	NA	NAP	**2.0E-05**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	2.020	7.6E-06	NA	NAP	**7.6E-06**	---	NAP	NAP	---
TOTAL			**3.1E-05**	---	---	**3.1E-05**	5.7E-01	---	---	5.7E-01

VOCs: volatile organic compounds
bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 26: Current Background Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4		---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6		---	NAP	NAP	---	---	NAP	NAP	---
Inorganics (mg/L)										
Antimony	7440-36-0	0.001	---	NAP	NAP	---	1.4E-02	NAP	NAP	1.4E-02
Cadmium	7440-43-9w		---	NAP	NAP	---	---	NAP	NAP	---
Copper	7440-50-8	0.001	---	NAP	NAP	---	2.9E-04	NAP	NAP	2.9E-04
Lead	7439-92-1		---	NAP	NAP	---	---	NAP	NAP	---
Radionuclides (pCi/L)										
Plutonium-239/240	PU-239/240	0.125	1.1E-07	NAP	NAP	1.1E-07	---	NAP	NAP	---
Uranium-233/234	U-233/234		---	NAP	NAP	---	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	0.314	2.8E-06	NAP	NAP	**2.8E-06**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	0.688	8.2E-06	NAP	NAP	**8.2E-06**	---	NAP	NAP	---
TOTAL			**1.1E-05**	---	---	**1.1E-05**	1.4E-02	---	---	1.4E-02

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 27: Current Incremental Residual Groundwater Risk for the Site Employee Scenario

			CANCER EFFECTS				NON-CANCER EFFECTS			
			Route-Specific Risk			Total	Route-Specific HI			Total
Analyte	CAS No.	Total EPC	Oral	Dermal	Inhalation $VOC_{(shower)}$	Cancer Risk	Oral	Dermal	Inhalation VOCs	Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6	0.002	1.7E-06	NAP	NAP	**1.7E-06**	7.5E-02	NAP	NAP	7.5E-02
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	NAP	NAP	---	3.4E-01	NAP	NAP	3.4E-01
Cadmium	7440-43-9w	0.007	---	NAP	NAP	---	1.3E-01	NAP	NAP	1.3E-01
Copper	7440-50-8	0.040	---	NAP	NAP	---	9.9E-03	NAP	NAP	9.9E-03
Lead	7439-92-1	0.013	---	NAP	NAP	---	---	NAP	NAP	---
Radionuclides (pCi/L)										
Plutonium-239/240	PU-239/240	1.875	1.6E-06	NAP	NAP	**1.6E-06**	---	NAP	NAP	---
Uranium-233/234	U-233/234	0.246	9.2E-07	NAP	NAP	9.2E-07	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.856	1.7E-05	NAP	NAP	**1.7E-05**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	1.332	5.0E-06	NAP	NAP	**5.0E-06**	---	NAP	NAP	---
TOTAL			**2.6E-05**	---	---	**2.6E-05**	5.5E-01	---	---	5.5E-01

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 28: Future Total Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	0.006	---	---	---	---	---	---	---	---
Dichloromethane (Methylene Chloride)	75-09-2	0.015	8.1E-08	4.3E-09	1.2E-09	8.6E-08	2.5E-03	1.3E-04	1.2E-05	2.7E-03
Fluorobenzene	462-06-6	0.009	---	---	---	---	---	---	---	---
O-Chloroflurobenzene	348-51-6	0.007	---	---	---	---	---	---	---	---
Tetrachloroethene	127-18-4	0.002	5.5E-08	---	1.5E-10	5.6E-08	1.5E-03	---	---	1.5E-03
Tert-butyl methyl ether	1634-04-4	0.002	---	---	---	---	---	---	1.9E-06	1.9E-06
Trichloroethylene (TCE)	79-01-6	0.004	5.7E-07	2.1E-06	1.1E-09	2.7E-06	1.3E-01	4.7E-01	---	6.0E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	0.018	1.7E-07	9.7E-08	NAP	2.7E-07	8.6E-03	4.8E-03	NAP	1.3E-02
Inorganics (mg/L)										
Aluminum	7429-90-5	2.024	---	---	NAP	---	2.0E-02	6.4E-04	NAP	2.0E-02
Antimony	7440-36-0	0.018	---	---	NAP	---	4.5E-01	9.7E-03	NAP	4.6E-01
Bismuth	7440-69-9	0.024	---	---	NAP	---	---	---	NAP	---
Cadmium	7440-43-9w	0.008	---	---	NAP	---	1.6E-01	2.0E-02	NAP	1.8E-01
Chromium (used VI CAS #)	18540-29-9	0.964	---	---	NAP	---	3.1E+00	4.1E-01	NAP	**3.6E+00**
Copper	7440-50-8	0.056	---	---	NAP	---	1.4E-02	4.4E-05	NAP	1.4E-02
Lead	7439-92-1	0.019	---	---	NAP	---	---	---	NAP	---
Lithium	7439-93-2	0.151	---	---	NAP	---	---	---	NAP	---
Molybdenum	7439-98-7	0.015	---	---	NAP	---	2.9E-02	2.5E-04	NAP	2.9E-02
Nickel	7440-02-0	0.278	---	---	NAP	---	1.4E-01	1.1E-02	NAP	1.5E-01
Nitrate/Nitrite	14797-65-0nn	6.510	---	---	NAP	---	6.4E-01	4.1E-03	NAP	6.4E-01
Thallium	7440-28-0	0.004	---	---	NAP	---	4.5E-01	1.4E-03	NAP	4.5E-01
Vanadium	7440-62-2	0.026	---	---	NAP	---	3.6E-02	4.5E-03	NAP	4.0E-02
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	0.259	4.2E-08	NA	NAP	4.2E-08	---	---	NAP	---
Potassium-40	13966-00-2	48.305	1.5E-06	NA	NAP	**1.5E-06**	---	---	NAP	---
Strontium-90	10098-97-2	1.417	9.9E-08	NA	NAP	9.9E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.588	4.7E-06	NA	NAP	**4.7E-06**	---	---	NAP	---
Tritium	10028-17-8w	66797.957	4.2E-06	2.1E-08	4.4E-08	**4.3E-06**	---	---	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.362	1.0E-06	NA	NAP	**1.0E-06**	---	---	NAP	---
Uranium-235 long lived decay	15117-96-1L	2.149	2.0E-06	NA	NAP	**2.0E-06**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	3.702	8.8E-06	NA	NAP	**8.8E-06**	---	---	NAP	---
TOTAL			**2.3E-05**	**2.3E-06**	4.6E-08	**2.6E-05**	**5.2E+00**	9.4E-01	1.4E-05	**6.1E+00**

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Table 28: Future Total Residual Groundwater Risk for the Construction Worker Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 29: Future Background Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5		---	---	---	---	---	---	---	---
Dichloromethane (Methylene Chloride)	75-09-2		---	---	---	---	---	---	---	---
Fluorobenzene	462-06-6		---	---	---	---	---	---	---	---
O-Chloroflurobenzene	348-51-6		---	---	---	---	---	---	---	---
Tert-butyl methyl ether	1634-04-4		---	---	---	---	---	---	---	---
Tetrachloroethene	127-18-4		---	---	---	---	---	---	---	---
Trichloroethylene (TCE)	79-01-6		---	---	---	---	---	---	---	---
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117 81-7		---	---	NAP	---	---	---	NAP	---
Inorganics (mg/L)										
Aluminum	7429-90-5	0.038	---	---	NAP	---	3.7E-04	1.2E-05	NAP	3.8E-04
Antimony	7440-36-0	0.001	---	---	NAP	---	1.4E-02	3.1E-04	NAP	1.4E-02
Bismuth	7440-69-9		---	---	NAP	---	---	---	NAP	---
Cadmium	7440-43-9w		---	---	NAP	---	---	---	NAP	---
Chromium (used VI CAS #)	18540-29-9	0.006	---	---	NAP	---	2.0E-02	2.6E-03	NAP	2.2E-02
Copper	7440-50-8	0.001	---	---	NAP	---	2.9E-04	9.2E-07	NAP	2.9E-04
Lead	7439-92-1		---	---	NAP	---	---	---	NAP	---
Lithium	7439-93-2	0.056	---	---	NAP	---	---	---	NAP	---
Molybdenum	7439-98-7	0.006	---	---	NAP	---	1.1E-02	9.3E-05	NAP	1.1E-02
Nickel	7440-02-0	0.035	---	---	NAP	---	1.7E-02	1.4E-03	NAP	1.8E-02
Nitrate/Nitrite	14797-65-0nn	5.349	---	---	NAP	---	5.2E-01	3.4E-03	NAP	5.3E-01
Thallium	7440-28-0		---	---	NAP	---	---	---	NAP	---
Vanadium	7440-62-2	0.017	---	---	NAP	---	2.4E-02	3.0E-03	NAP	2.7E-02
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	0.087	1.4E-08	NA	NAP	1.4E-08	---	---	NAP	---
Potassium-40	13966-00-2		---	NA	NAP	---	---	---	NAP	---
Strontium-90	10098-97-2	0.975	6.8E-08	NA	NAP	6.8E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	0.314	---	NA	NAP	---	---	---	NAP	---
Tritium	10028-17-8w	1485.470	9.4E-08	4.6E-10	9.7E-10	**9.6E-08**	---	---	NAP	---
Uranium-233 long lived decay	13968-55-3L		---	NA	NAP	---	---	---	NAP	---
Uranium-235 long lived decay	15117-96-1L	0.814	7.4E-07	NA	NAP	7.4E-07	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	0.688	1.6E-06	NA	NAP	**1.6E-06**	---	---	NAP	---
TOTAL			**2.6E-06**	4.6E-10	9.7E-10	**2.6E-06**	6.1E-01	1.1E-02	---	6.2E-01

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Table 29: Future Background Residual Groundwater Risk for the Construction Worker Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 30: Future Incremental Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	0.006	---	---	---	---	---	---	---	---
Dichloromethane (Methylene Chloride)	75-09-2	0.015	8.1E-08	4.3E-09	1.2E-09	8.6E-08	2.5E-03	1.3E-04	1.2E-05	2.7E-03
Fluorobenzene	462-06-6	0.009	---	---	---	---	---	---	---	---
O-Chloroflurobenzene	348-51-6	0.007	---	---	---	---	---	---	---	---
Tert-butyl methyl ether	1634-04-4	0.002	---	---	---	---	---	---	1.9E-06	1.9E-06
Tetrachloroethene	127-18-4	0.002	5.5E-08	---	1.5E-10	5.6E-08	1.5E-03	---	---	1.5E-03
Trichloroethylene (TCE)	79-01-6	0.004	5.7E-07	2.1E-06	1.1E-09	**2.7E-06**	1.3E-01	4.7E-01	---	6.0E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	0.018	1.7E-07	9.7E-08	NAP	2.7E-07	8.6E-03	4.8E-03	NAP	1.3E-02
Inorganics (mg/L)										
Aluminum	7429-90-5	1.986	---	---	NAP	---	1.9E-02	6.3E-04	NAP	2.0E-02
Antimony	7440-36-0	0.018	---	---	NAP	---	4.4E-01	9.4E-03	NAP	4.4E-01
Bismuth	7440-69-9	0.024	---	---	NAP	---	---	---	NAP	---
Cadmium	7440-43-9w	0.008	---	---	NAP	---	1.6E-01	2.0E-02	NAP	1.8E-01
Chromium (used VI CAS #)	18540-29-9	0.958	---	---	NAP	---	3.1E+00	4.0E-01	NAP	**3.5E+00**
Copper	7440-50-8	0.055	---	---	NAP	---	1.3E-02	4.3E-05	NAP	1.3E-02
Lead	7439-92-1	0.019	---	---	NAP	---	---	---	NAP	---
Lithium	7439-93-2	0.095	---	---	NAP	---	---	---	NAP	---
Molybdenum	7439-98-7	0.009	---	---	NAP	---	1.8E-02	1.5E-04	NAP	1.8E-02
Nickel	7440-02-0	0.243	---	---	NAP	---	1.2E-01	9.6E-03	NAP	1.3E-01
Nitrate/Nitrite	14797-65-0nn	1.161	---	---	NAP	---	1.1E-01	7.4E-04	NAP	1.1E-01
Thallium	7440-28-0	0.004	---	---	NAP	---	4.5E-01	1.4E-03	NAP	4.5E-01
Vanadium	7440-62-2	0.009	---	---	NAP	---	1.2E-02	1.5E-03	NAP	1.4E-02
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	0.172	2.8E-08	NA	NAP	2.8E-08	---	---	NAP	---
Potassium-40	13966-00-2	48.305	1.5E-06	NA	NAP	**1.5E-06**	---	---	NAP	---
Strontium-90	10098-97-2	0.442	3.1E-08	NA	NAP	3.1E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.274	4.1E-06	NA	NAP	**4.1E-06**	---	---	NAP	---
Tritium	10028-17-8w	65312.487	4.1E-06	2.0E-08	4.3E-08	**4.2E-06**	---	---	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.362	1.0E-06	NA	NAP	**1.0E-06**	---	---	NAP	---
Uranium-235 long lived decay	15117-96-1L	1.335	1.2E-06	NA	NAP	**1.2E-06**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	3.014	7.2E-06	NA	NAP	**7.2E-06**	---	---	NAP	---
TOTAL			**2.0E-05**	**2.3E-06**	4.5E-08	**2.2E-05**	**4.6E+00**	9.3E-01	1.4E-05	**5.5E+00**

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Table 30: Future Incremental Residual Groundwater Risk for the Construction Worker Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
SVOCs: semivolatile organic compounds
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 31: Future Total Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	5.8E-03	---	NAP	NAP	---	---	NAP	NAP	---
Dichloromethane (Methylene Chloride)	75-09-2	1.5E-02	4.0E-07	NAP	NAP	4.0E-07	2.5E-03	NAP	NAP	2.5E-03
Fluorobenzene	462-06-6	8.7E-03	---	NAP	NAP	---	---	NAP	NAP	---
O-Chloroflurobenzene	348-51-6	7.2E-03	---	NAP	NAP	---	---	NAP	NAP	---
Tert-butyl methyl ether	1634-04-4	6.1E-04	---	NAP	NAP	---	---	NAP	NAP	---
Tetrachloroethene	127-18-4	1.5E-03	2.8E-07	NAP	NAP	2.8E-07	1.5E-03	NAP	NAP	1.5E-03
Trichloroethylene (TCE)	79-01-6	3.9E-03	2.9E-06	NAP	NAP	2.9E-06	1.3E-01	NAP	NAP	1.3E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	1.8E-02	8.6E-07	NAP	NAP	8.6E-07	8.6E-03	NAP	NAP	8.6E-03
Inorganics (mg/L)										
Aluminum	7429-90-5	2.0E+00	---	NAP	NAP	---	2.0E-02	NAP	NAP	2.0E-02
Antimony	7440-36-0	1.8E-02	---	NAP	NAP	---	4.5E-01	NAP	NAP	4.5E-01
Bismuth	7440-69-9	2.4E-02	---	NAP	NAP	---	---	NAP	NAP	---
Cadmium	7440-43-9w	8.0E-03	---	NAP	NAP	---	1.6E-01	NAP	NAP	1.6E-01
Chromium (used VI CAS #)	18540-29-9	9.6E-01	---	NAP	NAP	---	3.1E+00	NAP	NAP	**3.1E+00**
Copper	7440-50-8	5.6E-02	---	NAP	NAP	---	1.4E-02	NAP	NAP	1.4E-02
Lead	7439-92-1	1.9E-02	---	NAP	NAP	---	---	NAP	NAP	---
Lithium	7439-93-2	1.5E-01	---	NAP	NAP	---	---	NAP	NAP	---
Molybdenum	7439-98-7	1.5E-02	---	NAP	NAP	---	2.9E-02	NAP	NAP	2.9E-02
Nickel	7440-02-0	2.8E-01	---	NAP	NAP	---	1.4E-01	NAP	NAP	1.4E-01
Thallium	7440-28-0	3.6E-03	---	NAP	NAP	---	4.5E-01	NAP	NAP	4.5E-01
Vanadium	7440-62-2	2.6E-02	---	NAP	NAP	---	3.6E-02	NAP	NAP	3.6E-02
Nitrate/Nitrite	14797-65-0nn	6.5E+00	---	NAP	NAP	---	6.4E-01	NAP	NAP	6.4E-01
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	2.6E-01	2.1E-07	NAP	NAP	2.1E-07	NAP	NAP	NAP	---
Potassium-40	13966-00-2	4.8E+01	7.5E-06	NAP	NAP	**7.5E-06**	NAP	NAP	NAP	---
Strontium-90	10098-97-2	1.4E+00	5.0E-07	NAP	NAP	**5.0E-07**	NAP	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.6E+00	2.3E-05	NAP	NAP	2.3E-05	NAP	NAP	NAP	---
Tritium	10028-17-8w	6.7E+04	2.1E-05	NAP	NAP	**2.1E-05**	NAP	NAP	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.4E+00	5.1E-06	NAP	NAP	**5.1E-06**	NAP	NAP	NAP	---
Uranium-235 long lived decay	15117-96-1L	2.1E+00	9.8E-06	NAP	NAP	**9.8E-06**	NAP	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	3.7E+00	4.4E-05	NAP	NAP	**4.4E-05**	NAP	NAP	NAP	---
TOTAL			**1.2E-04**	---	---	**1.2E-04**	**5.2E+00**	---	---	**5.2E+00**

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Table 31: Future Total Residual Groundwater Risk for the Site Employee Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
EPC: Exposure Point Concentration
HI: Hazard Index
CAS: Chemical Abstract Service
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 32: Future Background Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5		---	NAP	NAP	---	---	NAP	NAP	---
Dichloromethane (Methylene Chloride)	75-09-2		---	NAP	NAP	---	---	NAP	NAP	---
Fluorobenzene	462-06-6		---	NAP	NAP	---	---	NAP	NAP	---
O-Chloroflurobenzene	348-51-6		---	NAP	NAP	---	---	NAP	NAP	---
Tert-butyl methyl ether	1634-04-4		---	NAP	NAP	---	---	NAP	NAP	---
Tetrachloroethene	127-18-4		---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6		---	NAP	NAP	---	---	NAP	NAP	---
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7		---	NAP	NAP	---	---	NAP	NAP	---
Inorganics (mg/L)										
Aluminum	7429-90-5	3.8E-02	---	NAP	NAP	---	3.7E-04	NAP	NAP	3.7E-04
Antimony	7440-36-0	5.8E-04	---	NAP	NAP	---	1.4E-02	NAP	NAP	1.4E-02
Bismuth	7440-69-9		---	NAP	NAP	---	---	NAP	NAP	---
Cadmium	7440-43-9w		---	NAP	NAP	---	---	NAP	NAP	---
Chromium (used VI CAS #)	18540-29-9	6.1E-03	---	NAP	NAP	---	2.0E-02	NAP	NAP	2.0E-02
Copper	7440-50-8	1.2E-03	---	NAP	NAP	---	2.9E-04	NAP	NAP	2.9E-04
Lead	7439-92-1		---	NAP	NAP	---	---	NAP	NAP	---
Lithium	7439-93-2	5.6E-02	---	NAP	NAP	---	---	NAP	NAP	---
Molybdenum	7439-98-7	5.6E-03	---	NAP	NAP	---	1.1E-02	NAP	NAP	1.1E-02
Nickel	7440-02-0	3.5E-02	---	NAP	NAP	---	1.7E-02	NAP	NAP	1.7E-02
Thallium	7440-28-0		---	NAP	NAP	---	---	NAP	NAP	---
Vanadium	7440-62-2	1.7E-02	---	NAP	NAP	---	2.4E-02	NAP	NAP	2.4E-02
Nitrate/Nitrite	14797-65-0nn	5.3E+00	---	NAP	NAP	---	5.2E-01	NAP	NAP	5.2E-01
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	8.7E-02	7.1E-08	NAP	NAP	7.1E-08	---	NAP	NAP	---
Potassium-40	13966-00-2		---	NAP	NAP	---	---	NAP	NAP	---
Strontium-90	10098-97-2		---	NAP	NAP	---	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	9.8E-01	8.8E-06	NAP	NAP	8.8E-06	---	NAP	NAP	---
Tritium	10028-17-8w		---	NAP	NAP	---	---	NAP	NAP	---
Uranium-233 long lived decay	13968-55-3L		---	NAP	NAP	---	---	NAP	NAP	---
Uranium-235 long lived decay	15117-96-1L	8.1E-01	3.7E-06	NAP	NAP	3.7E-06	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	6.9E-01	8.2E-06	NAP	NAP	8.2E-06	---	NAP	NAP	---
TOTAL			**2.1E-05**	---	---	**2.1E-05**	6.1E-01	---	---	6.1E-01

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Table 32: Future Background Residual Groundwater Risk for the Site Employee Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
EPC: Exposure Point Concentration
HI: Hazard Index
CAS: Chemical Abstract Service
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 33: Future Incremental Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS Route-Specific Risk Oral	Dermal	Inhalation VOC	Total Cancer Risk	NON-CANCER EFFECTS Route-Specific HI Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	5.8E-03	---	NAP	NAP	---	---	NAP	NAP	---
Dichloromethane (Methylene Chloride)	75-09-2	1.5E-02	4.0E-07	NAP	NAP	4.0E-07	2.5E-03	NAP	NAP	2.5E-03
Fluorobenzene	462-06-6	8.7E-03	---	NAP	NAP	---	---	NAP	NAP	---
O-Chloroflurobenzene	348-51-6	7.2E-03	---	NAP	NAP	---	---	NAP	NAP	---
Tert-butyl methyl ether	1634-04-4	6.1E-04	---	NAP	NAP	---	---	NAP	NAP	---
Tetrachloroethene	127-18-4	1.5E-03	2.8E-07	NAP	NAP	2.8E-07	1.5E-03	NAP	NAP	1.5E-03
Trichloroethylene (TCE)	79-01-6	3.9E-03	2.9E-06	NAP	NAP	2.9E-06	1.3E-01	NAP	NAP	1.3E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	1.8E-02	8.6E-07	NAP	NAP	8.6E-07	8.6E-03	NAP	NAP	8.6E-03
Inorganics (mg/L)										
Aluminum	7429-90-5	2.0E+00	---	NAP	NAP	---	1.9E-02	NAP	NAP	1.9E-02
Antimony	7440-36-0	1.8E-02	---	NAP	NAP	---	4.4E-01	NAP	NAP	4.4E-01
Bismuth	7440-69-9	2.4E-02	---	NAP	NAP	---	---	NAP	NAP	---
Cadmium	7440-43-9w	8.0E-03	---	NAP	NAP	---	1.6E-01	NAP	NAP	1.6E-01
Chromium (used VI CAS #)	18540-29-9	9.6E-01	---	NAP	NAP	---	3.1E+00	NAP	NAP	**3.1E+00**
Copper	7440-50-8	5.5E-02	---	NAP	NAP	---	1.3E-02	NAP	NAP	1.3E-02
Lead	7439-92-1	1.9E-02	---	NAP	NAP	---	---	NAP	NAP	---
Lithium	7439-93-2	9.5E-02	---	NAP	NAP	---	---	NAP	NAP	---
Molybdenum	7439-98-7	9.3E-03	---	NAP	NAP	---	1.8E-02	NAP	NAP	1.8E-02
Nickel	7440-02-0	2.4E-01	---	NAP	NAP	---	1.2E-01	NAP	NAP	1.2E-01
Thallium	7440-28-0	3.6E-03	---	NAP	NAP	---	4.5E-01	NAP	NAP	4.5E-01
Vanadium	7440-62-2	8.6E-03	---	NAP	NAP	---	1.2E-02	NAP	NAP	1.2E-02
Nitrate/Nitrite	14797-65-0nn	1.2E+00	---	NAP	NAP	---	1.1E-01	NAP	NAP	1.1E-01
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	1.7E-01	1.4E-07	NAP	NAP	1.4E-07	---	NAP	NAP	---
Potassium-40	13966-00-2	4.8E+01	7.5E-06	NAP	NAP	**7.5E-06**	---	NAP	NAP	---
Strontium-90	10098-97-2	1.4E+00	5.0E-07	NAP	NAP	**5.0E-07**	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.6E+00	1.5E-05	NAP	NAP	1.5E-05	---	NAP	NAP	---
Tritium	10028-17-8w	6.7E+04	2.1E-05	NAP	NAP	**2.1E-05**	---	NAP	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.4E+00	5.1E-06	NAP	NAP	**5.1E-06**	---	NAP	NAP	---
Uranium-235 long lived decay	15117-96-1L	2.1E+00	9.8E-06	NAP	NAP	**9.8E-06**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	2.5E+00	3.0E-05	NAP	NAP	3.0E-05	---	NAP	NAP	---
TOTAL			**9.3E-05**	---	---	**9.3E-05**	**4.6E+00**	---	---	**4.6E+00**

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Table 33: Future Incremental Residual Groundwater Risk for the Site Employee Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
EPC: Exposure Point Concentration
HI: Hazard Index
CAS: Chemical Abstract Service
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 34: Total Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	1.7E-01	**1.3E-05**
			Dermal Contact	1.6E-03	3.5E-07
			Inhalation of Dust	NA	2.6E-08
			Inhalation of VOCs	NA	NA
			External	NA	**3.8E-05**
			Soil Total Risk	1.7E-01	**5.1E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.7E-01	**5.1E-06**
			Dermal Contact	3.1E-01	**1.3E-06**
			Inhalation while Showering	4.8E-07	6.7E-10
			Current Groundwater Total Risk	**8.7E-01**	**6.4E-06**
	Future Groundwater	Chemical & Radiological	Oral	**5.2E+00**	**2.3E-05**
			Dermal Contact	9.4E-01	**2.3E-06**
			Inhalation while Showering	1.4E-05	4.6E-08
			Future Groundwater Total Risk	**6.1E+00**	**2.6E-05**
	Air*	Radiological	Inhalation	NA	2.1E-07
			Air Total Risk	NA	2.1E-07
			Cumulative Total Current Risk	**1.0E+00**	**5.8E-05**
			Cumulative Total Future Risk	**6.3E+00**	**7.7E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	1.4E-02	**9.2E-06**
			Inhalation of Dust	NA	1.4E-07
			Inhalation of VOCs	NA	NA
			External	NA	**4.4E-05**
			Soil Total Risk	1.4E-02	**5.3E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.7E-01	**3.1E-05**
			Current Groundwater Total Risk	5.7E-01	**3.1E-05**
	Future Groundwater	Chemical & Radiological	Oral	**5.2E+00**	**1.2E-04**
			Future Groundwater Total Risk	**5.2E+00**	**1.2E-04**
	Air*	Radiological	Inhalation	NA	**1.0E-06**
			Air Total Risk	NA	**1.0E-06**
			Cumulative Total Current Risk	5.8E-01	**8.5E-05**
			Cumulative Total Future Risk	**5.2E+00**	**1.7E-04**

HI: Hazard Index
NA - not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls - below land surface
VOCs - volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 35: Background Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	2.7E-02	**5.7E-06**
			Dermal Contact	6.0E-05	NA
			Inhalation of Dust	NA	6.9E-09
			Inhalation of VOCs	NA	NA
			External	NA	**2.8E-05**
			Soil Total Risk	2.7E-02	**3.4E-05**
	Current Groundwater	Chemical & Radiological	Oral	1.4E-02	**1.6E-06**
			Dermal Contact	3.1E-04	NA
			Inhalation While Showering	NA	NA
			Current Groundwater Total Risk	1.5E-02	**1.6E-06**
	Future Groundwater	Chemical & Radiological	Oral	6.1E-01	**2.6E-06**
			Dermal Contact	1.1E-02	4.6E-10
			Inhalation While Showering	NA	9.7E-10
			Future Groundwater Total Risk	6.2E-01	**2.6E-06**
	Air*	Radiological	Inhalation	NA	7.7E-09
			Air Total Risk	NA	7.7E-09
			Cumulative Background Current Risk	4.2E-02	**3.6E-05**
			Cumulative Background Future Risk	**6.5E-01**	**3.7E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	1.4E-02	**5.2E-06**
			Inhalation of Dust	NA	4.1E-08
			Inhalation of VOCs	NA	NA
			External	NA	**3.1E-05**
			Soil Total Risk	1.4E-02	**3.7E-05**
	Current Groundwater	Chemical & Radiological	Oral	1.4E-02	**1.1E-05**
			Current Groundwater Total Risk	1.4E-02	**1.1E-05**
	Future Groundwater	Chemical & Radiological	Oral	6.1E-01	**2.1E-05**
			Future Groundwater Total Risk	6.1E-01	**2.1E-05**
	Air*	Radiological	Inhalation	NA	3.9E-08
			Air Total Risk	NA	3.9E-08
			Cumulative Background Current Risk	2.8E-02	**4.8E-05**
			Cumulative Background Future Risk	**6.2E-01**	**5.7E-05**

HI: Hazard Index
NA - not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls - below land surface
VOCs - volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 36: Incremental Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	1.4E-01	**7.4E-06**
			Dermal Contact	1.6E-03	3.5E-07
			Inhalation of Dust	NA	2.0E-08
			Inhalation of VOCs	NA	NA
			External	NA	**9.5E-06**
		Soil Total Risk		1.4E-01	**1.7E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.5E-01	**3.5E-06**
			Dermal Contact	3.1E-01	**1.3E-06**
			Inhalation While Showering	4.8E-07	NA
		Current Groundwater Total Risk		**8.6E-01**	**4.8E-06**
	Future Groundwater	Chemical & Radiological	Oral	**4.6E+00**	**2.0E-05**
			Dermal Contact	9.3E-01	**2.3E-06**
			Inhalation While Showering	1.4E-05	4.5E-08
		Future Groundwater Total Risk		**5.5E+00**	**2.2E-05**
	Air*	Radiological	Inhalation	NA	2.0E-07
		Air Total Risk		NA	2.0E-07
	Cumulative Incremental Current Risk			1.0E+00	**2.2E-05**
	Cumulative Incremental Future Risk			**5.7E+00**	**4.0E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	4.6E-04	**4.0E-06**
			Inhalation of Dust	NA	9.7E-08
			Inhalation of VOCs	NA	NA
			External	NA	**1.2E-05**
		Soil Total Risk		4.6E-04	**1.6E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.5E-01	**2.6E-05**
		Current Groundwater Total Risk		5.5E-01	**2.6E-05**
	Future Groundwater	Chemical & Radiological	Oral	**4.6E+00**	**9.3E-05**
		Future Groundwater Total Risk		**4.6E+00**	**9.3E-05**
	Air*	Radiological	Inhalation	NA	9.9E-07
		Air Total Risk		NA	9.9E-07
	Cumulative Incremental Current Risk			5.5E-01	**4.3E-05**
	Cumulative Incremental Future Risk			**4.6E+00**	**1.1E-04**

HI: Hazard Index
NA: not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls: below land surface
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 37: Background Values for Soil Analytes

Analyte	CAS Number	Background Concentration
Inorganics (mg/kg)		
Aluminum	7429-90-5	19000.000
Antimony	7440-36-0	
Arsenic	7440-38-2	8.600
Barium	7440-39-3	180.000
Beryllium	7440-41-7	1.300
Bismuth	7440-69-9	
Cadmium	7440-43-9s	2.100
Calcium	7440-70-2	310000.000
Chromium	7440-47-3	20.000
Chromium VI	18540-29-9	20.000
Cobalt	7440-48-4	19.000
Copper	7440-50-8	26.000
Cyanide	57-12-5	
Iron	7439-89-6	35000.000
Lead	7439-92-1	48.000
Lithium	7439-93-2	26.000
Magnesium	7439-95-4	40000.000
Manganese	7439-96-5s	1400.000
Mercury	7439-97-6	
Molybdenum	7439-98-7	27.000
Nickel	7440-02-0	32.000
Potassium	7440-09-7	1900.000
Selenium	7782-49-2	
Silver	7440-22-4	1.700
Sodium	7440-23-5	240.000
Thallium	7440-28-0	0.460
Tin	7440-31-5	20.000
Vanadium	7440-62-2	25.000
Zinc	7440-66-6	140.000
Pesticides (mg/kg)		
4,4'-DDE	72-55-9	0.004
Chlordane	57-74-9	
SVOCs (mg/kg)		
Anthracene	120-12-7	
Benzo(a)anthracene	56-55-3	
Benzo(a)pyrene	50-32-8	
Benzo(b)fluoranthene	205-99-2	
Benzo(g,h,i)perylene	191-24-2	
Benzo(k)fluoranthene	207-08-9	
Bis(2-ethylhexyl)phthalate	117-81-7	
Chrysene	218-01-9	
Di-n-butyl Phthalate	84-74-2	
Fluoranthene	206-44-0	
Indeno(1,2,3-cd)pyrene	193-39-5	

Table 37: Background Values for Soil Analytes

Analyte	CAS Number	Background Concentration
N-Nitrosodiphenylamine	86-30-6	
Phenanthrene	85-01-8	
Pyrene	129-00-0	
VOCs (mg/kg)		
2-Butanone	78-93-3	
4-Methyl-2-pentanone	108-10-1	
Acetone	67-64-1	
Dichloromethane (Methylene Chloride)	75-09-2	
Naphthalene	91-20-3	
Tetrachloroethene	127-18-4	
Toluene	108-88-3	
Xylenes, Total	1330-20-7	
mp-Xylene	mp-Xylene	
Radionuclides (pCi/g)		
Actinium-227	14952-40-0	
Actinium-227 +D	14952-40-0(+D)	
Actinium-227 long lived decay	14952-40-0L	
Actinium-228	14331-83-0	
Bismuth-214	14733-03-0	
Cesium-137	10045-97-3	0.420
Cesium-137 +D	10045-97-3(+D)	0.420
Cesium-137 long lived decay	10045-97-3L	0.420
Lead-210	14255-04-0	
Lead-210+D	14255-04-0(+D)	
Lead-210 long lived decay	14255-04-0L	
Lead-212	15092-94-1	
Lead-214	15067-28-4	
Plutonium-238	13981-16-3	0.130
Plutonium-239	15117-48-3	0.180
Plutonium-239/240	PU-239/240	0.180
Potassium-40	13966-00-2	37.000
Radium-224	13233-32-4	
Radium-226	13982-63-3	2.000
Radium-226+D	13982-63-3(+D)	2.000
Radium-226 long lived decay	13982-63-3L	2.000
Radium-228	15262-20-1	
Radium-228+D	15262-20-1(+D)	
Radium-228 long lived decay	15262-20-1L	
Thallium-208	14913-50-9	
Thorium-227	15623-47-9	
Thorium-228	14274-82-9	1.500
Thorium-228+D	14274-82-9(+D)	1.500
Thorium-228 long lived decay	14274-82-9L	1.500
Thorium-230	14269-63-7	1.900
Thorium-230 long lived decay	14269-63-7L	1.900

Table 37: Background Values for Soil Analytes

Analyte	CAS Number	Background Concentration
Thorium-232	7440-29-1	1.400
Thorium-232 long lived decay	7440-29-1L	1.400
Uranium-234	13966-29-5	1.100
Uranium-235	15117-96-1	0.110
Uranium-235+D	15117-96-1(+D)	0.110
Uranium-235 long lived decay	15117-96-1L	0.110
Uranium-238	7440-61-1	1.200
Uranium-238+D	7440-61-1(+D)	1.200
Uranium-238 long lived decay	7440-61-1L	1.200

CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal $1x10^{-3}$ and 0.001

Table 38: Background Values for Groundwater Analytes

Analyte	CAS Number	Background Concentration
(mg/L)		
Nitrate	7697-37-2	5.3490
Nitrate/Nitrite	1497-55-8	5.3490
Nitrite	14797-65-0	
Metals (mg/L)		
Aluminum	7429-90-5	0.0375
Antimony	7440-36-0	0.0006
Arsenic	7440-38-2	0.0330
Barium	7440-39-3	0.3102
Beryllium	7440-41-7	
Bismuth	7440-69-9	
Boron	7440-42-8	
Cadmium	7440-43-9w	
Calcium	7440-70-2	111.1107
Chromium	7440-47-3	0.0061
Cobalt	7440-48-4	
Copper	7440-50-8	0.0012
Cyanide	57-12-5	
Iron	7439-89-6	4.0649
Lead	7439-92-1	
Lithium	7439-93-2	0.0557
Magnesium	7439-95-4	40.4281
Manganese	7439-96-5	0.2296
Molybdenum	7439-98-7	0.0056
Nickel	7440-02-0	0.0350
Potassium	7440-09-7	4.4611
Selenium	7782-49-2	
Silver	7440-22-4	
Sodium	7440-23-5	62.4256
Thallium	7440-28-0	
Tin	7440-31-5	0.0344
Vanadium	7440-62-2	0.0171
Zinc	7440-66-6	0.1196
SVOCs (mg/L)		
Bis(2-ethylhexyl)phthalate	117-81-7	
VOCs (mg/L)		
1,1,1-Trichloroethane	71-55-6	
1,2-Dichloroethene *	540-59-0	
1,2-cis-Dichloroethene	156-59-2	
2-Butanone	78-93-3	
Acetone	67-64-1	
Bromochloromethane	74-97-5	
Dichloromethane (Methylene Chloride)	75-09-2	

Table 38: Background Values for Groundwater Analytes

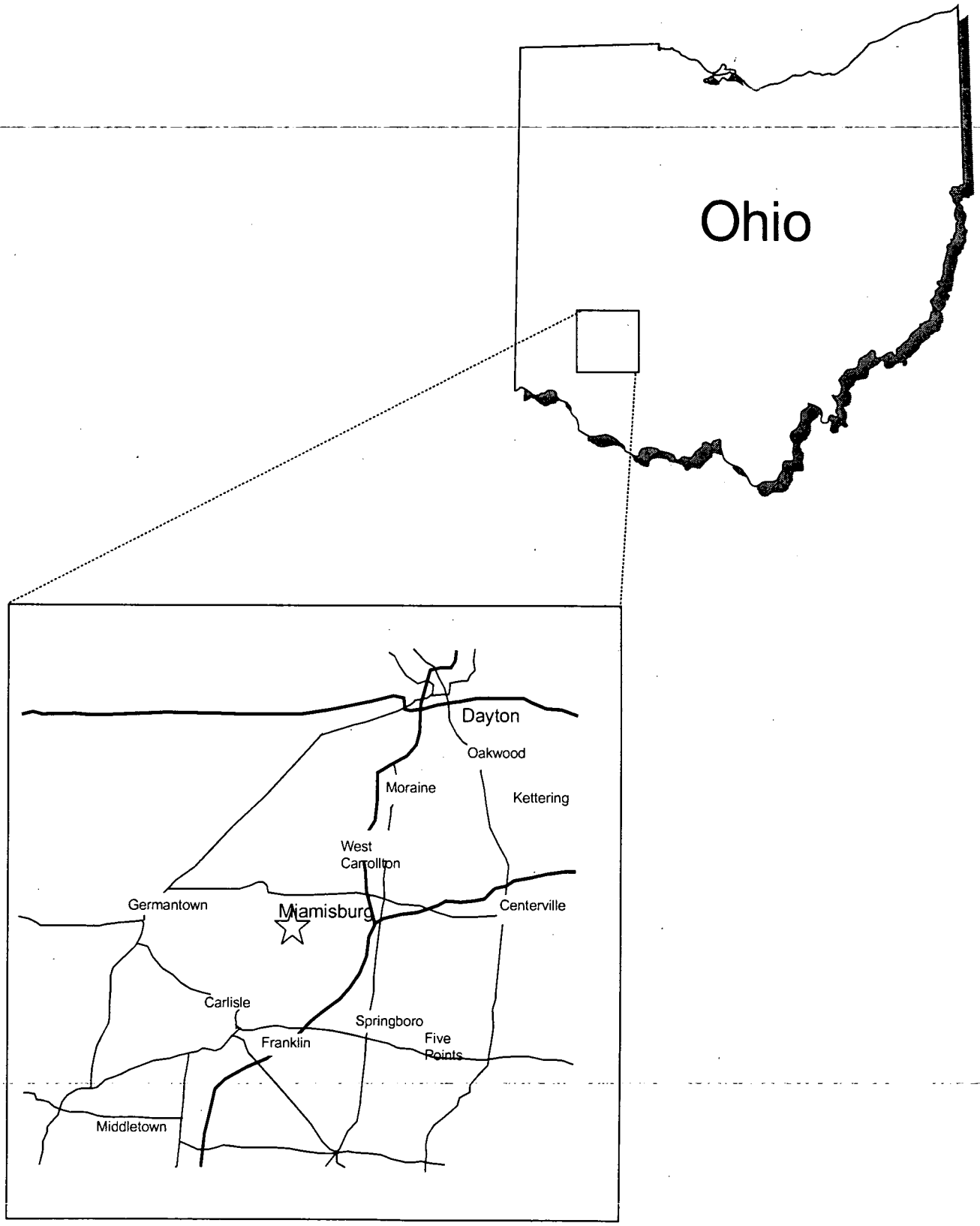
Analyte	CAS Number	Background Concentration
Fluorobenzene	462-06-6	
O-Chloroflurobenzene	348-51-6	
Tetrachloroethene	127-18-4	
Trichloroethylene (TCE)	79-01-6	
Radionuclides (pCi/L)		
Americium-241	14596-10-2	0.1390
Plutonium-238	13981-16-3	0.0870
Plutonium-239/240	PU-239/240	0.1250
Plutonium-242	13982-10-0	
Potassium-40	13966-00-2	
Radium-226	13982-63-3	0.9960
Radium-226 +D	13982-63-3(+D)	0.9960
Radium-226 long lived decay	13982-63-3L	0.9960
Radium-228	15262-20-1	
Radium-228 +D	15262-20-1(+D)	
Radium-228 long lived decay	15262-20-1L	
Strontium-90	10098-97-2	
Thorium-227	15623-47-9	
Thorium-228	14274-82-9	0.7790
Thorium-228+D	14274-82-9(+D)	0.7790
Thorium-228 long lived decay	14274-82-9L	0.7790
Thorium-230	14269-63-7	
Thorium-230 long lived decay	14269-63-7L	
Thorium-232	7440-29-1	0.3140
Thorium-232 long lived decay	7440-29-1L	0.3140
Tritium	10028-17-8w	1485.5000
Uranium-233	13968-55-3	
Uranium-233 long lived decay	13968-55-3L	
Uranium-233/234	U-233/234	
Uranium-234	13966-29-5	0.7920
Uranium-235	15117-96-1	0.8140
Uranium-235+D	15117-96-1(+D)	0.8140
Uranium-235 long lived decay	15117-96-1L	0.8140
Uranium-235/236	U-235/236	
Uranium-238	7440-61-1	0.6880
Uranium-238+D	7440-61-1(+D)	0.6880
Uranium-238 long lived decay	7440-61-1L	0.6880

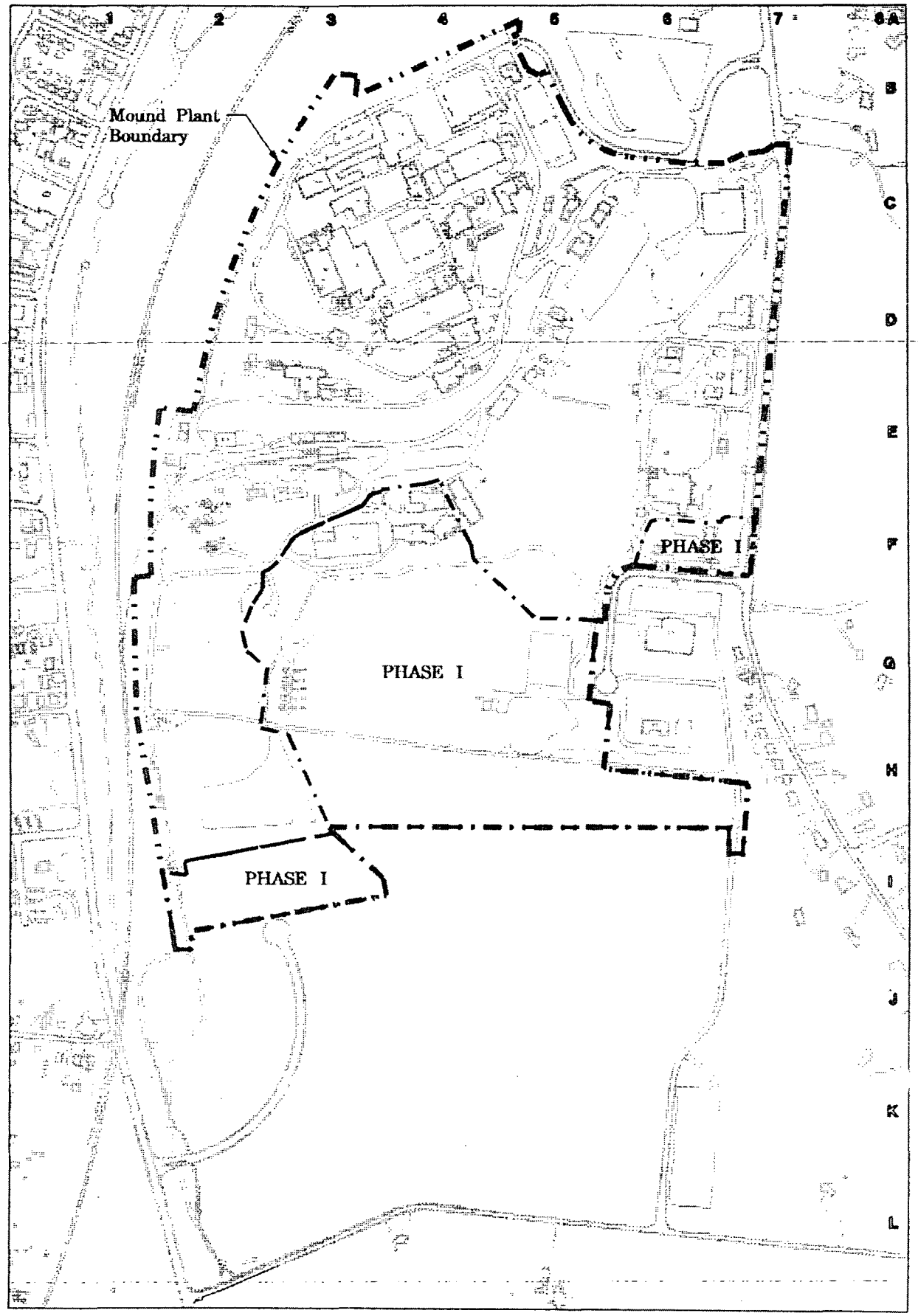
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal $1x10^{-3}$ and 0.001

APPENDIX D

Figures

Figure 1: Regional Context of the Mound Plant





Legend

Structures
Paved roadway
Unpaved roadway
Railroad
Water course
Fence
Mound Plant boundary
Contour line

0 100 200 400 600 800 1000
Scale In Feet

05/08/02	ISSUE FOR GENERAL USE	SSP			
DATE	REVISION				

MOUND
Environmental Restoration Geographic Information System

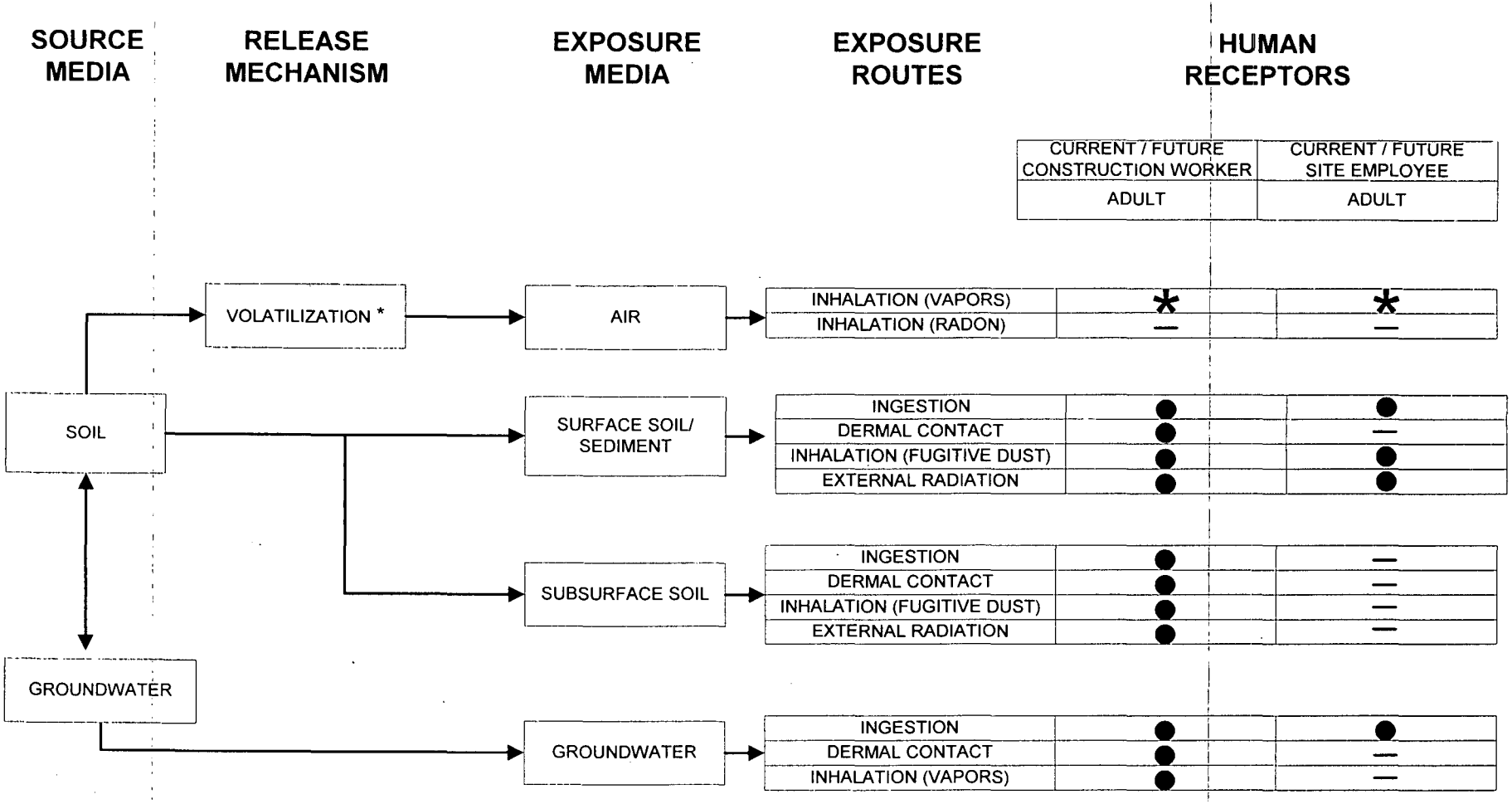
UNCLASSIFIED

Figure 2
Location of Phase I

D:\gen_site_plan.dgn

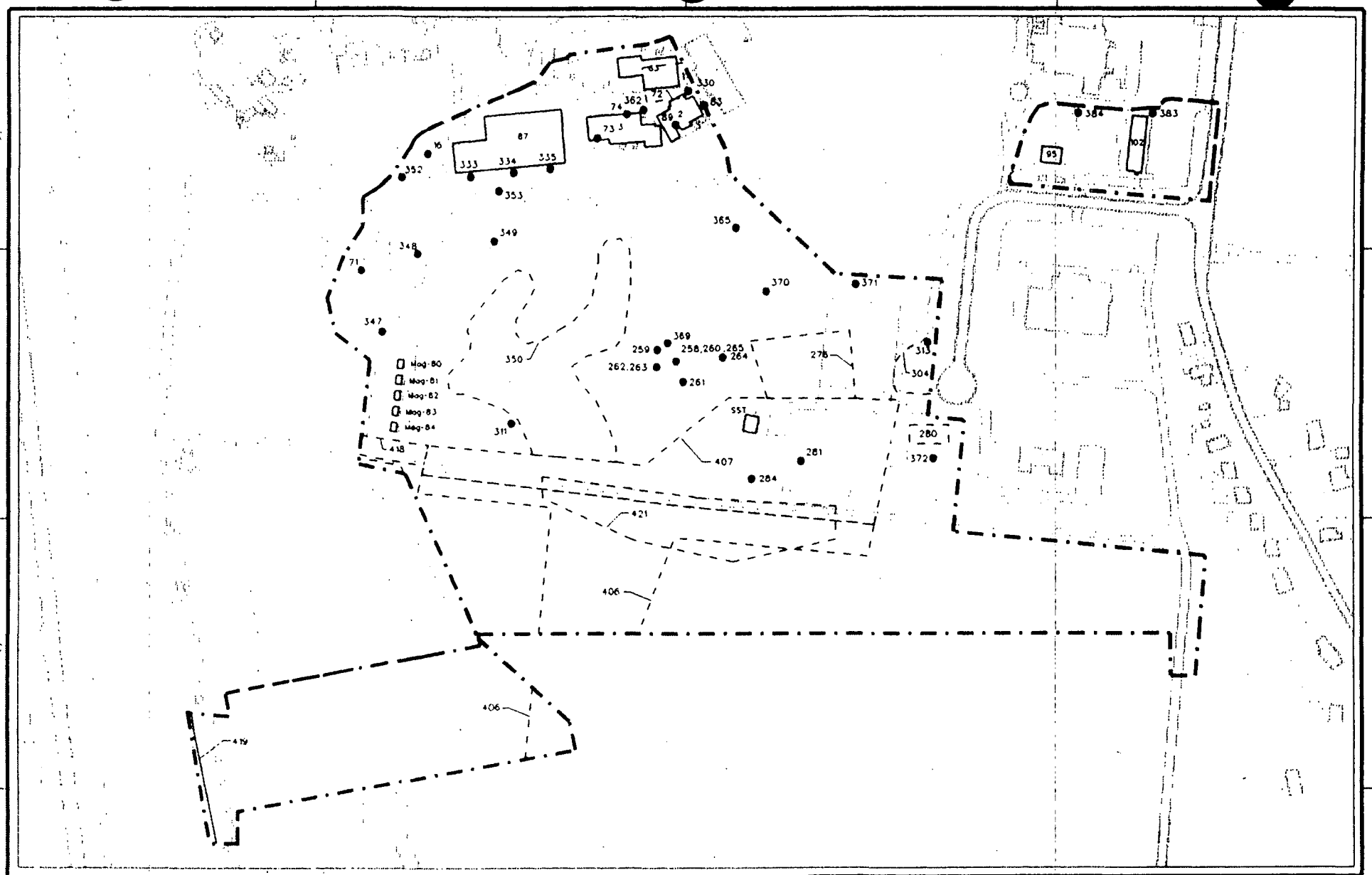
STATUS MD-REL-09/14/93

gen_site_plan.dgn



● COMPLETE PATHWAY EVALUATED QUANTITATIVELY
○ COMPLETE PATHWAY EVALUATED QUALITATIVELY
— INCOMPLETE PATHWAY, NOT EVALUATED
* NO VOLATILE COPCs IN AREA

Figure 3
Conceptual Site Model for the Phase I RRE



MOUND

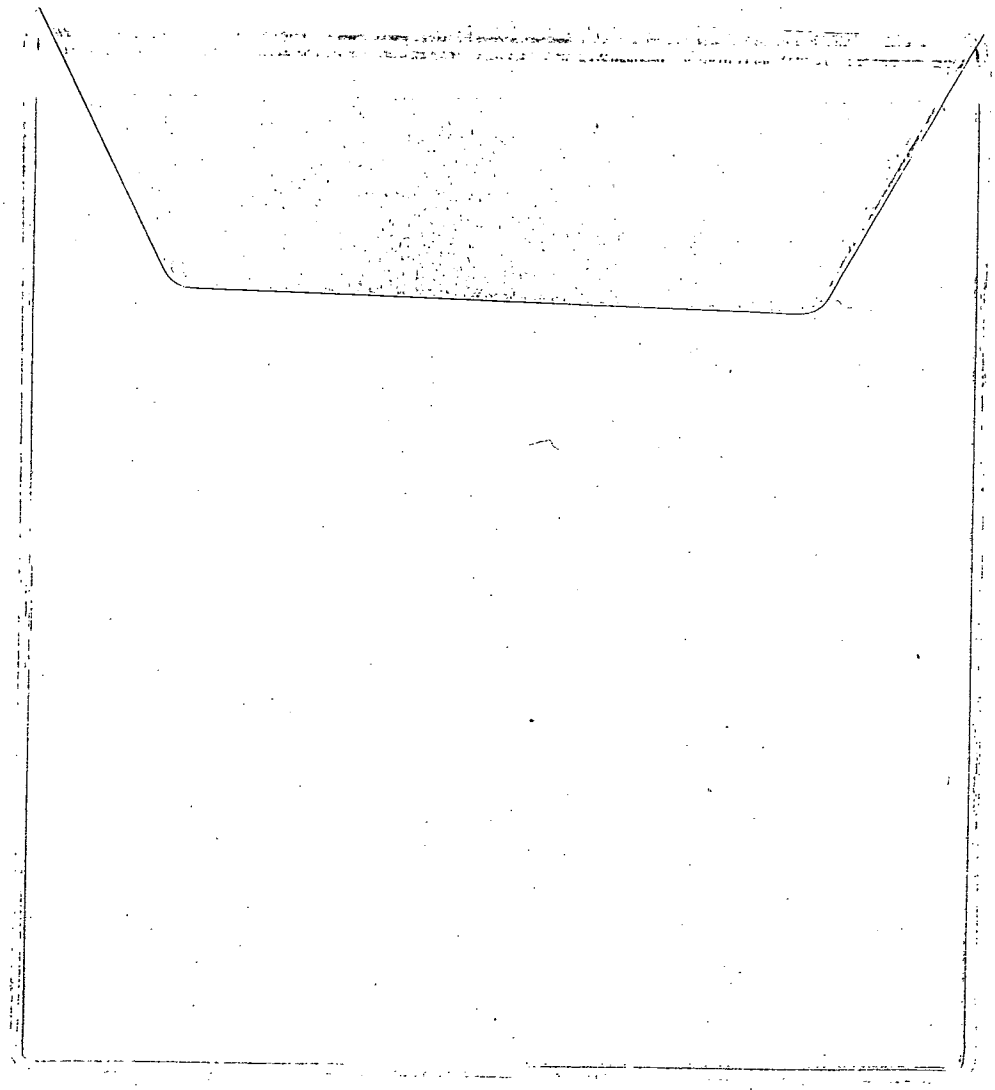
Environmental Restoration Geographic Information System

Figure 4: Phase I Buildings and PRSs

	05/08/02		SSR					
NO	DATE	REVISION	BY	CHKR	ENG	PROJ	APVD	#

APPENDIX E

CD of Phase I Database Information



APPENDIX F

Building Information

BUILDING INFORMATION

Phase I includes 53.8 acres of land located in three distinct sections or parcels of the site property (Figure 2). The first parcel, the largest block of property in Phase I includes lands located on the south central part of the original 182 acres of the site that was purchased in 1947. This piece of property also contains a portion of the South Property (purchased in 1982). The second parcel of property included in Phase I is situated to the south of the Spoils Area and the site well pump houses, in the area designated as the South Property. The third parcel of property in Phase I lies to the south-southwest of Building 38.

Phase I includes 13 existing buildings and explosives magazines and 25 former production-era building sites including buildings, explosives storage magazines, and an electrical generator. Since the plant became operational, the properties in Phase I, with the exception of the South Property, have supported a number of plant related operations. Included in the activities that once took place in Phase I is explosives testing and production-related activities, administrative activities (i.e., offices and site security operations), utilities operations, waste processing operations (the Burn Area), and cleanup waste storage operations.

In addition to the 38 production-era buildings noted above, Phase I also includes building sites for around seven buildings constructed in 1947 with the sole purpose to support the construction of the original site buildings. An additional building location includes the site of a building that was transferred from Dayton Unit III to the Mound site in 1949. This building was again moved to another location on the Mound site, and is known as "Building 19." The building sites dating from the construction era include a storage warehouse, a quonset-type building, and some other temporary buildings.

Phase I lands have also been used for various waste and non-waste storage activities including waste container management, equipment management, and for other general plant uses.

BUILDINGS CURRENTLY LOCATED IN PHASE I

There are 13 existing buildings located within Phase I (as shown in Figure 4), including five buildings located in the Test Fire Area that have supported detonator and explosives testing operations (Buildings 2, 3, 63E, 63W, and 87). In addition to the five Test Fire Area buildings, there are five explosives magazines located to the southwest of the Test Fire Area (Magazines 80, 81, 82, 83, and 84). All of the buildings in the Test Fire Area, with the exception of Building 2, as well as the explosives magazines, are currently operated under users agreements that are being administered by MMCIC.

The remaining three buildings located in Phase I include Building 95, which is a chiller and steam plant that is located on the SM/PP Hill; Building 102, an office building located on the SM/PP Hill; and the Salt Storage (SST) Building.

Buildings currently located in Phase I are described below.

Building 2. The former Energetic Materials Destructive Testing Facility (Building 2) was constructed in 1956. At the time of construction, the building contained approximately

3,130 square feet of floor space. With five additions to the building, the square footage of Building 2 has grown to 6,291 square feet. Today, Building 2 exists as a reinforced concrete and concrete block structure that is constructed slab-on-grade with a built-up membrane roof. In addition to the more permanent parts of the building, Building 2 includes two attached metal storage sheds.

From the time of its construction in 1956 until the construction of Building 87 in the late 1980s, the function of Building 2 remained the same, a facility for the destructive testing of energetic materials.

Building 3. Building 3 was constructed in 1963 and is an explosives material destructive test firing and environmental testing laboratory. With four additions to the building, including two attached corrugated fiberglass faced metal framed storage sheds, the square footage of Building 3 is currently 12,400 square feet.

When operated by DOE and the contractor, Building 3 included 17 environmental chambers for thermal testing, six systems for mechanical testing operations, two vibration testing systems, one centrifuge testing system, and three shock testing systems.

Building 3 was used as a facility for the destructive and environmental testing of explosives materials from the time of construction in 1963 until the building was turned over to EG&G Star City (now Perkin-Elmer) in 1994 under a lease agreement with the DOE. Building 3 has operated under that agreement since that time.

Buildings 63E and 63W. Building 63 East/West is actually two separate, or two distinct buildings, that are adjacent and therefore share the same building number. There is no shared point of entry between either building.

Building 63 East contains 14,418 square feet of floor space, and was constructed to provide a facility to test systems design and for related development activities.

Building 63 West contains 3,050 square feet of floor space and was constructed to provide a facility for long-term environmental conditioning studies. When constructed, one-half of the building consisted of administrative areas (i.e., offices). The other part of Building 63 West was used for environmental storage and conditioning chambers, ovens, and spin testing equipment. Building 63 West included 10 environmental chambers for spin testing and eight chambers for thermal testing.

Building 63 East/West functioned as a facility for testing and testing research and related support activities, from the time of construction in 1981 until the building was turned over to EG&G Star City (now Perkin-Elmer). The transition of Building 63 East and Building 63 West to private industry took place in the mid-1990s. Building 63 East/West has continued to operate under this lease agreement since that time.

Building 87. Building 87 (or CTF-the Component Test Facility) is a two-story, 38,882 square foot, concrete structure, built slab-on-grade. The CTF offices and support facilities and other operational control/testing facilities that supported the testing cells

were located on the first floor. The mechanical penthouse, on the second floor, contains HVAC heating and air conditioning, air handling units for the test cell areas, and a heat exchanger for hot water. The mechanical area occupies approximately 600 square feet. Building 87 was constructed in the 1980s and underwent shut down in about 1995.

Building 87 is currently being renovated by MMCIC for use by private industry.

Building 95. Building 95, the "SM/PP Chiller" consists of one larger building (Building 95) with 2,000 square feet of floor space, and two smaller ancillary buildings (Buildings 95-A and 95-B, each having 450 square feet of floor space. Buildings 95 (collectively) was constructed in the mid-1980s, in order to supplement P Building (Power Plant) operations, and in order to satisfy the demand for a chiller on the SM/PP Hill.

Building 102. Building 102 is a 10,982 square-foot two-story office building that was constructed in 1987 to support Mound's Decontamination and Decommissioning Program (D&D Program), and to provide an administrative area to house cleanup related staff. Through time, Building 102 has continued in its mission as an office, however, the building tenants have differed, including staff members from the PST Program, Soil Project team staff, as well as D&D Program staff members.

SST Building. SST Building was constructed in the early 1970s and is located in the vicinity of the former Burn Area, just to the southwest of where that area was located, and just to the east of the former Building 21 location. SST has been used for salt storage for snow control on site.

SST Building is a one-story, 590 square-foot, slab-on grade structure with wood framing for the walls and roof. The front of SST Building is open from wall to wall and from the ground to the roof. A 3-foot high concrete wall separates the wood structure from the slab and divides the area into two sections. Wood siding and the roof are covered with tar paper. SST Building was renovated in 2000.

Magazines 80, 81, 82, 83, and 84. Magazines 80, 81, 82, 83, and 84, are smaller explosives storage bunkers (explosives magazines) that were constructed in 1985.

Magazines 80, 81, 82, 83, and 84 each contain two-units or compartments. Each of the magazines is constructed of reinforced concrete as a box-shaped structure and considered non-standard earthen-covered magazines. The configuration of Magazines 80, 81, 82, 83, and 84 appears to be one unit. These magazines were used for the storage of energetic materials, and were used for that purpose, until they were transferred to EG&G Star City (now Perkin-Elmer) under a user agreement initiated with DOE.

The transition of Magazines 80, 81, 82, 83, and 84 to private industry took place in the mid-1990s, and these magazines have continued to operate under a user lease agreement since that time.

FORMER PRODUCTION ERA BUILDING SITES

There are 24 sites where production era buildings were once located within Phase I. Included in the former buildings that were located in Phase I are 4 buildings (Buildings 13, 14, 35, and 59) in the Test Fire Area that supported detonator and explosives testing operations. In addition to the Test Fire buildings, there were six explosives storage magazines to the southwest of the Test Fire Area (Magazines 4, 5, 8, 9, 10, and 20) that supported explosive operations.

Buildings 12 and 18 were located near the current Building 87 location into the 1980s. These buildings were apparently storage warehouses that were used to support explosives operations.

There was also an explosive storage magazine (Magazine 6) that was later converted from an explosive storage magazine to a storage area for use by the security force to store weapons. Magazine 6 was located between Buildings 49 and 63.

An additional four buildings or facilities were located in an area designated as the "Burn Area." This area was located to the northwest of SST Building, and included the Pyroshed Energetic Materials Waste Storage Unit, the Open Burn Energetic Materials Treatment Unit, Building 90 and the retort unit (an explosives treatment unit), and Magazine 53 (an explosives storage area).

Other building sites in Phase I also include the location for Building 39, a maintenance building, the location for an emergency electrical generator (Electric Generator Number 7), a process material storage building (Building 21), and four modular office buildings (Buildings 77, 78, 97, and 101).

The last of the building sites in Phase I is for Building 85. Building 85 is also the last building to be demolished in Phase I. Building 85 was an explosives powder process facility that was never placed into production.

The buildings once located on the former building sites within Phase I are described below.

Buildings 12 and 18. Building 12, titled the "Detonator Storage Building" was constructed in 1960, as a 57' x 32' long "Armco" steel building. Building 18, constructed in 1963, was similar in size and construction to Building 12. Both buildings were used to support explosives operations and were located about where Building 87 is currently located. Buildings 12 and Building 18 were demolished in the 1980s.

Building 13. Building 13 was a one-story, 44 square-foot wood-framed asbestos-coated steel structure on a concrete slab. Building 13 was located to the west of Building 21, and was used to support a program for remote monitoring of energetic materials destructed in the Burn Area, located to the east. Building 13 contained a video monitor and electrical initiation equipment for firing explosive materials treatment devices. The building use, as described in 1990, was a "firing shed." Building 13 was demolished in 1997.

Building 14. Building 14 was a 42 square-foot, one-story, structure. This building was constructed with a wood and metal-frame and asbestos-coated sidewalls, with concrete deck roof on concrete footings. This building was used as an observation post in association with the former Burn Area to the east. The facility had no heating, cooling, or electrical services. The building use, as described in 1990, was metal melting. Building 14 was demolished in 1997.

Building 21. Building 21 was used for the storage of materials associated with two of Mound's processing missions, including thorium ores and protactinium ores (Cotter Concentrates). This structure was located along the south central border of the improved plant property; adjacent to the area designated as the Burn Area.

Building 21 was a 4,032 square-foot concrete structure with 10-inch thick floors and 14- to 16-inch thick walls. The roof was constructed of iron and steel. The facility was designed to ensure liquid tightness and was divided into two separate isolated bay areas. Building 21 became operational in 1964. Storage operations ended in 1987. Beginning in 1964, 1,338 drums of thorium oxalate were dumped in bulk form into the small bay area, while 3,576 drums of thorium hydroxide sludge were dumped in bulk form into the larger bay. The thorium sludge was ultimately sold to General Atomic Company for reclamation and was removed from Building 21 in 1975. Following removal of the thorium sludge, the building was cleaned and used as a staging area for Cotter Concentrates (high-level waste resulting from uranium milling). Approximately 1,258 drums of Cotter Concentrate were stored in Building 21. These drums were eventually shipped to the Nevada Test Site (NTS) in 1987 and use of Building 21 ceased. Since 1987, the building and surrounding area were maintained in a safe mode until the building was demolished in 1997.

Building 35. Building 35 was a 2,500 square-foot single-story structure built of concrete block. Building 35 was designed to provide x-ray and eddy current non-destructive testing of explosives. Building 35 was also used as the control room for the californium-252 multiplier (CFX) neutron radiography facility that was located in adjacent Building 59. Building 35 was demolished in the spring of 1998.

Building 39. Building 39, constructed in 1969, was a one-story structure constructed of prefabricated metal with a metal roof.

Initially, the eastern end of Building 39 was used by the Decontamination and Decommissioning project, which worked to produce fiberglass wooden boxes that were used for radioactive trash. The turntable used for this operation is still in place. Indications are that the facility was also used to perform gamma spectroscopy on these boxes.

From 1984 to 1988, the building was either inactive or used for storage.

In 1988, Building 39 was converted to a maintenance shop, and was divided into three sections: the east end was a machine shop; the middle was a break room; and the west

end was used primarily for storage of building materials, parts, paints, and some solvents.

Building 39 was demolished in 1998.

Building 59. Building 59, the neutron radiography facility, was a 700 square-foot, two-story reinforced concrete structure with a rolled roof. Building 59 was constructed in 1970 to provide neutron radiography capability to the site.

Building 59 housed a neutron-radiation source (californium-252) that was used to supply neutrons to an assembly of uranium plates. The californium-252 source was stored remotely from the core when not in use; when radiography operations were to be conducted, the source would be transported via a hand-cranked source transfer system into its proper location within the core assembly. The californium-252 source was removed from the facility and transported to Oak Ridge National Lab in 1995. Building 59 was demolished in the spring of 1998.

Building 77 and 78. Building 77 and 78, both located to the north of Building 39 were modular office structures that were used in the early 1980s. Both Building 77 and Building 78 contained 12 rooms, each with overall dimensions of 23.5 feet by 60 feet, and a combined square footage of 2,995. Both of these buildings were removed from service or were dismantled by the 1990s.

Building 85. Building 85 was constructed in late 1980s as a 3,160 square-foot building for the processing and blending of explosive powders. Designed much like an above ground bunker, each of the building's eight rooms had its own outside entry door. There were no passage doors between any of the rooms. There was an earthen embankment on the buildings eastern side, where the powder blending cells were located.

Building 85 was constructed as a Class I explosive powder processing facility, with reinforced interior and exterior concrete walls that vary in thickness, dependent upon the function of the rooms in the building. Wall thickness varied between 1 foot and 3.5 feet. The building was constructed on a slab that also varied in thickness dependent upon intended room function. Building 85 had a reinforced concrete roof where the thickness was also a function of the rooms.

Building 85, at the time of its demolition in 2002, existed much as it did when constructed, with the exception of the fact that some of the equipment installed at the completion of construction had been removed.

Site history indicates that Building 85 was never placed into production.

Building 97. Building 97 was a 12-room, 7,410 square-foot, 23.5 foot by 60 foot modular office structure, located to the south of Building 39. Building 97 was constructed in the early to late 1980s and was removed from service and dismantled in the 1990s.

Building 101. Building 101 was a single-story modular building with wooden exterior and Hypalon roof. The square footage of Building 101 was 1,815. Building 101 was brought

on site in 1986, and was used as offices for the area maintenance foreman and planner. It was sold and removed from the site in 1999.

Building 120. Building 120 was a 350 square-foot, one-story, wood-sided building with a metal roof. Building 120 was located just to the south of Building 102 and was used as an administrative office for the Decontamination and Decommissioning (D&D) Group. It was dismantled in 1998.

Burn Area Buildings. The Burn Area, excluding Magazine 53, described below, included three buildings and/or areas, as follows:

1. Pyroshed Energetic Materials Waste Storage Unit. This structure, known as the "Pyroshed" was used for the storage of pyrotechnic wastes and other energetic materials prior to their treatment at the Burn Area. The Pyroshed was located inside the fenced Burn Area and was constructed on a concrete pad measuring approximately 9 feet by 15 feet. The shed was approximately 7 feet high, with chain-link fence walls. A locked entry gate was located in the front side of the structure.

2. Open Burn Energetic Materials Treatment Unit. The open burn unit was used for op en burning of non-liquid explosive waste, pyrotechnic waste, and thermal treatment of explosive-contaminated material.

   The open burn unit consisted of a 12.3-foot by 18-foot base encircled by a 10-foot high composite metal wall with a sand core. The treatment zone measured approximately 12 feet by 12 feet, and the remainder of the floor space was occupied by an access-way. The entrance consisted of a 4-foot wide aisle that turned at a right angle to enter the treatment zone. The unit was developed on an 18-inch wide by 30-inch deep continuous, concrete footing developed on native soil. The enclosure's sides consisted of 0.25-inch thick milled steel plates.

3. Building 90. Building 90, constructed in 1984 and demolished in 1997, was a pre-engineered sheet metal building constructed on a reinforced concrete slab. The retort unit part of this building was located within a rectangular enclosure attached to the east side of Building 90 that was approximately 30 feet long and 15 feet wide with 9-foot high walls. Building 90 was designed to house the unit controls and waste feed operations for the Retort Unit (rotary-kiln-thermal-treatment-unit). Operations in Building 90 were suspended in January 1996, and the building was demolished in 1996-1997.

The buildings and facilities within the Burn Area were used for the destruction of pyrotechnics and energetic materials, including regulated hazardous waste explosives. Consequently, these operations underwent a RCRA closure, and as a part of that process were demolished in 1997 and 1998.

Electrical Generator 7. EG-7 (emergency generator) was constructed in 1972 to provide emergency electrical power to the Test Fire Area. The generator was an internal combustion key-starting engine generator housed in an 80-foot square metal structure,

which was located just to the north of Building 63. EG-7 remained available as an emergency generator until the 1990s, when it was taken out of use. EG-7 was sold in 1998.

Magazines 5, 8, 10, and 20. Magazines 5, 8, 10, and 20 were smaller explosive storage magazines or bunkers that were constructed in the mid-1950s and into the early 1960's. These magazines were located in the Test Fire Area, in a fenced area behind the former Building 85 site and behind Building 87. The purpose of these structures was for the storage of Mounds energetic materials. These buildings were demolished.

Magazine 53. Magazine 53 was a one-story, 239 square-foot reinforced concrete structure. The roof was made of reinforced steel, and the structure was covered with earth. Magazine 53 was constructed in 1970 and was used for the storage of pyrotechnics and energetic materials that were destroyed in the Burn Area. Magazine 53 was also used as a storage area for hazardous waste regulated explosives, and consequently underwent a RCRA closure. Magazine 53, as part of this closure, was demolished in January 1998.

Magazines 4 and 9. Magazine 4, the bulk storage magazine, was constructed in 1962 as an earthen covered magazine. Magazine 53 was constructed in an area adjacent to Magazine 9. Magazine 4 contained 4 units, with the front of the structure measuring 53 feet across. Magazine 9 was constructed in 1956, also as an earthen covered magazine. Magazine 9 contained a single cell that measured 17-feet by 14-feet. Both magazines were in the vicinity of Building 87. Magazines 4 and 9 were demolished by the 1980s.

Magazine 6. Magazine 6,constructed with reinforced concrete walls and roof, was located just to the east of Building 63E in the Test Fire Area. Magazine 6 was a 90 square-foot storage bunker or magazine that was constructed in 1956. Construction of this building appears to be associated with the construction of Building 2 located just to the south. Building 2, an explosives materials test firing facility, was the second building that was constructed on the site to support the newly assigned detonator mission.

FORMER CONSTRUCTION-ERA BUILDING SITES LOCATED IN PHASE I

There are three locations within Phase I that were used during the time that the original 1948-era buildings were constructed on the Mound site. These locations are summarized below:

Warehouse 12. Warehouse 12 was located in the approximate vicinity of the Building 39 site and was constructed by Maxon Construction Company to provide an administrative area (i.e., storage warehouse) in 1947 during the construction era for Mound's original buildings. Later plant records do not indicate any mission-related uses for Warehouse 12. Based upon comparisons of site photographs and available information, Warehouse 12 was likely demolished in the late 1940s or the early 1950s.

Tropical Huts and other Temporary Buildings. A number of shacks and tents (tropical huts) were used in conjunction with the construction of the original plant buildings in the

very early 1950s for the storage of debris and other polonium contaminated materials. Little information is available on these buildings. However, based upon early photographs, there were three of these structures located near the current location of Building 2.

Building 19 Quonset Hut. The Quonset Hut is a 40-foot by 60-foot Stransteel brand structure that was originally located at Dayton Unit III and was relocated to the Mound site. When Unit III was being cleaned up, this building was disassembled and was moved from Unit III. In 1949, it was relocated to the lower valley of the Mound Laboratory site where the existing Building 3 is now located.

The Quonset Hut was used for shipping, receiving, and storing of radioactive field materials in the 1950s.

The Quonset Hut was also used for storage of bismuth-chloride sludges from the polonium separations. At that time, 500 to 600 drums of sludge generated by the hydrolysis process were stored in the Quonset Hut awaiting a determination on potential reuse or shipment to the Oak Ridge site for burial.

The Quonset Hut was also used for the storage of thorium in 1952 and for the storage of Purex residues from 1949 to 1954.

In 1963, the Quonset Hut was again relocated when it was moved to its current location near the western property boundary.

OTHER LAND USE AREAS IN PHASE I

In addition to uses of the Test Fire Area (i.e., around Building 2) for the management of materials during the construction era and use of those same areas for early production era uses, the lands in Phase I have also been used for the following purposes:

SM/PP Pad. The SM/PP Pad is a concrete pad that was used by waste management for the management of low-level waste boxes containing soil and debris, as well as being used as a staging site for unused or empty low-level waste boxes. This pad is located to the east of the former Building 21 site and north of the SST Building.

Fenced Location for Storage of Equipment and Drums near Building 21. A fenced area to the east-southeast of Building 21 was used for the management of low-level waste drums and potentially contaminated equipment. This area was addressed as part of the Building 21 cleanup activities.

Building 21 soils management area, east of SST Building. This area was used for the management of soils excavated after the Building 21 operations ceased and was addressed as part of the Building 21 cleanup activities.

South Property Portions of Phase I. The portions of the south property included in Phase I are part of two property parcels containing 124 acres of rolling hills to the south of the main processing related areas. DOE had purchased the South Property (also

called the "New Property") in 1981 in part as a buffer and in part for possible future expansions. Despite its purchase for possible future expansion, it has for the most part remained unused since the date of purchase. The only plant uses that have taken place in the areas to be transferred in Phase I are the installation of boundary fences, the grading of the surface and the associated filling in of low-lying areas, and road installation and mobile laboratory operations in support of the Canal Removal Action.

An older unimproved road. The road running from the vicinity of Building 105 to the area behind Buildings 2, 3, and 87 was improved and the curves banked to utilize the area as a haul road in support of clean up activities in the Building 21 area and in the Burn Area.

Unidentified trailers near Building 21 and the SST Building. A grouping of office-type trailers existed in the vicinity of Building 21 and the SST Building were removed from this location by the 1990s.

Concrete Pad West of Building 35. The Building 35 concrete pad area was used by waste management for the management of low-level waste boxes of soil and debris.

P Building Soils Management Area-"Petro Piles". In the early 1990s, soil that was removed in conjunction with the removal of the P Building fuel oil tank removal were staged in the vicinity of Building 87 and Building 85 for treatment in a biodegradation facility for petroleum contaminated soils.

Management Area for Equipment. In 1996 and 1997, along the current property line for (previously transferred) Release Block D and Phase I (west of Building 100), an area was used to store portable office trailers, modular guard shacks, portable utility buildings, and various types of equipment that had been removed from an equipment management area in the Spoils Area.

Storage of Bird-Cage Drums. In the mid-1990s, empty blue transport drums that had been used for the transportation of fissile (product) material were located along the current property line for Release Block D and Phase I (west of Building 100). These drums were constructed with an internal framework that suspended the material contained in the drum in the drums' center, allowing the placement of the drums in a manner that was consistent with the criticality requirements for the contained material.

APPENDIX G

PRS Information

PRS 16. Area C (Old Building 72) was a former Hazardous Waste Storage Area dismantled in accordance with an Ohio Environmental Protection Agency approved RCRA closure plan. Core Team decided that PRS 16 requires No Further Assessment.

PRS 71. Building 85 Waste Solvent Tank was designed to store waste solvent associated with explosives processing; however, historical information indicates that the tank was never used. Core Team decided that PRS 71 requires No Further Assessment.

PRS 72. Area 13, Polonium from Dayton Unit IV, was identified as the storage site of contaminated materials brought to Mound from the former Dayton Unit operations in the 1950s. Core Team decided that PRS 72 requires No Further Assessment.

PRS 73. PRS 73, the Evaporator Storage Area, was an equipment storage area located in the Test Fire Valley. Further Assessment sampling in July 2001 identified no levels of concern. Core Team decided that PRS 73 requires No Further Assessment.

PRS 74. Quonset Hut (former), placed on a potentially contaminated concrete floor shows no indication that its shell was ever contaminated. The concrete floor was removed in 1963. Core Team decided that PRS 74 requires No Further Assessment.

PRS 83. Building 2 Propane Storage Tank (Tank 122). Core Team decided that PRS 83 requires No Further Assessment.

PRS 89. The Test Fire Residual Storage Tank is still active. Core Team decided that PRS 89 requires No Further Assessment.

PRS 258-265. PRSs 258-265 refer to the waste storage and treatment facilities formerly located in the "Burn Area" where a variety of wastes such as explosive powders, pyrotechnic materials, solid wastes contaminated with energetic materials, and non-radiological weapons components were thermally treated. Beryllium was the only COC identified as exceeding its Guideline Value during sampling events. There are no reported recent historical events to indicate other reasons for concern. Core Team decided that PRSs 258-265 require No Further Assessment.

PRS 276. Area 22, Orphan Soil from Other Areas, was a potentially contaminated site due to its use as a temporary storage area for contaminated soils. The soils were removed in accordance with the Core Team recommendation. Core Team decided that PRS 276 requires No Further Assessment.

PRS 280. Further Assessment sampling in the Waste Oil Drum Field yielded only low-level and isolated exceedances were noted above 10^{-6} RBGVs/screening levels; however, none were above cleanup objectives (10^{-5} RBGV + background). Core Team decided that PRS 280 requires No Further Assessment.

PRS 281. Area E, identified as a historical, isolated waste oil spill, produced levels of radiological contamination over Mound soils guidelines for radium-226. The area was subject to the removal action associated with the Building 21 demolition. Core Team decided that PRS 281 requires No Further Assessment.

PRS 284. The Building 21 Thorium Sludge Storage Facility held 4,914 drums of thorium

oxalate from 1966-1975 and 1,258 drums of Cotter Concentrate (high-level nuclear waste) until 1987. Cleanup and removal of Building 21 was completed 31 March 1997. Core Team decided that PRS 284 requires No Further Assessment.

PRS 304. This Excavated Material Disposal Area was created due to the dumping of low-level thorium soils. Sampling in 1984 found plutonium and thorium levels below the risk-based guideline values. Core Team decided that PRS 304 requires No Further Assessment.

PRS 311. Potential Hot Spot Location S0706 was identified during a 1983 site survey project, which discovered an isolated plutonium-238 reading of 29 pCi/g. This level is below all associated cleanup levels and guideline values. Core Team decided that PRS 311 requires No Further Assessment.

PRS 313. Potential Hot Spot Location S0982 was identified as a thorium hot spot during the Radiological Site Survey Project. Results from sampling in 1995 indicated no radioactive contamination in excess of guideline criteria. Core Team decided that PRS 313 requires No Further Assessment.

PRS 330. In 1994, qualitative hydrocarbon detections were found in the Building 2 Fuel Oil Tank (Tank 260) during the PETREX soil gas portion of the OU5, Non Area of Concern investigation. However, the 1996 sampling effort detected no contamination above the acceptable risk range. Core Team decided that PRS 330 requires No Further Assessment.

PRS 333. PRS 333 is an explosive surge tank (Tank 263) located along the southern border of Building 87,a previous explosives testing area that has since undergone Safe Shutdown. Core Team decided that PRS 333 requires No Further Assessment.

PRS 334. PRS 334 is an explosive surge tank (Tank 264) located along the southern border of Building 87,a previous explosives testing area that has since undergone Safe Shutdown. Core Team decided that PRS 334 requires No Further Assessment.

PRS 335. PRS 335 is an explosive surge tank (Tank 265) located along the southern border of Building 87,a previous explosives testing area that has since undergone Safe Shutdown. Core Team decided that PRS 335 requires No Further Assessment.

PRS 347. PRS 347 was identified according to qualitative hydrocarbon detections found during the PETREX soil gas portion of OU5, Non Area of Concern investigation. The 1996 Soil Gas confirmation sampling effort discovered no contamination above the 10^{-6} risk range. Core Team decided that PRS 347 requires No Further Assessment.

PRS 348. PRS 348 was identified according to qualitative hydrocarbon detections found during the PETREX soil gas portion of OU5, Non Area of Concern investigation. The 1996 Soil Gas confirmation sampling effort discovered no contamination above the 10^{-6} risk range. Core Team decided that PRS 348 requires No Further Assessment.

PRS 349. PRS 349 was identified due to plutonium detections found during the Mound Soil Screening Analysis performed as part of the June 1994 OU5, Operational Area Phase I Investigation. All concentrations are below the 10^{-5} Risk Based Guideline Value. Core Team decided that PRS 349 requires No Further Assessment.

PRS 350. Soil Contamination, Area West of Building 21, consists of detectable plutonium concentrations; however, concentrations were below all associated cleanup levels and guideline values. Core Team decided that PRS 350 requires No Further Assessment.

PRS 352. PRS 352 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas portion of the OU5, Non Area of Concern investigation. Soil gas confirmation sampling indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 352 requires No Further Assessment.

PRS 353. PRS 353 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas portion of the OU5, Non Area of Concern investigation. Soil gas confirmation sampling indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 353 requires No Further Assessment.

PRS 362. PRS 362 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas portion of the OU5, Non Area of Concern investigation. Soil gas confirmation sampling indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 362 requires No Further Assessment.

PRS 365. PRS 365 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas survey result in 1994. A soil gas confirmation sample collected within 50 feet of this PRS indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 365 requires No Further Assessment.

PRS 369. PRS 369 was identified as an elevated soil gas location due to elevation qualitative PETREX hydrocarbon levels. During the 1996 soil gas confirmation sampling, all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 369 requires No Further Assessment.

PRS 370. PRS 370 was identified according to qualitative hydrocarbon detections found during the PETREX soil gas portion of OU5, Non Area of Concern investigation. The 1996 Soil Gas confirmation sampling effort discovered no contamination above the 10^{-6} risk range. Core Team decided that PRS 370 requires No Further Assessment.

PRS 371. PRS 371 was identified due to a single, elevated plutonium-238 detection during the OU5, Operational Area Phase I Investigation in 1994. In 1996, a sample was collected within approximately 25 feet of PRS 371 during the Soil Gas Confirmation Investigation. All concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 371 requires No Further Assessment.

PRS 372. PRS 372 was identified due to elevated soil gas measurements. Subsequent quantitative sampling showed that all soil samples taken in the area were at or below their respective 10^{-6} Risk Based Guideline Value. Core Team decided that PRS 372 requires No Further Assessment.

PRS 383. PRS 383 was identified as an area of possible organic contamination during the 1992 PETREX Survey. However, additional sampling in 1995 quantitatively determined that no volatile, semivolatile, PCBs, pesticides, metals, radionuclides, or explosives exceeded applicable guideline values. Core Team decided that PRS 383 requires No Further Assessment.

PRS 384. PRS 384 was identified due to elevated qualitative PETREX hydrocarbon levels. However, the soil gas confirmation investigation in 1996 determined that no volatile, semivolatile, PCBs, pesticides, metals, radionuclides, or explosives exceeded applicable guideline values. Core Team decided that PRS 384 requires No Further Assessment.

PRS 406. The southern portion of PRS 283 became a PRS due to potential thorium dust from the thorium sludge redrumming. However, radionuclides in the soils were scattered and infrequent, and all occurrences were below the 10^{-5} risk-based guideline values. Core Team decided that PRS 406 requires No Further Assessment.

PRS 407. Soil Contamination West of Building 21 resulted in a removal action in which one to two feet of soil was excavated and disposed of via railcar shipments to Envirocare. PRS 407 was later binned No Further Action in 2000. Core Team decided that PRS 407 requires No Further Assessment.

PRS 418. PRS 418, the Overflow Pond South Inlet, was created to address potential plutonium-238, thorium-228, thorium-232, and Radium-226 contamination from PRS 407. Since the PRS 407 removal action, there are no known PRSs draining into the inlet. Although sample results for benzo(a)pyrene exceed the 10^{-6} guideline value, they are below the 10^{-5} risk-based guideline value. All other constituents are below guideline criteria. Core Team decided that PRS 418 requires No Further Assessment.

PRS 419. The Mound Plant Drainage Outflow Reroute, constructed during the Miami-Erie Canal Remediation Project, is monitored for radiological parameters under DOE Order 5400.1 and the DOE Regulatory Guide. It is also monitored for non-radiological parameters in accordance with the site's NPDES permit. To address potential radiological releases, the Outflow Reroute is also monitored daily for gross alpha and tritium, and bi-weekly from flow-proportional 24-hour composite samples for multiple radionuclides. Core Team decided that PRS 419 requires No Further Assessment.

PRS 421. PRS 421 is "The Ridge" across the road south of the location of the former Building 21. It was identified as a PRS when historical sampling data indicated the presence of contaminated soil. Contamination was confirmed during the verification sampling for PRS 407. The source of the contamination was surface runoff from the PRS 407 cleanup that followed preferential and intermediate drainage pathways south to the PRS 421 area. The removal action resulted in the excavation and containerization for disposal of approximately 105,133 cubic feet of soil, concrete, and asphalt. The cleanup objectives were 55 pCi/g for plutonium-238, 2.1 pCi/g for thorium-232, and 2.6

pCi/g for thorium-228. The OSC report documented that all verification sample results were below cleanup objectives.

APPENDIX H

Demonstration of Equilibrium

Several of the radionuclides of interest at Mound are part of the naturally occurring decay chains. The naturally occurring decay chains are the uranium-238 chain (The Uranium Series), the uranium-235 chain (The Actinium Series) and the thorium-232 chain (The Thorium Series). These chains satisfy the conditions of secular equilibrium. The conditions for secular equilibrium are met if a parent substance decays much more slowly than any of the other members of the chain. Secular equilibrium means the activities of each member of the decay chain are equal.

By assuming secular equilibrium for radionuclides of interest at Mound, one can conservatively calculate risk using the sum of the member's slope factors. Table 1 lists the members of the extended chains (designated "long lived decay" in the text of the RRE).

The Phase I Risk Working group (MEMP, OEPA, USEPA, and BWXTO) identified overlap of the mean plus/minus two standard deviations as the metric to demonstrate secular equilibrium. Figures 1-3 for the uranium-235, uranium-238 and thorium-232 chains illustrate that the data for Phase I demonstrate that the parent and daughters can be assumed to be in equilibrium for the purposes of this risk evaluation. Figures 4- 6 for the uranium-235, uranium-238, and thorium-232 chains illustrate that the production well data for Phase I demonstrate that the parent and daughter radionuclides can be assumed to be in equilibrium. Figures 7- 9 for the uranium-235, uranium-238, and thorium-232 chains illustrate that the bedrock well data for Phase I demonstrate that the parent and daughters can be assumed to be in equilibrium.

For calculating soil risk, the exposure point concentration for each chain was assigned as follows:

U-238 chain represented by U-238 EPC

U-235 chain represented by Ac-227 EPC

Th-232 chain represented by Th-228 EPC

For calculating ground water risk, the exposure point concentration for each chain was assigned as follows:

<u>Current Ground Water</u>
U-238 chain represented by U-234 EPC

U-235 chain represented by U-235 EPC

Th-232 chain represented by Th-228 EPC

Future Ground Water
U-238 chain represented by Ra-226 EPC

U-235 chain represented by U-235 EPC

Th-232 chain represented by Ra-228 EPC

The Total Future Ground Water EPC will be represented by the sum of the current and future ground water EPCs identified by chain in the above.

The process used to select the EPC to represent the chain was based on process history; knowledge of sampling analysis and methods; contaminants of concern for Phase I; use of a conservative concentration and a review of the distribution of the data.

For calculating background risk, the established background value for the principal (parent) nuclide of the chain is used.

The risk is then calculated or quantified using the EPC and the total of the slope factors for each daughter (Table 2).

Th-232 screens out of the risk evaluation as a contaminant of concern for soil, current ground water and future ground water. Due to the uncertainty and understanding that the Mound onsite gamma results for Th-232 are biased low, the contaminant is retained for the risk evaluation. Risk calculations for the Th-232 chain begin with the slope factor for Th-232 and includes the slope factors of long-lived decay daughters.

An example of how the risk is calculated for the Th-232 chain is as follows: In soil, Th-232 screens out as a contaminant of concern as shown on Tables 3 and 5 in Appendix C of the RRE. To calculate risk, from contaminated soil, for the Th-232 chain, the EPC for Th-228 is used. Table 3 in Appendix C indicates the EPC for Th-228 for the construction worker is 1.640 pCi/g and Table 5 in Appendix C indicates the EPC for Th-228 for the site employee is 1.7 pCi/g. On Tables 16 and 19 in Appendix C of the RRE, Th-232 is listed with the EPC of Th-228 for the construction worker and site employee, respectively. The slope factors used to calculate risk start with Th-232 and incorporate the long lived decay daughters as shown in Table 2. These summed slope factors are multiplied by the intake concentrations for soil (see Section 3.4.1, page 16) to derive risk levels (see Section 5.1.1, page 24), which are quantified on Tables 16 and 19 in Appendix C of the RRE.

Example 2: The U-238 risk for Current Groundwater for the Construction Worker is calculated based on the EPC of U-234. On Table 7 in Appendix C, the EPC for U-238 is 0.4090 pCi/L. U-234 is a daughter of U-238. On Table 22 in

Appendix C, only U-238 is listed with the EPC of U-234 (2.02 pCi/L). The EPC of U-234 was selected to ensure using a conservative approach to assessing risk. On Table 2, for the oral pathway the summed slope factor for U-238 can be found in the Oral Water Ingestion SF column, as a total, representing the appropriate daughters. This value is 1.90E-09. The U-234 EPC is used in an equation (see Section 3.4.2, page 21) to obtain an Intake value. The Intake value is then multiplied by the 1.90E-09 slope factor to obtain a risk value. The resulting risk value incorporates risk from all appropriate daughters and for this example can be found in Table 22 in Appendix C under the Cancer Effects, Oral column.

Figure 1: Phase I Soils U-235 Series

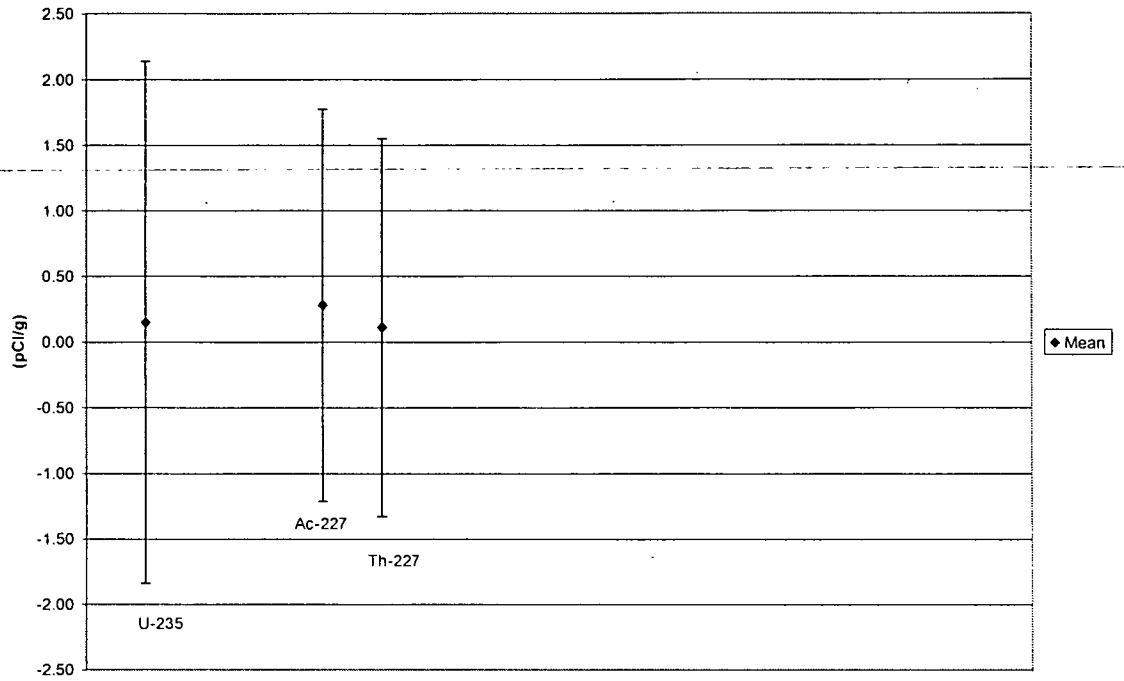


Figure 2: Phase I Soils U-238 Series

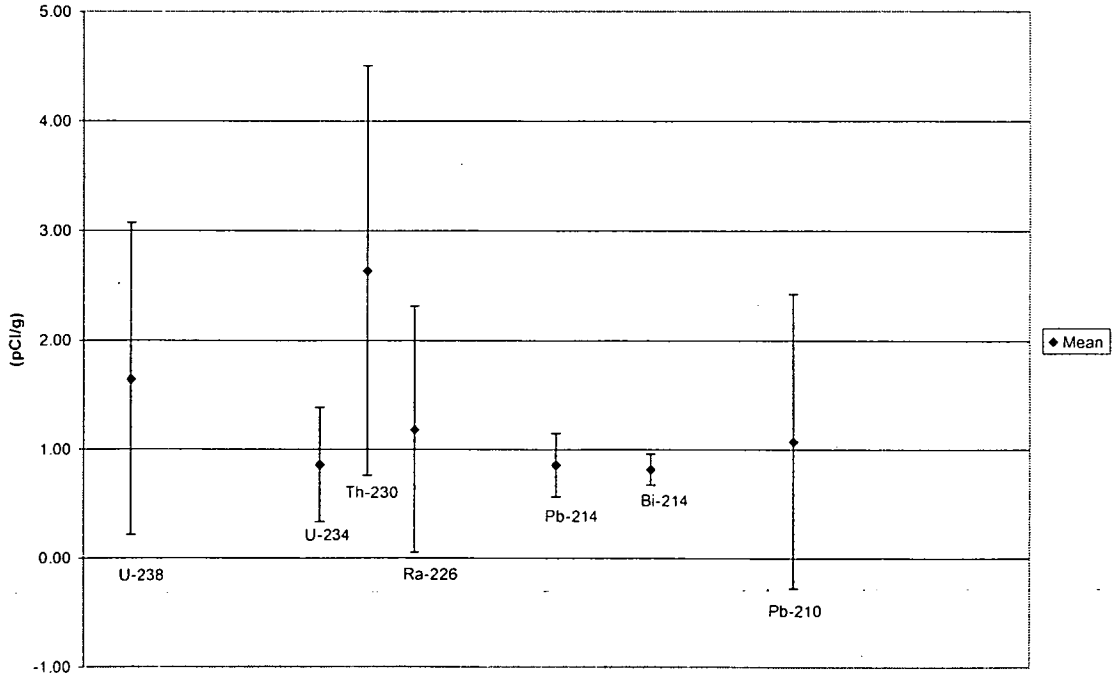


Figure 3: Phase I Soils Th-232 Series

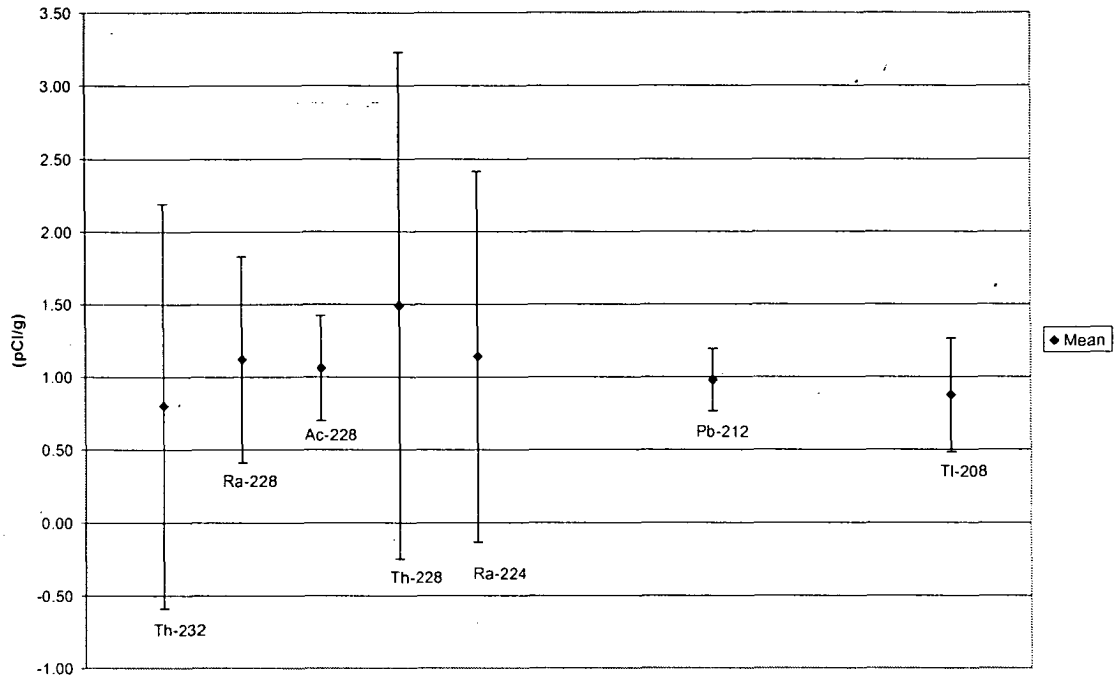


Figure 4: Production Wells U-235 Series

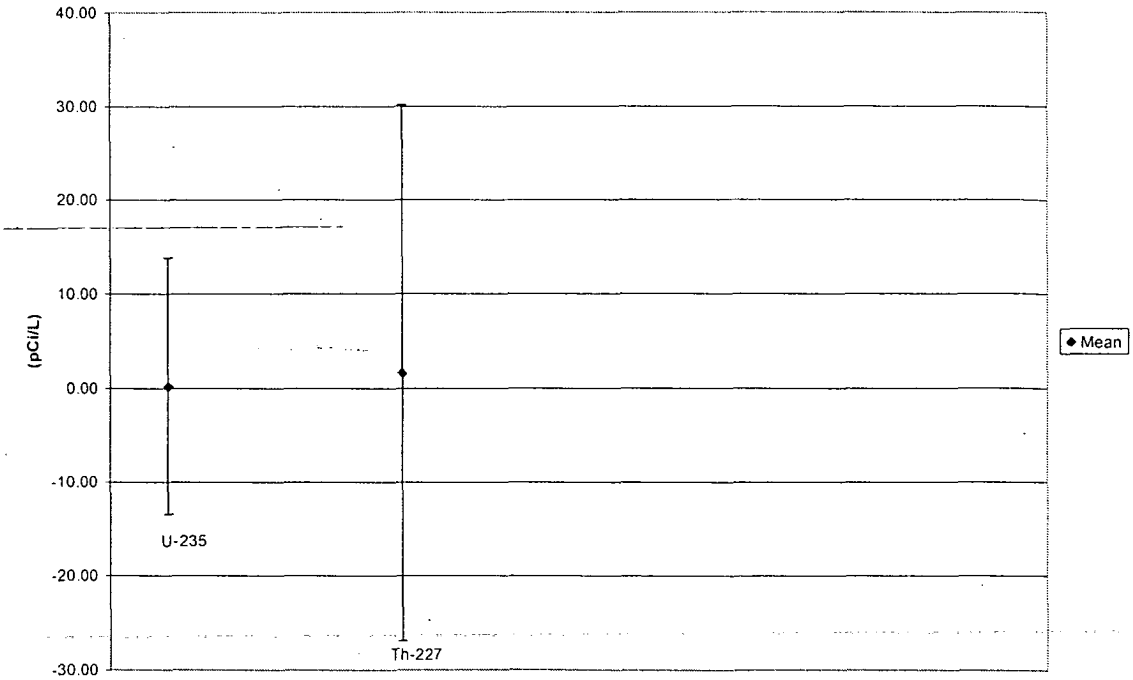


Figure 5: Production Wells U-238 Series

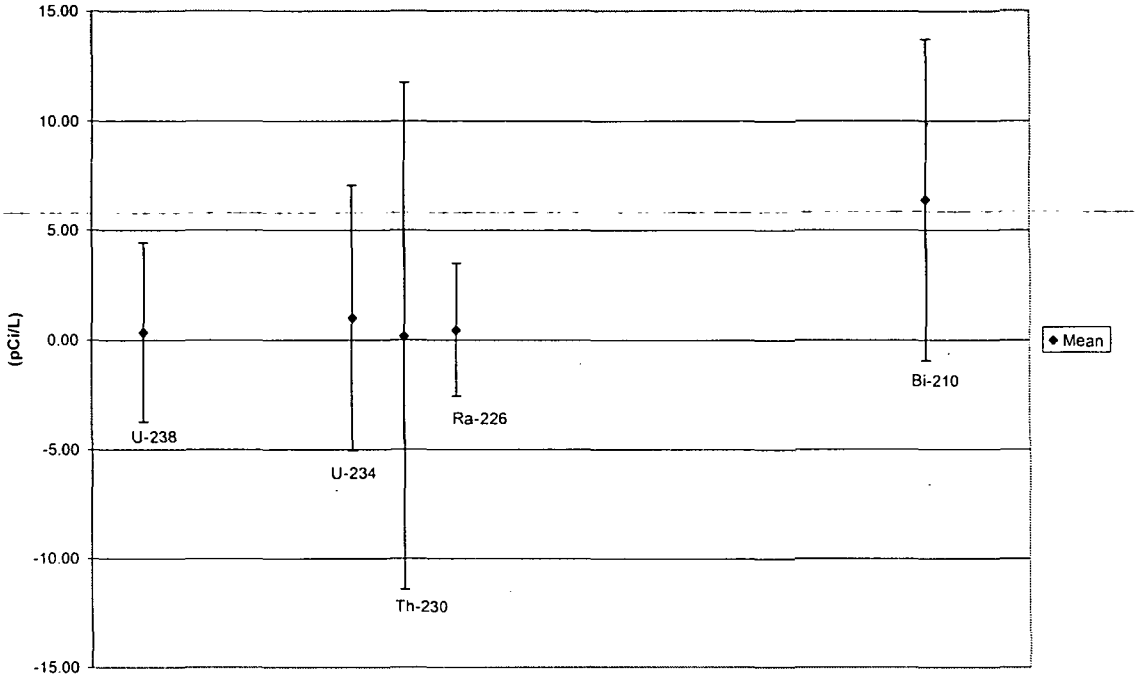


Figure 6: Production Wells Th-232 Series

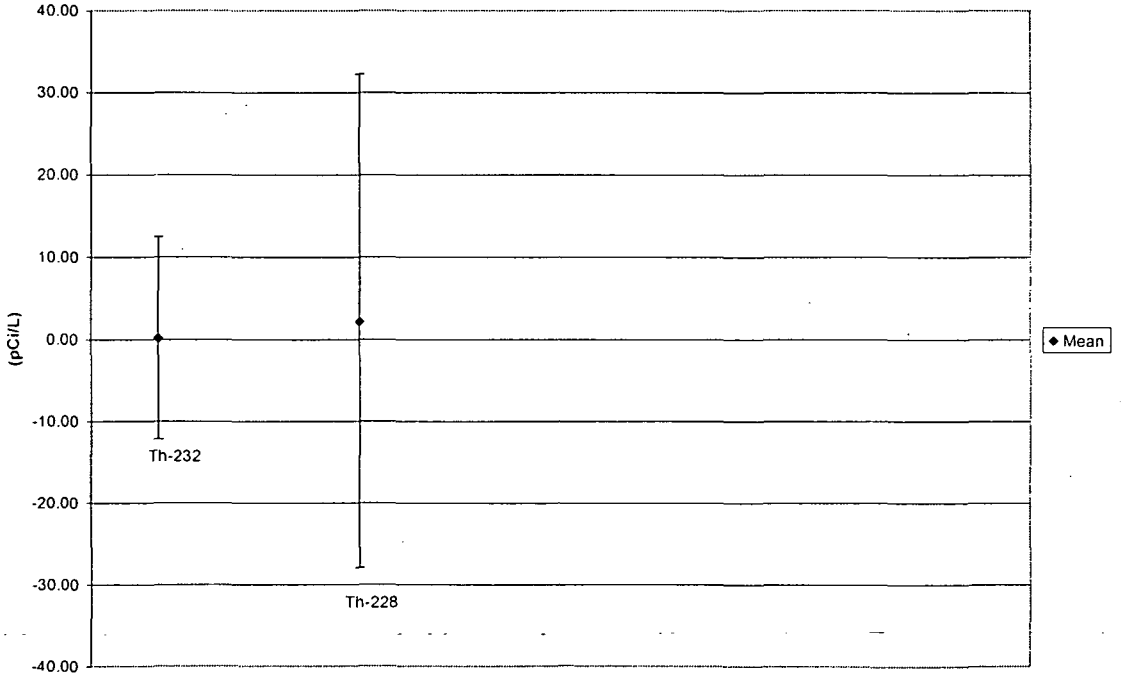


Figure 7: Bedrock Wells U-235 Series

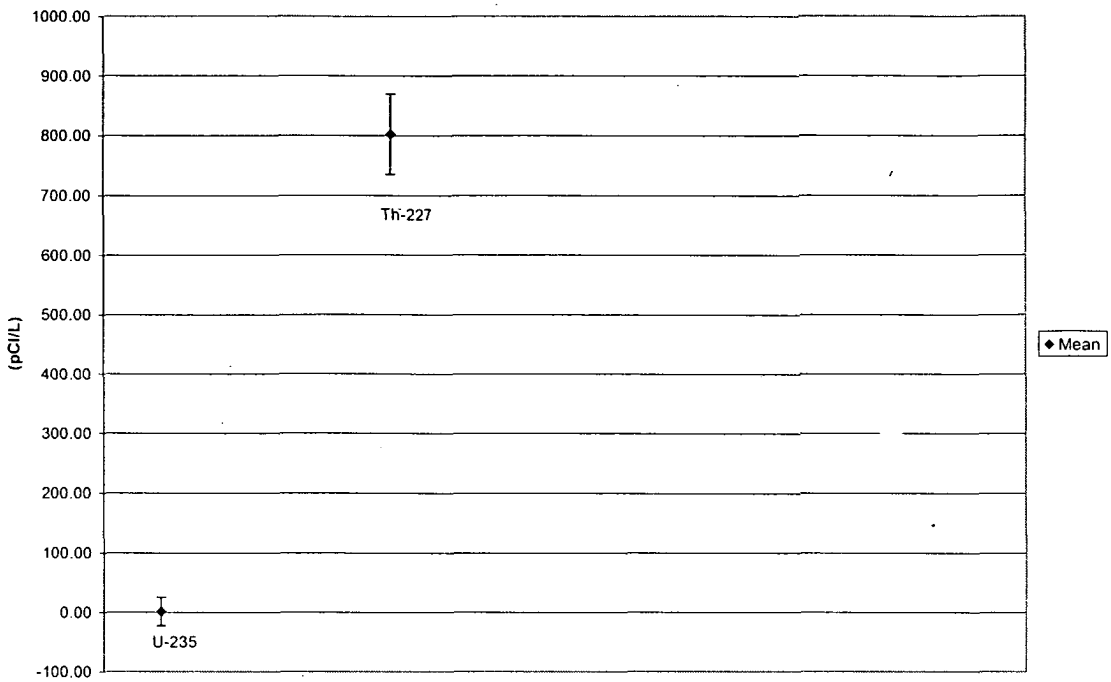


Figure 8: Bedrock Wells U-238 Series

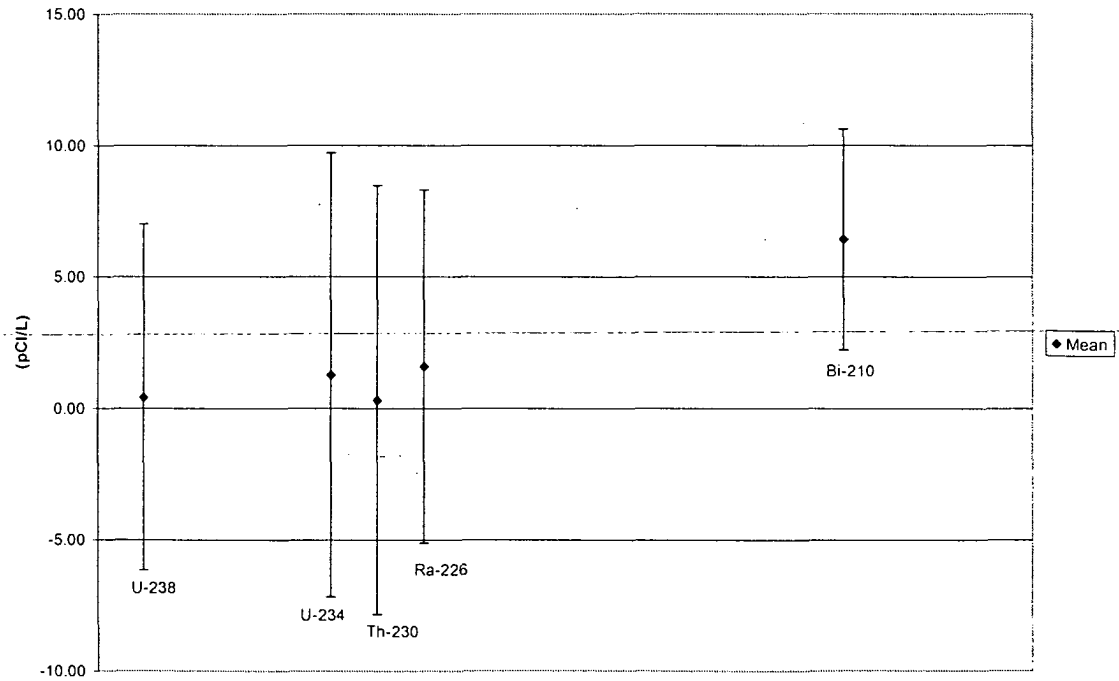


Figure 9: Bedrock Wells Th-232 Series

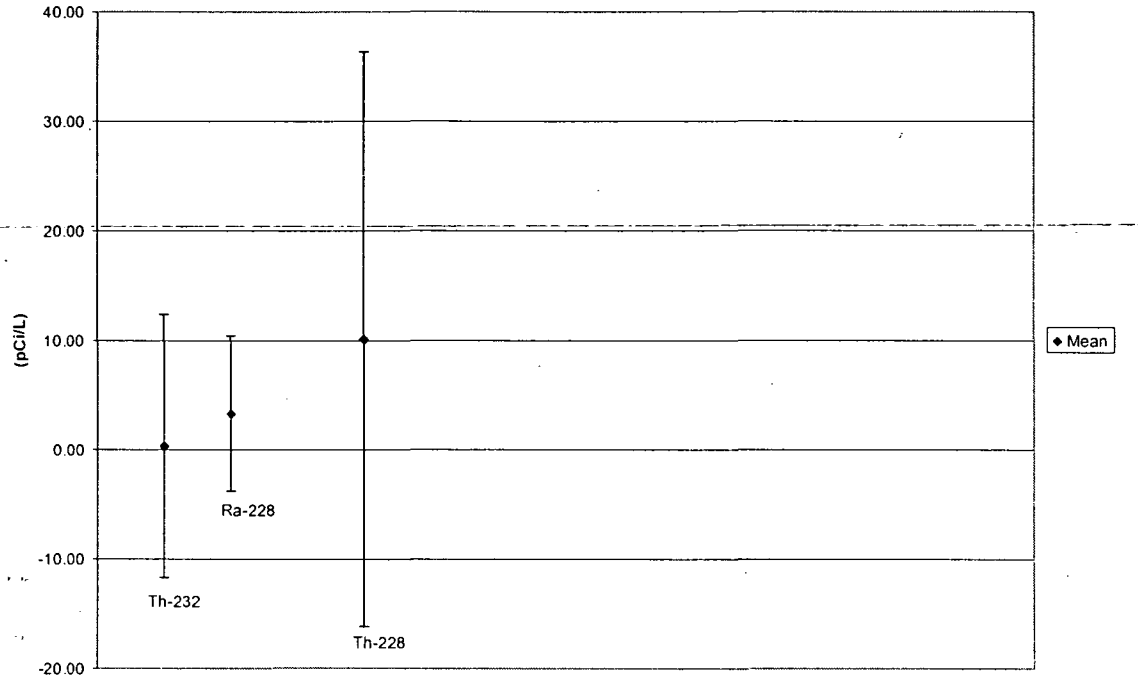


Table: Long Lived Decay Chains

Long Lived Decay Chain	Parent	Terminal Nuclide	$HEAST_1$	$HEAST_2$	$HEAST_3$	$HEAST_4$	$HEAST_5$	Compare to HEAST
Ac-227	Ac-227	Pb-207	Ac-227+D					Same as HEAST Ac-227+D
Cs-137	Cs-137	Ba-137	Cs-137+D					Same as HEAST Cs-137+D
Pb-210	Pb-210	Pb-206	Pb-210+D					Same as HEAST Pb-210+D
Pa-231	Pa-231	Pb-207	Pa-231	Ac-227+D				Differs, HEAST lists no '+D'
Ra-226	Ra-226	Pb-206	Ra226+D	Pb210+D				Differs, HEAST does not include Pb210+D
Ra-228	Ra-228	Pb-208	Ra-228+D	Th-228+D				Differs, HEAST does not include Th-228+D
Th-228	Th-228	Pb-208	Th-228+D					Same as HEAST Th-228+D
Th-229	Th-229	Bi-209	Th-229+D					Same as HEAST Th-229+D
Th-230	Th-230	Pb-208	Th-230	Ra-226+D	Pb-210+D			Differs, no "+D" in HEAST
Th-232	Th-232	Pb-208	Th-232	Ra-228+D	Th-228+D			Differs, No '+D' in HEAST
U-233	U-233	Bi-209	U-233	Th-229+D				Differs, HEAST does not include Th-229+D
U-235	U-235	Pb-207	U-235+D	Pa-231	Ac-227+D			Differs, HEAST does not include Pa-231 and Ac-227+D
U-238	U-238	Pb-206	U-238+D	U-234	Th-230	Ra-226+D	Pb-210+D	Differs, HEAST does not include U-234, Th-230, Ra-226+D and Pb-210+D

Slope factor of Chain 'X+11d' = Sum of slope factors of $HEAST_n$

Table 2: Slope Factors for Long Lived Decay Chains

Chemical	CAS Number	Decay Chain Additions	Oral Soil Ingestion SF (risk/pCi)	Oral Water Ingestion SF (risk/pCi)	Inhalation SF (risk/pCi)	External SF (risk/yr per pCi/g soil)
Actinium-227 + long lived decay	14952-40-0(+D)	Actinium-227+D	1.16E-09	4.86E-10	2.09E-07	1.47E-06
	14952-40-0L	Total	1.16E-09	4.86E-10	2.09E-07	1.47E-06
Cesium-137 + long lived decay	10045-97-3(+D)	Cesium-137+D	4.33E-11	3.04E-11	1.19E-11	2.55E-06
	10045-97-3L	Total	4.33E-11	3.04E-11	1.19E-11	2.55E-06
Lead-210 + long lived decay	14255-04-0(+D)	Pb-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	14255-04-0L	Total	2.66E-09	1.27E-09	1.39E-08	4.21E-09
Protactinium-231 + long lived Decay	14331-85-2	Protactinium-231	3.74E-10	1.73E-10	4.55E-08	1.39E-07
	14952-40-0(+D)	Actinium-227+D	1.16E-09	4.86E-10	2.09E-07	1.47E-06
	14331-85-2L	Total	1.53E-09	6.59E-10	2.55E-07	1.61E-06
Radium-226 + long lived decay	13982-63-3(+D)	Radium-226+D	7.30E-10	3.86E-10	1.16E-08	8.49E-06
	14255-04-0(+D)	Lead-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	13982-63-3L	Total	3.39E-09	1.66E-09	2.55E-08	8.49E-06
Radium-228 + long lived decay	15262-20-1(+D)	Radium-228+D	2.29E-09	1.04E-09	5.23E-09	4.53E-06
	14274-82-9(+D)	Thorium-228+D	8.09E-10	3.00E-10	1.43E-07	7.76E-06
	15262-20-1L	Total	3.10E-09	1.34E-09	1.48E-07	1.23E-05
Thorium-228 +Long lived Decay	14274-82-9(+D)	Thorium-228+D	8.09E-10	3.00E-10	1.43E-07	7.76E-06
	14274-82-9L	Total	8.09E-10	3.00E-10	1.43E-07	7.76E-06
Thorium-229 +Long lived Decay	15594-54-4(+D)	Thorium-229+D	1.29E-09	5.28E-10	2.25E-07	1.17E-06
	15594-54-4L	Total	1.29E-09	5.28E-10	2.25E-07	1.17E-06

Table 2: Slope Factors for Long Lived Decay Chains

Chemical	CAS Number	Decay Chain Additions	Oral Soil Ingestion SF (risk/pCi)	Oral Water Ingestion SF (risk/pCi)	Inhalation SF (risk/pCi)	External SF (risk/yr per pCi/g soil)
Thorium-230 + Long lived Decay	14269-63-7	Thorium-230	2.02E-10	9.10E-11	2.85E-08	8.19E-10
	13982-63-3(+D)	Radium-226+D	7.30E-10	3.86E-10	1.16E-08	8.49E-06
	14255-04-0(+D)	Lead-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	14269-63-7L	Total	3.59E-09	1.75E-09	5.40E-08	8.50E-06
Thorium-232 + long lived decay	7440-29-1	Thorium-232	2.31E-10	1.01E-10	4.33E-08	3.42E-10
	15262-20-1(+D)	Radium-228+D	2.29E-09	1.04E-09	5.23E-09	4.53E-06
	14274-82-9(+D)	Thorium-228+D	8.09E-10	3.00E-10	1.43E-07	7.76E-06
	7440-29-1L	Total	3.33E-09	1.44E-09	1.92E-07	1.23E-05
Uranium-233 + long lived Decay	13968-55-3	Uranium-233	1.60E-10	7.18E-11	1.16E-08	9.82E-10
	15594-54-4(+D)	Thorium-229+D	1.29E-09	5.28E-10	2.25E-07	1.17E-06
	13968-55-3L	Total	1.45E-09	6.00E-10	2.37E-07	1.17E-06
Uranium-235 + long lived Decay	15117-96-1(+D)	Uranium-235+D	1.63E-10	7.18E-11	1.01E-08	5.43E-07
	14331-85-2	Protactinium-231	3.74E-10	1.73E-10	4.55E-08	1.39E-07
	14952-40-0(+D)	Actinium-227+D	1.16E-09	4.86E-10	2.09E-07	1.47E-06
	15117-96-1L	Total	1.70E-09	7.31E-10	2.65E-07	2.15E-06
Uranium-238 + long lived Decay	7440-61-1(+D)	Uranium-238+D	2.10E-10	8.71E-11	9.35E-09	1.14E-07
	13966-29-5	Uranium-234	1.58E-10	7.07E-11	1.14E-08	2.52E-10
	14269-63-7	Thorium-230	2.02E-10	9.10E-11	2.85E-08	8.19E-10
	13982-63-3(+D)	Radium-226+D	7.30E-10	3.86E-10	1.16E-08	8.49E-06
	14255-04-0(+D)	Lead-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	7440-61-1L	Total	3.96E-09	1.90E-09	7.48E-08	8.61E-06

Source for slope factors: HEAST, April 2002

APPENDIX I

Listing of All Detected Analytes

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
BTEX Compounds										
Benzene (UG/KG)	71-43-2	0			O	0/ 15	0.0			NO
Ethylbenzene (UG/KG)	100-41-4	0			O	0/ 15	0.0			NO
Toluene (UG/KG)	108-88-3	0			O	0/ 15	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	0			O	0/ 15	0.0			NO
Explosives										
1,3,5-Trinitrobenzene (UG/KG)	99-35-4	0			O	0/ 81	0.0			NO
1,3-Dinitrobenzene (UG/KG)	99-65-0	0			O	0/ 81	0.0			NO
2,4,6-Trinitrotoluene (UG/KG)	118-96-7	1	1.1E+02	1.1E+02	D	1/ 91	1.1	6.3E+02	1.1E+02	NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 75	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 32	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/KG)	35572-78-2	0			O	0/ 61	0.0			NO
4-Amino-2,6-Dinitrotoluene (UG/KG)	1946-51-0	0			O	0/ 19	0.0			NO
HMX (UG/KG)	2691-41-0	0			O	0/ 98	0.0			NO
Nitrobenzene (UG/KG)	98-95-3	1	3.8E+02	3.8E+02	D	1/ 32	3.1	4.7E+02	3.8E+02	NO
Nitroglycerin (UG/KG)	55-63-0	0			O	0/ 76	0.0			NO
PETN (UG/KG)	78-11-5	0			O	0/ 99	0.0			NO
RDX (UG/KG)	121-82-4	0			O	0/ 99	0.0			NO
Tetryl (UG/KG)	479-45-8	0			O	0/ 71	0.0			NO
Metals										
Aluminum (UG/KG)	7429-90-5	145	5.9E+05	2.3E+07	N	145/ 146	99.3	1.5E+07	1.5E+07	YES
Antimony (UG/KG)	7440-36-0	64	2.1E+02	4.5E+04	D	64/ 209	30.6	8.5E+03	8.5E+03	YES
Arsenic (UG/KG)	7440-38-2	137	4.9E+02	2.0E+04	X	137/ 143	95.8	8.2E+03	8.2E+03	YES
Barium (UG/KG)	7440-39-3	226	4.4E+03	6.0E+05	X	226/ 227	99.6	1.0E+05	1.0E+05	YES
Beryllium (UG/KG)	7440-41-7	220	5.0E+01	3.6E+03	X	220/ 226	97.3	1.1E+03	1.1E+03	YES
Bismuth (UG/KG)	7440-69-9	33	8.2E+02	7.3E+04	X	33/ 59	55.9	1.3E+05	7.3E+04	YES
Cadmium (UG/KG)	7440-43-9	69	2.5E+02	1.2E+04	D	69/ 227	30.4	1.5E+03	1.5E+03	YES
Calcium (UG/KG)	7440-70-2	145	1.4E+06	3.4E+08	X	145/ 146	99.3	1.5E+08	1.5E+08	YES
Chromium (UG/KG)	7440-47-3	226	1.1E+03	3.7E+04	X	226/ 227	99.6	1.7E+04	1.7E+04	YES
Cobalt (UG/KG)	7440-48-4	145	7.9E+02	2.5E+04	X	145/ 146	99.3	1.3E+04	1.3E+04	YES
Copper (UG/KG)	7440-50-8	143	1.8E+03	1.1E+06	X	143/ 146	97.9	2.2E+04	2.2E+04	YES
Cyanide (UG/KG)	57-12-5	35	1.0E+02	8.9E+03	D	35/ 162	21.6	5.8E+02	5.8E+02	YES
Iron (UG/KG)	7439-89-6	145	2.3E+04	4.3E+07	N	145/ 146	99.3	3.1E+07	3.1E+07	YES
Lead (UG/KG)	7439-92-1	242	1.6E+03	2.2E+05	X	242/ 256	94.5	1.5E+04	1.5E+04	YES
Lithium (UG/KG)	7439-93-2	53	2.3E+03	3.4E+04	N	53/ 55	96.4	1.8E+04	1.8E+04	YES

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Magnesium (UG/KG)	7439-95-4	145	1.2E+04	1.2E+08	X	145/ 146	99.3	2.9E+07	2.9E+07	YES
Manganese (UG/KG)	7439-96-5	137	6.5E+04	8.2E+06	X	137/ 138	99.3	6.8E+05	6.8E+05	YES
Mercury (UG/KG)	7439-97-6	61	3.0E+01	1.4E+03	D	61/ 139	43.9	1.2E+02	1.2E+02	YES
Molybdenum (UG/KG)	7439-98-7	49	2.2E+02	9.7E+03	L	49/ 54	90.7	4.0E+03	4.0E+03	YES
Nickel (UG/KG)	7440-02-0	224	2.3E+03	2.5E+05	X	224/ 227	98.7	2.2E+04	2.2E+04	YES
Potassium (UG/KG)	7440-09-7	142	3.1E+05	3.3E+08	X	142/ 147	96.6	1.9E+06	1.9E+06	YES
Selenium (UG/KG)	7782-49-2	19	4.6E+02	2.3E+03	D	19/ 131	14.5	9.6E+02	9.6E+02	YES
Silver (UG/KG)	7440-22-4	65	1.1E+02	2.1E+04	D	65/ 227	28.6	2.4E+03	2.4E+03	YES
Sodium (UG/KG)	7440-23-5	136	4.2E+04	3.5E+06	X	136/ 146	93.2	1.1E+06	1.1E+06	YES
Thallium (UG/KG)	7440-28-0	29	2.0E+02	3.5E+03	D	29/ 142	20.4	1.1E+03	1.1E+03	YES
Tin (UG/KG)	7440-31-5	22	6.7E+02	3.3E+03	D	22/ 54	40.7	1.2E+04	3.3E+03	YES
Vanadium (UG/KG)	7440-62-2	145	1.7E+03	4.3E+04	X	145/ 146	99.3	2.5E+04	2.5E+04	YES
Zinc (UG/KG)	7440-66-6	145	5.5E+03	4.6E+05	X	145/ 146	99.3	9.3E+04	9.3E+04	YES
Pesticides and/or PCBs										
4,4'-DDD (UG/KG)	72-54-8	0			O	0/ 122	0.0			NO
4,4'-DDE (UG/KG)	72-55-9	7	2.8E-01	1.8E+00	D	7/ 121	5.8	3.3E+00	1.8E+00	YES
4,4'-DDT (UG/KG)	50-29-3	0			O	0/ 122	0.0			NO
Aldrin (UG/KG)	309-00-2	1	5.4E-02	5.4E-02	D	1/ 122	0.8	2.2E+00	5.4E-02	NO
Alpha Chlordane (UG/KG)	5103-71-9	0			O	0/ 99	0.0			NO
Alpha-BHC (UG/KG)	319-84-6	0			O	0/ 122	0.0			NO
Aroclor-1016 (UG/KG)	12674-11-2	0			O	0/ 151	0.0			NO
Aroclor-1221 (UG/KG)	11104-28-2	0			O	0/ 151	0.0			NO
Aroclor-1232 (UG/KG)	11141-16-5	1	1.2E+02	1.2E+02	D	1/ 151	0.7	3.3E+01	3.3E+01	NO
Aroclor-1242 (UG/KG)	53469-21-9	1	1.2E+02	1.2E+02	D	1/ 151	0.7	3.3E+01	3.3E+01	NO
Aroclor-1248 (UG/KG)	12672-29-6	3	7.4E+01	9.1E+02	D	3/ 150	2.0	3.7E+01	3.7E+01	NO
Aroclor-1254 (UG/KG)	11097-69-1	1	2.2E+02	2.2E+02	D	1/ 151	0.7	5.8E+01	5.8E+01	NO
Aroclor-1260 (UG/KG)	11096-82-5	0			O	0/ 150	0.0			NO
Beta-BHC (UG/KG)	319-85-7	3	1.8E-01	1.2E+02	D	3/ 120	2.5	3.1E+00	3.1E+00	NO
Chlordane (UG/KG)	57-74-9	2	1.9E+01	9.8E+01	D	2/ 23	8.7	1.6E+01	1.6E+01	YES
Delta-BHC (UG/KG)	319-86-8	1	1.7E-01	1.7E-01	D	1/ 122	0.8	3.4E+00	1.7E-01	NO
Dieldrin (UG/KG)	60-57-1	3	5.2E-01	4.4E+00	D	3/ 122	2.5	3.1E+00	3.1E+00	NO
Endosulfan I (UG/KG)	959-98-8	0			O	0/ 122	0.0			NO
Endosulfan II (UG/KG)	33213-65-9	0			O	0/ 122	0.0			NO
Endosulfan Sulfate (UG/KG)	1031-07-8	0			O	0/ 122	0.0			NO
Endrin (UG/KG)	72-20-8	2	1.5E-01	2.3E+01	D	2/ 121	1.7	4.6E+00	4.6E+00	NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Endrin Aldehyde (UG/KG)	7421-93-4	0			O	0/ 108	0.0			NO
Endrin Ketone (UG/KG)	53494-70-5	2	5.2E-01	7.6E-01	D	2/ 122	1.6	1.3E+01	7.6E-01	NO
Gamma Chlordane (UG/KG)	5103-74-2	1	5.7E-02	5.7E-02	D	1/ 99	1.0	1.7E+01	5.7E-02	NO
Gamma-BHC (Lindane) (UG/KG)	58-89-9	0			O	0/ 122	0.0			NO
Heptachlor (UG/KG)	76-44-8	2	1.1E-01	1.3E-01	D	2/ 122	1.6	2.0E+00	1.3E-01	NO
Heptachlor Epoxide (UG/KG)	1024-57-3	2	1.1E-01	3.5E-01	D	2/ 122	1.6	1.3E+01	3.5E-01	NO
Methoxychlor (UG/KG)	72-43-5	0			O	0/ 122	0.0			NO
Toxaphene (UG/KG)	8001-35-2	0			O	0/ 122	0.0			NO
Phenols										
Phenolics (UG/KG)	64743-03-9	0			O	0/ 24	0.0			NO
Radiological										
Actinium-227 (PCI/G)	14952-40-0	37	5.0E-02	2.1E+00	D	37/ 282	13.1	3.0E-01	3.0E-01	YES
Actinium-228 (PCI/G)	14331-83-0	7	7.6E-01	1.4E+00	D	7/ 7	100.0	1.2E+00	1.4E+00	YES
Americium-241 (PCI/G)	14596-10-2	12	5.0E-02	3.8E+01	D	12/ 558	2.2	1.1E-01	1.1E-01	NO
Bismuth-207 (PCI/G)	13982-38-2	0			O	0/ 126	0.0			
Bismuth-210 (PCI/G)	14331-79-4	1	6.8E-02	6.8E-02	D	1/ 222	0.5	2.9E-02	2.9E-02	NO
Bismuth-210M (PCI/G)	BI-210M	3	1.4E-01	2.7E-01	D	3/ 84	3.6	5.5E-02	5.5E-02	NO
Bismuth-214 (PCI/G)	14733-03-0	10	7.0E-01	9.3E-01	N	10/ 10	100.0	8.6E-01	9.3E-01	YES
Cesium-137 (PCI/G)	10045-97-3	276	2.1E-02	1.6E+00	D	276/ 564	48.9	1.6E-01	1.6E-01	YES
Cobalt-60 (PCI/G)	10198-40-0	14	2.0E-02	5.0E-01	D	14/ 575	2.4	3.6E-02	3.6E-02	NO
Europium-152 (PCI/G)	14683-23-9	1	8.7E-02	8.7E-02	D	1/ 191	0.5	4.7E-02	4.7E-02	NO
Europium-154 (PCI/G)	15585-10-1	0			O	0/ 180	0.0			NO
Lead-210 (PCI/G)	14255-04-0	180	4.9E-01	3.7E+00	X	180/ 344	52.3	1.2E+00	1.2E+00	YES
Lead-212 (PCI/G)	15092-94-1	10	8.4E-01	1.2E+00	L	10/ 10	100.0	1.1E+00	1.2E+00	YES
Lead-214 (PCI/G)	15067-28-4	20	5.7E-01	1.1E+00	N	20/ 20	100.0	9.2E-01	9.2E-01	YES
Plutonium-238 (PCI/G)	13981-16-3	665	1.2E-02	4.0E+02	D	665/1545	43.0	2.6E+01	2.6E+01	YES
Plutonium-239 (PCI/G)	15117-48-3	83	3.5E-03	1.3E+00	X	83/ 90	92.2	6.9E-02	6.9E-02	YES
Plutonium-239/240 (PCI/G)	PU-239/240	79	3.7E-03	1.0E+00	D	79/ 254	31.1	4.4E-02	4.4E-02	YES
Plutonium-242 (PCI/G)	13982-10-0	0			O	0/ 5	0.0			NO
Potassium-40 (PCI/G)	13966-00-2	122	7.2E+00	3.7E+01	X	122/ 126	96.8	2.1E+01	2.1E+01	YES
Protactinium-231 (PCI/G)	14331-85-2	0			O	0/ 36	0.0			NO
Radium-224 (PCI/G)	13233-32-4	190	7.3E-02	6.3E+00	X	190/ 190	100.0	1.3E+00	1.3E+00	YES
Radium-226 (PCI/G)	13982-63-3	494	1.8E-01	3.7E+00	X	494/ 567	87.1	1.2E+00	1.2E+00	YES
Radium-228 (PCI/G)	15262-20-1	80	3.1E-01	2.0E+00	N	80/ 81	98.8	1.2E+00	1.2E+00	YES
Strontium-90 (PCI/G)	10098-97-2	0			O	0/ 21	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Thallium-208 (PCI/G)	14913-50-9	10	1.6E-01	4.0E-01	N	10/ 10	100.0	3.8E-01	4.0E-01	YES
Thorium-227 (PCI/G)	15623-47-9	17	6.0E-02	4.4E-01	L	17/ 33	51.5	1.4E-01	1.4E-01	YES
Thorium-228 (PCI/G)	14274-82-9	342	3.7E-02	4.5E+00	X	342/ 384	89.1	1.6E+00	1.6E+00	YES
Thorium-229 (PCI/G)	15594-54-4	0			O	0/ 36	0.0			NO
Thorium-230 (PCI/G)	14269-63-7	340	1.0E-01	7.5E+00	X	340/ 595	57.1	2.8E+00	2.8E+00	YES
Thorium-232 (PCI/G)	7440-29-1	789	4.5E-02	8.0E+01	D	789/1805	43.7	8.3E-01	8.3E-01	YES
Tritium (PCI/G)	10028-17-8	1	1.4E+00	1.4E+00	D	1/ 21	4.8	2.0E+00	1.4E+00	NO
Uranium-234 (PCI/G)	13966-29-5	46	3.8E-01	1.6E+00	N	46/ 54	85.2	1.0E+00	1.0E+00	YES
Uranium-235 (PCI/G)	15117-96-1	28	2.7E-02	2.1E-01	D	28/ 77	36.4	1.9E-01	1.9E-01	YES
Uranium-235/236 (PCI/G)	U-235/236	0			O	0/ 2	0.0			NO
Uranium-238 (PCI/G)	7440-61-1	72	4.1E-01	2.0E+00	X	72/ 119	60.5	1.9E+00	1.9E+00	YES
Semi-Volatile Organics										
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 159	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 159	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 159	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 159	0.0			NO
1-chloro-4-phenoxybenzene (UG/KG)	7005-72-3	0			O	0/ 159	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/KG)	108-60-1	0			O	0/ 159	0.0			NO
2,4,5-Trichlorophenol (UG/KG)	95-95-4	0			O	0/ 159	0.0			NO
2,4,6-Trichlorophenol (UG/KG)	88-06-2	0			O	0/ 159	0.0			NO
2,4-Dichlorophenol (UG/KG)	120-83-2	0			O	0/ 159	0.0			NO
2,4-Dimethylphenol (UG/KG)	105-67-9	0			O	0/ 159	0.0			NO
2,4-Dinitrophenol (UG/KG)	51-28-5	0			O	0/ 159	0.0			NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 91	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 134	0.0			NO
2-Benzyl-4-Chlorophenol (UG/KG)	120-32-1	0			O	0/ 30	0.0			NO
2-Chloronaphthalene (UG/KG)	91-58-7	0			O	0/ 174	0.0			NO
2-Chlorophenol (UG/KG)	95-57-8	0			O	0/ 159	0.0			NO
2-Methylnaphthalene (UG/KG)	91-57-6	3	5.4E+01	9.9E+01	D	3/ 174	1.7	2.8E+02	9.9E+01	NO
2-Methylphenol (UG/KG)	95-48-7	0			O	0/ 159	0.0			NO
2-Nitroaniline (UG/KG)	88-74-4	0			O	0/ 159	0.0			NO
2-Nitrophenol (UG/KG)	88-75-5	0			O	0/ 159	0.0			NO
3,3'-Dichlorobenzidine (UG/KG)	91-94-1	0			O	0/ 159	0.0			NO
3-Nitroaniline (UG/KG)	99-09-2	0			O	0/ 157	0.0			NO
4,6-Dinitro-o-Cresol (UG/KG)	534-52-1	0			O	0/ 159	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
4-Bromophenyl-phenyl Ether (UG/KG)	101-55-3	0			O	0/ 159	0.0			NO
4-Chloro-3-methylphenol (UG/KG)	59-50-7	0			O	0/ 159	0.0			NO
4-Chloroaniline (UG/KG)	106-47-8	0			O	0/ 159	0.0			NO
4-Methylphenol (UG/KG)	106-44-5	1	4.1E+02	4.1E+02	D	1/ 159	0.6	2.8E+02	2.8E+02	NO
4-Nitroaniline (UG/KG)	100-01-6	0			O	0/ 159	0.0			NO
4-Nitrophenol (UG/KG)	100-02-7	1	1.8E+02	1.8E+02	D	1/ 159	0.6	1.2E+03	1.8E+02	NO
Acenaphthene (UG/KG)	83-32-9	6	2.7E+01	4.3E+02	D	6/ 174	3.4	2.9E+02	2.9E+02	NO
Acenaphthylene (UG/KG)	208-96-8	0			O	0/ 174	0.0			NO
Anthracene (UG/KG)	120-12-7	13	2.2E+01	2.8E+03	D	13/ 174	7.5	3.1E+02	3.1E+02	YES
Benzidine (UG/KG)	92-87-5	0			O	0/ 21	0.0			NO
Benzo(a)anthracene (UG/KG)	56-55-3	31	2.3E+01	4.2E+03	D	31/ 174	17.8	3.2E+02	3.2E+02	YES
Benzo(a)pyrene (UG/KG)	50-32-8	29	2.3E+01	3.6E+03	D	29/ 174	16.7	3.2E+02	3.2E+02	YES
Benzo(b)fluoranthene (UG/KG)	205-99-2	35	2.5E+01	2.8E+03	D	35/ 174	20.1	3.2E+02	3.2E+02	YES
Benzo(g,h,i)perylene (UG/KG)	191-24-2	16	2.7E+01	2.1E+03	D	16/ 174	9.2	3.0E+02	3.0E+02	YES
Benzo(k)fluoranthene (UG/KG)	207-08-9	27	2.1E+01	3.4E+03	D	27/ 174	15.5	3.2E+02	3.2E+02	YES
Benzoic Acid (UG/KG)	65-85-0	5	7.8E+01	9.5E+01	D	5/ 139	3.6	1.5E+03	9.5E+01	NO
Benzyl Alcohol (UG/KG)	100-51-6	0			O	0/ 139	0.0			NO
Bis(2-chloroethoxy)methane (UG/KG)	111-91-1	0			O	0/ 159	0.0			NO
Bis(2-chloroethyl)ether (UG/KG)	111-44-4	0			O	0/ 159	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/KG)	117-81-7	59	1.9E+01	6.5E+03	D	59/ 159	37.1	3.3E+02	3.3E+02	YES
Butyl Benzyl Phthalate (UG/KG)	85-68-7	3	4.8E+01	6.4E+01	D	3/ 159	1.9	2.8E+02	6.4E+01	NO
Carbazole (UG/KG)	86-74-8	2	1.5E+02	1.7E+02	D	2/ 89	2.2	2.0E+02	1.7E+02	NO
Chrysene (UG/KG)	218-01-9	30	2.0E+01	1.7E+03	D	30/ 159	18.9	3.0E+02	3.0E+02	YES
Di-n-butyl Phthalate (UG/KG)	84-74-2	61	2.1E+01	2.0E+03	D	61/ 240	25.4	3.1E+02	3.1E+02	YES
Di-n-octyl Phthalate (UG/KG)	117-84-0	1	4.0E+02	4.0E+02	D	1/ 159	0.6	2.8E+02	2.8E+02	NO
Dibenz(a,h)anthracene (UG/KG)	53-70-3	6	7.1E+01	8.0E+02	D	6/ 174	3.4	2.8E+02	2.8E+02	NO
Dibenzofuran (UG/KG)	132-64-9	6	3.2E+01	5.8E+02	D	6/ 159	3.8	2.7E+02	2.7E+02	NO
Diethyl Phthalate (UG/KG)	84-66-2	6	3.9E+01	1.1E+02	D	6/ 159	3.8	2.8E+02	1.1E+02	NO
Dimethyl Phthalate (UG/KG)	131-11-3	0			O	0/ 159	0.0			NO
Diphenylamine (UG/KG)	122-39-4	0			O	0/ 81	0.0			NO
Fluoranthene (UG/KG)	206-44-0	48	2.3E+01	1.1E+04	D	48/ 174	27.6	3.7E+02	3.7E+02	YES
Fluorene (UG/KG)	86-73-7	7	3.8E+01	1.1E+03	D	7/ 174	4.0	2.9E+02	2.9E+02	NO
Hexachlorobenzene (UG/KG)	118-74-1	0			O	0/ 159	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 159	0.0			NO
Hexachlorocyclopentadiene (UG/KG)	77-47-4	0			O	0/ 159	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Hexachloroethane (UG/KG)	67-72-1	0			O	0/ 159	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/KG)	193-39-5	18	2.5E+01	1.9E+03	D	18/ 174	10.3	3.0E+02	3.0E+02	YES
Isophorone (UG/KG)	78-59-1	0			O	0/ 159	0.0			NO
N-Nitroso-di-n-propylamine (UG/KG)	621-64-7	0			O	0/ 159	0.0			NO
N-Nitrosodiphenylamine (UG/KG)	86-30-6	8	5.7E+01	2.1E+02	D	8/ 159	5.0	2.7E+02	2.1E+02	YES
Naphthalene (UG/KG)	91-20-3	5	2.6E+01	4.1E+02	D	5/ 171	2.9	2.9E+02	2.9E+02	NO
Nitrobenzene (UG/KG)	98-95-3	0			O	0/ 134	0.0			NO
Pentachlorophenol (UG/KG)	87-86-5	0			O	0/ 159	0.0			NO
Phenanthrene (UG/KG)	85-01-8	32	2.7E+01	1.1E+04	D	32/ 174	18.4	3.5E+02	3.5E+02	YES
Phenol (UG/KG)	108-95-2	2	8.5E+01	3.2E+02	D	2/ 159	1.3	2.8E+02	2.8E+02	NO
Pyrene (UG/KG)	129-00-0	45	2.6E+01	9.7E+03	D	45/ 174	25.9	3.6E+02	3.6E+02	YES
Volatile Organics										
1,1,1,2-Tetrachloroethane (UG/KG)	630-20-6	0			O	0/ 23	0.0			NO
1,1,1-Trichloroethane (UG/KG)	71-55-6	4	1.0E+00	8.0E+00	D	4/ 200	2.0	3.4E+00	3.4E+00	NO
1,1,2,2-Tetrachloroethane (UG/KG)	79-34-5	0			O	0/ 200	0.0			NO
1,1,2-Trichloroethane (UG/KG)	79-00-5	0			O	0/ 200	0.0			NO
1,1-Dichloroethane (UG/KG)	75-34-3	1	3.0E+00	3.0E+00	D	1/ 200	0.5	3.4E+00	3.0E+00	NO
1,1-Dichloroethene (UG/KG)	75-35-4	0			O	0/ 200	0.0			NO
1,1-Dichloropropene (UG/KG)	563-58-6	0			O	0/ 23	0.0			NO
1,2,3-Trichlorobenzene (UG/KG)	87-61-6	0			O	0/ 23	0.0			NO
1,2,3-Trichloropropane (UG/KG)	96-18-4	0			O	0/ 23	0.0			NO
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 3	0.0			NO
1,2,4-Trimethylbenzene (UG/KG)	95-63-6	0			O	0/ 23	0.0			NO
1,2-Dibromo-3-Chloropropane (UG/KG)	96-12-8	0			O	0/ 23	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 3	0.0			NO
1,2-Dichloroethane (UG/KG)	107-06-2	0			O	0/ 200	0.0			NO
1,2-Dichloroethene (UG/KG)	540-59-0	5	2.0E+00	2.1E+02	D	5/ 177	2.8	4.1E+00	4.1E+00	NO
1,2-Dichloropropane (UG/KG)	78-87-5	0			O	0/ 200	0.0			NO
1,2-Diethylbenzene (UG/KG)	135-01-3	0			O	0/ 31	0.0			NO
1,2-cis-Dichloroethene (UG/KG)	156-59-2	0			O	0/ 34	0.0			NO
1,2-trans-Dichloroethene (UG/KG)	156-60-5	0			O	0/ 34	0.0			NO
1,3,5-Trimethylbenzene (UG/KG)	108-67-8	0			O	0/ 23	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 3	0.0			NO
1,3-Dichloropropane (UG/KG)	142-28-9	0			O	0/ 23	0.0			NO
1,3-cis-Dichloropropene (UG/KG)	10061-01-5	0			O	0/ 200	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
1,3-trans-Dichloropropene (UG/KG)	10061-02-6	0			O	0/ 200	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 3	0.0			NO
2,2-Dichloropropane (UG/KG)	594-20-7	0			O	0/ 23	0.0			NO
2-Butanone (UG/KG)	78-93-3	18	1.0E+00	3.1E+01	D	18/ 177	10.2	6.8E+00	6.8E+00	YES
2-Chlorotoluene (UG/KG)	95-49-8	0			O	0/ 23	0.0			NO
2-Hexanone (UG/KG)	591-78-6	0			O	0/ 177	0.0			NO
4-Chlorotoluene (UG/KG)	106-43-4	0			O	0/ 23	0.0			NO
4-Methyl-2-pentanone (UG/KG)	108-10-1	9	1.0E+00	7.0E+00	D	9/ 177	5.1	6.0E+00	6.0E+00	YES
Acetone (UG/KG)	67-64-1	48	4.0E+00	1.7E+02	D	48/ 177	27.1	1.4E+01	1.4E+01	YES
Acetonitrile (UG/KG)	75-05-8	0			O	0/ 31	0.0			NO
Acrylonitrile (UG/KG)	107-13-1	0			O	0/ 31	0.0			NO
Benzene (UG/KG)	71-43-2	2	2.0E+00	5.0E+00	D	2/ 200	1.0	3.4E+00	3.4E+00	NO
Bromochloromethane (UG/KG)	74-97-5	0			O	0/ 23	0.0			NO
Bromodichloromethane (UG/KG)	75-27-4	1	5.0E+00	5.0E+00	D	1/ 200	0.5	3.4E+00	3.4E+00	NO
Bromoform (UG/KG)	75-25-2	0			O	0/ 200	0.0			NO
Bromomethane (UG/KG)	74-83-9	0			O	0/ 200	0.0			NO
Carbon Disulfide (UG/KG)	75-15-0	4	1.0E+00	3.0E+00	D	4/ 177	2.3	3.4E+00	3.0E+00	NO
Carbon Tetrachloride (UG/KG)	56-23-5	0			O	0/ 200	0.0			NO
Chlorobenzene (UG/KG)	108-90-7	0			O	0/ 200	0.0			NO
Chloroethane (UG/KG)	75-00-3	0			O	0/ 200	0.0			NO
Chloroform (Trichloromethane) (UG/KG	67-66-3	1	2.4E+01	2.4E+01	D	1/ 200	0.5	3.4E+00	3.4E+00	NO
Chloromethane (UG/KG)	74-87-3	2	1.0E+00	4.0E+00	D	2/ 200	1.0	5.7E+00	4.0E+00	NO
Dibromochloromethane (UG/KG)	124-48-1	1	1.0E+00	1.0E+00	D	1/ 200	0.5	3.4E+00	1.0E+00	NO
Dibromomethane (UG/KG)	74-95-3	0			O	0/ 23	0.0			NO
Dichlorodifluoromethane (UG/KG)	75-71-8	0			O	0/ 23	0.0			NO
Dichloromethane (Methylene Chloride) (UG/KG)	75-09-2	96	3.0E+00	6.8E+01	D	96/ 200	48.0	1.0E+01	1.0E+01	YES
Ethylbenzene (UG/KG)	100-41-4	9	1.0E+00	1.1E+01	D	9/ 200	4.5	3.4E+00	3.4E+00	NO
Ethylene Dibromide (1,2-Dibromoethane) (UG/KG	106-93-4	0			O	0/ 23	0.0			NO
FREON-113 (UG/KG)	76-13-1	0			O	0/ 39	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 3	0.0			NO
Hexane (UG/KG)	110-54-3	0			O	0/ 39	0.0			NO
Iodomethane (UG/KG)	74-88-4	0			O	0/ 31	0.0			NO
Isopropyl Benzene (UG/KG)	98-82-8	0			O	0/ 23	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Monobromobenzene (Phenyl bromide) (UG/KG)	108-86-1	0			O	0/ 23	0.0			NO
Naphthalene (UG/KG)	91-20-3	3	1.0E+00	6.0E+00	D	3/ 6	50.0	1.0E+01	6.0E+00	YES
Styrene (UG/KG)	100-42-5	0			O	0/ 200	0.0			NO
Tetrachloroethene (UG/KG)	127-18-4	13	2.0E+00	4.1E+01	D	13/ 200	6.5	3.9E+00	3.9E+00	YES
Toluene (UG/KG)	108-88-3	35	1.0E+00	5.1E+01	D	35/ 200	17.5	3.8E+00	3.8E+00	YES
Trichloroethylene (TCE) (UG/KG)	79-01-6	7	3.0E+00	7.4E+01	D	7/ 200	3.5	3.8E+00	3.8E+00	NO
Trichlorofluoromethane (UG/KG)	75-69-4	0			O	0/ 23	0.0			NO
Vinyl Acetate (UG/KG)	108-05-4	0			O	0/ 149	0.0			NO
Vinyl Chloride (UG/KG)	75-01-4	0			O	0/ 200	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	16	1.0E+00	3.9E+01	D	16/ 177	9.0	3.7E+00	3.7E+00	YES
m-Xylene (UG/KG)	108-38-3	0			O	0/ 11	0.0			NO
mp-Xylene (UG/KG)	mp-Xylene	23	5.0E+00	6.0E+00	X	23/ 23	100.0	6.0E+00	6.0E+00	YES
n-Butylbenzene (UG/KG)	104-51-8	0			O	0/ 23	0.0			NO
n-propylbenzene (UG/KG)	103-65-1	0			O	0/ 23	0.0			NO
o-Xylene (UG/KG)	95-47-6	0			O	0/ 34	0.0			NO
p-Isopropyltoluene (UG/KG)	99-87-6	0			O	0/ 23	0.0			NO
sec-Butylbenzene (UG/KG)	135-98-8	0			O	0/ 23	0.0			NO
tert-Butylbenzene (UG/KG)	98-06-6	0			O	0/ 23	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
BTEX Compounds										
Benzene (UG/KG)	71-43-2	0			O	0/ 15	0.0			NO
Ethylbenzene (UG/KG)	100-41-4	0			O	0/ 15	0.0			NO
Toluene (UG/KG)	108-88-3	0			O	0/ 15	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	0			O	0/ 15	0.0			NO
Explosives										
1,3,5-Trinitrobenzene (UG/KG)	99-35-4	0			O	0/ 53	0.0			NO
1,3-Dinitrobenzene (UG/KG)	99-65-0	0			O	0/ 53	0.0			NO
2,4,6-Trinitrotoluene (UG/KG)	118-96-7	1	1.1E+02	1.1E+02	D	1/ 59	1.7	7.4E+02	1.1E+02	NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 50	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 12	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/KG)	35572-78-2	0			O	0/ 52	0.0			NO
4-Amino-2,6-Dinitrotoluene (UG/KG)	1946-51-0	0			O	0/ 1	0.0			NO
HMX (UG/KG)	2691-41-0	0			O	0/ 66	0.0			NO
Nitrobenzene (UG/KG)	98-95-3	1	3.8E+02	3.8E+02	D	1/ 12	8.3	1.3E+03	3.8E+02	YES
Nitroglycerin (UG/KG)	55-63-0	0			O	0/ 50	0.0			NO
PETN (UG/KG)	78-11-5	0			O	0/ 53	0.0			NO
RDX (UG/KG)	121-82-4	0			O	0/ 67	0.0			NO
Tetryl (UG/KG)	479-45-8	0			O	0/ 46	0.0			NO
Metals										
Aluminum (UG/KG)	7429-90-5	105	5.9E+05	2.3E+07	N	105/ 105	100.0	1.2E+07	1.2E+07	YES
Antimony (UG/KG)	7440-36-0	42	2.1E+02	4.5E+04	D	42/ 146	28.8	1.3E+04	1.3E+04	YES
Arsenic (UG/KG)	7440-38-2	104	4.9E+02	2.0E+04	X	104/ 105	99.0	8.9E+03	8.9E+03	YES
Barium (UG/KG)	7440-39-3	158	4.4E+03	4.5E+05	X	158/ 158	100.0	1.0E+05	1.0E+05	YES
Beryllium (UG/KG)	7440-41-7	155	1.2E+02	3.6E+03	X	155/ 158	98.1	1.2E+03	1.2E+03	YES
Bismuth (UG/KG)	7440-69-9	26	1.3E+04	7.3E+04	X	26/ 36	72.2	1.0E+05	7.3E+04	YES
Cadmium (UG/KG)	7440-43-9	43	2.5E+02	1.2E+04	D	43/ 158	27.2	1.2E+03	1.2E+03	YES
Calcium (UG/KG)	7440-70-2	105	1.4E+06	3.1E+08	X	105/ 105	100.0	1.3E+08	1.3E+08	YES
Chromium (UG/KG)	7440-47-3	158	1.1E+03	3.7E+04	X	158/ 158	100.0	1.8E+04	1.8E+04	YES
Cobalt (UG/KG)	7440-48-4	105	7.9E+02	2.5E+04	X	105/ 105	100.0	1.3E+04	1.3E+04	YES
Copper (UG/KG)	7440-50-8	103	2.6E+03	1.1E+06	X	103/ 105	98.1	2.3E+04	2.3E+04	YES
Cyanide (UG/KG)	57-12-5	31	1.0E+02	8.9E+03	D	31/ 126	24.6	6.7E+02	6.7E+02	YES
Iron (UG/KG)	7439-89-6	105	2.3E+04	4.3E+07	N	105/ 105	100.0	2.8E+07	2.8E+07	YES
Lead (UG/KG)	7439-92-1	179	1.6E+03	2.2E+05	X	179/ 186	96.2	1.7E+04	1.7E+04	YES
Lithium (UG/KG)	7439-93-2	31	2.3E+03	2.7E+04	N	31/ 31	100.0	1.7E+04	1.7E+04	YES
Magnesium (UG/KG)	7439-95-4	105	1.2E+04	1.2E+08	X	105/ 105	100.0	3.3E+07	3.3E+07	YES
Manganese (UG/KG)	7439-96-5	104	6.5E+04	1.3E+06	X	104/ 104	100.0	5.7E+05	5.7E+05	YES

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Mercury (UG/KG)	7439-97-6	43	3.0E+01	6.5E+02	D	43/ 97	44.3	1.0E+02	1.0E+02	YES
Molybdenum (UG/KG)	7439-98-7	29	4.7E+02	9.7E+03	L	29/ 31	93.5	5.9E+03	5.9E+03	YES
Nickel (UG/KG)	7440-02-0	157	2.3E+03	2.5E+05	X	157/ 158	99.4	2.3E+04	2.3E+04	YES
Potassium (UG/KG)	7440-09-7	103	3.1E+05	5.2E+06	X	103/ 105	98.1	1.7E+06	1.7E+06	YES
Selenium (UG/KG)	7782-49-2	18	4.9E+02	2.3E+03	D	18/ 96	18.8	1.1E+03	1.1E+03	YES
Silver (UG/KG)	7440-22-4	47	1.1E+02	2.1E+04	D	47/ 158	29.7	2.7E+03	2.7E+03	YES
Sodium (UG/KG)	7440-23-5	100	4.2E+04	3.5E+06	X	100/ 105	95.2	1.3E+06	1.3E+06	YES
Thallium (UG/KG)	7440-28-0	27	2.2E+02	3.5E+03	D	27/ 100	27.0	1.8E+03	1.8E+03	YES
Tin (UG/KG)	7440-31-5	7	1.1E+03	2.2E+03	D	7/ 31	22.6	2.2E+04	2.2E+03	YES
Vanadium (UG/KG)	7440-62-2	105	1.7E+03	4.0E+04	X	105/ 105	100.0	2.6E+04	2.6E+04	YES
Zinc (UG/KG)	7440-66-6	105	5.5E+03	4.6E+05	X	105/ 105	100.0	8.4E+04	8.4E+04	YES
Pesticides and/or PCBs										
4,4'-DDD (UG/KG)	72-54-8	0			O	0/ 86	0.0			NO
4,4'-DDE (UG/KG)	72-55-9	7	2.8E-01	1.8E+00	D	7/ 85	8.2	3.1E+00	1.8E+00	YES
4,4'-DDT (UG/KG)	50-29-3	0			O	0/ 86	0.0			NO
Aldrin (UG/KG)	309-00-2	1	5.4E-02	5.4E-02	D	1/ 86	1.2	2.3E+00	5.4E-02	NO
Alpha Chlordane (UG/KG)	5103-71-9	0			O	0/ 63	0.0			NO
Alpha-BHC (UG/KG)	319-84-6	0			O	0/ 86	0.0			NO
Aroclor-1016 (UG/KG)	12674-11-2	0			O	0/ 115	0.0			NO
Aroclor-1221 (UG/KG)	11104-28-2	0			O	0/ 115	0.0			NO
Aroclor-1232 (UG/KG)	11141-16-5	1	1.2E+02	1.2E+02	D	1/ 115	0.9	3.4E+01	3.4E+01	NO
Aroclor-1242 (UG/KG)	53469-21-9	1	1.2E+02	1.2E+02	D	1/ 115	0.9	3.4E+01	3.4E+01	NO
Aroclor-1248 (UG/KG)	12672-29-6	3	7.4E+01	9.1E+02	D	3/ 114	2.6	3.8E+01	3.8E+01	NO
Aroclor-1254 (UG/KG)	11097-69-1	1	2.2E+02	2.2E+02	D	1/ 115	0.9	5.9E+01	5.9E+01	NO
Aroclor-1260 (UG/KG)	11096-82-5	0			O	0/ 114	0.0			NO
Beta-BHC (UG/KG)	319-85-7	3	1.8E-01	1.2E+02	D	3/ 86	3.5	3.9E+00	3.9E+00	NO
Chlordane (UG/KG)	57-74-9	2	1.9E+01	9.8E+01	D	2/ 23	8.7	1.6E+01	1.6E+01	YES
Delta-BHC (UG/KG)	319-86-8	1	1.7E-01	1.7E-01	D	1/ 86	1.2	4.0E+00	1.7E-01	NO
Dieldrin (UG/KG)	60-57-1	3	5.2E-01	4.4E+00	D	3/ 86	3.5	2.8E+00	2.8E+00	NO
Endosulfan I (UG/KG)	959-98-8	0			O	0/ 86	0.0			NO
Endosulfan II (UG/KG)	33213-65-9	0			O	0/ 86	0.0			NO
Endosulfan Sulfate (UG/KG)	1031-07-8	0			O	0/ 86	0.0			NO
Endrin (UG/KG)	72-20-8	2	1.5E-01	2.3E+01	D	2/ 85	2.4	5.2E+00	5.2E+00	NO
Endrin Aldehyde (UG/KG)	7421-93-4	0			O	0/ 79	0.0			NO
Endrin Ketone (UG/KG)	53494-70-5	2	5.2E-01	7.6E-01	D	2/ 86	2.3	1.9E+01	7.6E-01	NO
Gamma Chlordane (UG/KG)	5103-74-2	1	5.7E-02	5.7E-02	D	1/ 63	1.6	2.0E+01	5.7E-02	NO
Gamma-BHC (Lindane) (UG/KG)	58-89-9	0			O	0/ 86	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

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Heptachlor (UG/KG)	76-44-8	2	1.1E-01	1.3E-01	D	2/ 86	2.3	2.0E+00	1.3E-01	NO
Heptachlor Epoxide (UG/KG)	1024-57-3	2	1.1E-01	3.5E-01	D	2/ 86	2.3	2.6E+01	3.5E-01	NO
Methoxychlor (UG/KG)	72-43-5	0			O	0/ 86	0.0			NO
Toxaphene (UG/KG)	8001-35-2	0			O	0/ 86	0.0			NO
Phenols										
Phenolics (UG/KG)	64743-03-9	0			O	0/ 24	0.0			NO
Radiological										
Actinium-227 (PCI/G)	14952-40-0	36	5.0E-02	2.1E+00	D	36/ 219	16.4	3.5E-01	3.5E-01	YES
Actinium-228 (PCI/G)	14331-83-0	7	7.6E-01	1.4E+00	D	7/ 7	100.0	1.2E+00	1.4E+00	YES
Americium-241 (PCI/G)	14596-10-2	11	5.0E-02	3.8E+01	D	11/ 458	2.4	1.1E-01	1.1E-01	NO
Bismuth-207 (PCI/G)	13982-38-2	0			O	0/ 96	0.0			NO
Bismuth-210 (PCI/G)	14331-79-4	1	6.8E-02	6.8E-02	D	1/ 194	0.5	2.3E-02	2.3E-02	NO
Bismuth-210M (PCI/G)	BI-210M	3	1.4E-01	2.7E-01	D	3/ 78	3.8	5.7E-02	5.7E-02	NO
Bismuth-214 (PCI/G)	14733-03-0	10	7.0E-01	9.3E-01	N	10/ 10	100.0	8.6E-01	9.3E-01	YES
Cesium-137 (PCI/G)	10045-97-3	258	2.1E-02	1.6E+00	X	258/ 461	56.0	1.8E-01	1.8E-01	YES
Cobalt-60 (PCI/G)	10198-40-0	11	2.0E-02	5.0E-01	D	11/ 461	2.4	3.4E-02	3.4E-02	NO
Europium-152 (PCI/G)	14683-23-9	1	8.7E-02	8.7E-02	D	1/ 176	0.6	4.3E-02	4.3E-02	NO
Europium-154 (PCI/G)	15585-10-1	0			O	0/ 176	0.0			NO
Lead-210 (PCI/G)	14255-04-0	146	6.3E-01	3.7E+00	X	146/ 262	55.7	1.3E+00	1.3E+00	YES
Lead-212 (PCI/G)	15092-94-1	10	8.4E-01	1.2E+00	L	10/ 10	100.0	1.1E+00	1.2E+00	YES
Lead-214 (PCI/G)	15067-28-4	10	8.3E-01	1.1E+00	N	10/ 10	100.0	1.0E+00	1.1E+00	YES
Plutonium-238 (PCI/G)	13981-16-3	592	1.2E-02	4.0E+02	D	592/1308	45.3	2.5E+01	2.5E+01	YES
Plutonium-239 (PCI/G)	15117-48-3	83	3.5E-03	1.3E+00	X	83/ 90	92.2	6.9E-02	6.9E-02	YES
Plutonium-239/240 (PCI/G)	PU-239/240	64	3.9E-03	1.0E+00	D	64/ 230	27.8	4.4E-02	4.4E-02	YES
Plutonium-242 (PCI/G)	13982-10-0	0			O	0/ 5	0.0			NO
Potassium-40 (PCI/G)	13966-00-2	96	7.5E+00	3.6E+01	X	96/ 96	100.0	1.9E+01	1.9E+01	YES
Protactinium-231 (PCI/G)	14331-85-2	0			O	0/ 36	0.0			NO
Radium-224 (PCI/G)	13233-32-4	186	7.3E-02	6.3E+00	X	186/ 186	100.0	1.3E+00	1.3E+00	YES
Radium-226 (PCI/G)	13982-63-3	411	1.8E-01	3.7E+00	X	411/ 466	88.2	1.3E+00	1.3E+00	YES
Radium-228 (PCI/G)	15262-20-1	74	5.5E-01	2.0E+00	N	74/ 75	98.7	1.3E+00	1.3E+00	YES
Strontium-90 (PCI/G)	10098-97-2	0			O	0/ 16	0.0			NO
Thallium-208 (PCI/G)	14913-50-9	10	1.6E-01	4.0E-01	N	10/ 10	100.0	3.8E-01	4.0E-01	YES
Thorium-227 (PCI/G)	15623-47-9	17	6.0E-02	4.4E-01	L	17/ 33	51.5	1.4E-01	1.4E-01	YES
Thorium-228 (PCI/G)	14274-82-9	319	3.7E-02	4.5E+00	X	319/ 356	89.6	1.7E+00	1.7E+00	YES
Thorium-229 (PCI/G)	15594-54-4	0			O	0/ 36	0.0			NO
Thorium-230 (PCI/G)	14269-63-7	317	1.0E-01	7.5E+00	X	317/ 499	63.5	2.7E+00	2.7E+00	YES
Thorium-232 (PCI/G)	7440-29-1	675	4.5E-02	8.0E+01	D	675/1518	44.5	8.7E-01	8.7E-01	YES

Analytes Detected in Surface Soil for the Site Employee Scenario

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Tritium (PCI/G)	10028-17-8	1	1.4E+00	1.4E+00	D	1/ 16	6.3	2.2E+00	1.4E+00	YES
Uranium-234 (PCI/G)	13966-29-5	25	3.9E-01	1.6E+00	N	25/ 29	86.2	9.8E-01	9.8E-01	YES
Uranium-235 (PCI/G)	15117-96-1	13	3.3E-02	2.1E-01	D	13/ 55	23.6	2.5E-01	2.1E-01	YES
Uranium-238 (PCI/G)	7440-61-1	50	4.8E-01	2.0E+00	X	50/ 91	54.9	2.0E+00	2.0E+00	YES
Semi-Volatile Organics										
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 119	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 119	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 119	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 119	0.0			NO
1-chloro-4-phenoxybenzene (UG/KG)	7005-72-3	0			O	0/ 119	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/KG)	108-60-1	0			O	0/ 119	0.0			NO
2,4,5-Trichlorophenol (UG/KG)	95-95-4	0			O	0/ 119	0.0			NO
2,4,6-Trichlorophenol (UG/KG)	88-06-2	0			O	0/ 119	0.0			NO
2,4-Dichlorophenol (UG/KG)	120-83-2	0			O	0/ 119	0.0			NO
2,4-Dimethylphenol (UG/KG)	105-67-9	0			O	0/ 119	0.0			NO
2,4-Dinitrophenol (UG/KG)	51-28-5	0			O	0/ 119	0.0			NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 75	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 113	0.0			NO
2-Benzyl-4-Chlorophenol (UG/KG)	120-32-1	0			O	0/ 27	0.0			NO
2-Chloronaphthalene (UG/KG)	91-58-7	0			O	0/ 134	0.0			NO
2-Chlorophenol (UG/KG)	95-57-8	0			O	0/ 119	0.0			NO
2-Methylnaphthalene (UG/KG)	91-57-6	3	5.4E+01	9.9E+01	D	3/ 134	2.2	3.0E+02	9.9E+01	NO
2-Methylphenol (UG/KG)	95-48-7	0			O	0/ 119	0.0			NO
2-Nitroaniline (UG/KG)	88-74-4	0			O	0/ 119	0.0			NO
2-Nitrophenol (UG/KG)	88-75-5	0			O	0/ 119	0.0			NO
3,3'-Dichlorobenzidine (UG/KG)	91-94-1	0			O	0/ 119	0.0			NO
3-Nitroaniline (UG/KG)	99-09-2	0			O	0/ 117	0.0			NO
4,6-Dinitro-o-Cresol (UG/KG)	534-52-1	0			O	0/ 119	0.0			NO
4-Bromophenyl-phenyl Ether (UG/KG)	101-55-3	0			O	0/ 119	0.0			NO
4-Chloro-3-methylphenol (UG/KG)	59-50-7	0			O	0/ 119	0.0			NO
4-Chloroaniline (UG/KG)	106-47-8	0			O	0/ 119	0.0			NO
4-Methylphenol (UG/KG)	106-44-5	1	4.1E+02	4.1E+02	D	1/ 119	0.8	2.9E+02	2.9E+02	NO
4-Nitroaniline (UG/KG)	100-01-6	0			O	0/ 119	0.0			NO
4-Nitrophenol (UG/KG)	100-02-7	1	1.8E+02	1.8E+02	D	1/ 119	0.8	1.3E+03	1.8E+02	NO
Acenaphthene (UG/KG)	83-32-9	5	6.5E+01	4.3E+02	D	5/ 134	3.7	3.0E+02	3.0E+02	NO
Acenaphthylene (UG/KG)	208-96-8	0			O	0/ 134	0.0			NO
Anthracene (UG/KG)	120-12-7	11	2.2E+01	2.8E+03	D	11/ 134	8.2	3.4E+02	3.4E+02	YES

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Benzidine (UG/KG)	92-87-5	0			O	0/ 21	0.0			NO
Benzo(a)anthracene (UG/KG)	56-55-3	24	2.8E+01	4.2E+03	D	24/ 134	17.9	3.5E+02	3.5E+02	YES
Benzo(a)pyrene (UG/KG)	50-32-8	22	2.4E+01	3.6E+03	D	22/ 134	16.4	3.5E+02	3.5E+02	YES
Benzo(b)fluoranthene (UG/KG)	205-99-2	28	2.5E+01	2.8E+03	D	28/ 134	20.9	3.5E+02	3.5E+02	YES
Benzo(g,h,i)perylene (UG/KG)	191-24-2	12	2.7E+01	2.1E+03	D	12/ 134	9.0	3.3E+02	3.3E+02	YES
Benzo(k)fluoranthene (UG/KG)	207-08-9	24	2.5E+01	3.4E+03	D	24/ 134	17.9	3.4E+02	3.4E+02	YES
Benzoic Acid (UG/KG)	65-85-0	5	7.8E+01	9.5E+01	D	5/ 118	4.2	1.6E+03	9.5E+01	NO
Benzyl Alcohol (UG/KG)	100-51-6	0			O	0/ 118	0.0			NO
Bis(2-chloroethoxy)methane (UG/KG)	111-91-1	0			O	0/ 119	0.0			NO
Bis(2-chloroethyl)ether (UG/KG)	111-44-4	0			O	0/ 119	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/KG)	117-81-7	44	2.0E+01	6.5E+03	D	44/ 119	37.0	3.8E+02	3.8E+02	YES
Butyl Benzyl Phthalate (UG/KG)	85-68-7	3	4.8E+01	6.4E+01	D	3/ 119	2.5	2.9E+02	6.4E+01	NO
Carbazole (UG/KG)	86-74-8	2	1.5E+02	1.7E+02	D	2/ 67	3.0	2.0E+02	1.7E+02	NO
Chrysene (UG/KG)	218-01-9	23	2.0E+01	1.7E+03	D	23/ 119	19.3	3.3E+02	3.3E+02	YES
Di-n-butyl Phthalate (UG/KG)	84-74-2	48	2.1E+01	2.0E+03	D	48/ 172	27.9	3.5E+02	3.5E+02	YES
Di-n-octyl Phthalate (UG/KG)	117-84-0	1	4.0E+02	4.0E+02	D	1/ 119	0.8	2.9E+02	2.9E+02	NO
Dibenz(a,h)anthracene (UG/KG)	53-70-3	6	7.1E+01	8.0E+02	D	6/ 134	4.5	3.0E+02	3.0E+02	NO
Dibenzofuran (UG/KG)	132-64-9	6	3.2E+01	5.8E+02	D	6/ 119	5.0	2.8E+02	2.8E+02	YES
Diethyl Phthalate (UG/KG)	84-66-2	6	3.9E+01	1.1E+02	D	6/ 119	5.0	2.9E+02	1.1E+02	YES
Dimethyl Phthalate (UG/KG)	131-11-3	0			O	0/ 119	0.0			NO
Diphenylamine (UG/KG)	122-39-4	0			O	0/ 53	0.0			NO
Fluoranthene (UG/KG)	206-44-0	40	2.3E+01	1.1E+04	D	40/ 134	29.9	4.3E+02	4.3E+02	YES
Fluorene (UG/KG)	86-73-7	7	3.8E+01	1.1E+03	D	7/ 134	5.2	3.0E+02	3.0E+02	YES
Hexachlorobenzene (UG/KG)	118-74-1	0			O	0/ 119	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 119	0.0			NO
Hexachlorocyclopentadiene (UG/KG)	77-47-4	0			O	0/ 119	0.0			NO
Hexachloroethane (UG/KG)	67-72-1	0			O	0/ 119	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/KG)	193-39-5	14	2.5E+01	1.9E+03	D	14/ 134	10.4	3.3E+02	3.3E+02	YES
Isophorone (UG/KG)	78-59-1	0			O	0/ 119	0.0			NO
N-Nitroso-di-n-propylamine (UG/KG)	621-64-7	0			O	0/ 119	0.0			NO
N-Nitrosodiphenylamine (UG/KG)	86-30-6	5	7.8E+01	2.1E+02	D	5/ 119	4.2	2.8E+02	2.1E+02	NO
Naphthalene (UG/KG)	91-20-3	4	2.6E+01	4.1E+02	D	4/ 131	3.1	3.0E+02	3.0E+02	NO
Nitrobenzene (UG/KG)	98-95-3	0			O	0/ 113	0.0			NO
Pentachlorophenol (UG/KG)	87-86-5	0			O	0/ 119	0.0			NO
Phenanthrene (UG/KG)	85-01-8	25	2.7E+01	1.1E+04	D	25/ 134	18.7	4.0E+02	4.0E+02	YES
Phenol (UG/KG)	108-95-2	1	3.2E+02	3.2E+02	D	1/ 119	0.8	2.9E+02	2.9E+02	NO
Pyrene (UG/KG)	129-00-0	37	2.8E+01	9.7E+03	D	37/ 134	27.6	4.2E+02	4.2E+02	YES

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Volatile Organics										
1,1,1,2-Tetrachloroethane (UG/KG)	630-20-6	0			O	0/ 23	0.0			NO
1,1,1-Trichloroethane (UG/KG)	71-55-6	4	1.0E+00	8.0E+00	D	4/ 109	3.7	3.1E+00	3.1E+00	NO
1,1,2,2-Tetrachloroethane (UG/KG)	79-34-5	0			O	0/ 109	0.0			NO
1,1,2-Trichloroethane (UG/KG)	79-00-5	0			O	0/ 109	0.0			NO
1,1-Dichloroethane (UG/KG)	75-34-3	1	3.0E+00	3.0E+00	D	1/ 109	0.9	3.1E+00	3.0E+00	NO
1,1-Dichloroethene (UG/KG)	75-35-4	0			O	0/ 109	0.0			NO
1,1-Dichloropropene (UG/KG)	563-58-6	0			O	0/ 23	0.0			NO
1,2,3-Trichlorobenzene (UG/KG)	87-61-6	0			O	0/ 23	0.0			NO
1,2,3-Trichloropropane (UG/KG)	96-18-4	0			O	0/ 23	0.0			NO
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 3	0.0			NO
1,2,4-Trimethylbenzene (UG/KG)	95-63-6	0			O	0/ 23	0.0			NO
1,2-Dibromo-3-Chloropropane (UG/KG)	96-12-8	0			O	0/ 23	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 3	0.0			NO
1,2-Dichloroethane (UG/KG)	107-06-2	0			O	0/ 109	0.0			NO
1,2-Dichloroethene (UG/KG)	540-59-0	2	2.0E+00	6.0E+00	D	2/ 86	2.3	3.1E+00	3.1E+00	NO
1,2-Dichloropropane (UG/KG)	78-87-5	0			O	0/ 109	0.0			NO
1,2-Diethylbenzene (UG/KG)	135-01-3	0			O	0/ 28	0.0			NO
1,2-cis-Dichloroethene (UG/KG)	156-59-2	0			O	0/ 34	0.0			NO
1,2-trans-Dichloroethene (UG/KG)	156-60-5	0			O	0/ 34	0.0			NO
1,3,5-Trimethylbenzene (UG/KG)	108-67-8	0			O	0/ 23	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 3	0.0			NO
1,3-Dichloropropane (UG/KG)	142-28-9	0			O	0/ 23	0.0			NO
1,3-cis-Dichloropropene (UG/KG)	10061-01-5	0			O	0/ 109	0.0			NO
1,3-trans-Dichloropropene (UG/KG)	10061-02-6	0			O	0/ 109	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 3	0.0			NO
2,2-Dichloropropane (UG/KG)	594-20-7	0			O	0/ 23	0.0			NO
2-Butanone (UG/KG)	78-93-3	7	1.0E+00	1.7E+01	D	7/ 86	8.1	6.2E+00	6.2E+00	YES
2-Chlorotoluene (UG/KG)	95-49-8	0			O	0/ 23	0.0			NO
2-Hexanone (UG/KG)	591-78-6	0			O	0/ 86	0.0			NO
4-Chlorotoluene (UG/KG)	106-43-4	0			O	0/ 23	0.0			NO
4-Methyl-2-pentanone (UG/KG)	108-10-1	5	1.0E+00	6.0E+00	D	5/ 86	5.8	6.1E+00	6.0E+00	YES
Acetone (UG/KG)	67-64-1	14	4.0E+00	1.5E+02	D	14/ 86	16.3	9.0E+00	9.0E+00	YES
Acetonitrile (UG/KG)	75-05-8	0			O	0/ 28	0.0			NO
Acrylonitrile (UG/KG)	107-13-1	0			O	0/ 28	0.0			NO
Benzene (UG/KG)	71-43-2	0			O	0/ 109	0.0			NO
Bromochloromethane (UG/KG)	74-97-5	0			O	0/ 23	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Bromodichloromethane (UG/KG)	75-27-4	0			O	0/ 109	0.0			NO
Bromoform (UG/KG)	75-25-2	0			O	0/ 109	0.0			NO
Bromomethane (UG/KG)	74-83-9	0			O	0/ 109	0.0			NO
Carbon Disulfide (UG/KG)	75-15-0	2	1.0E+00	2.0E+00	D	2/ 86	2.3	3.1E+00	2.0E+00	NO
Carbon Tetrachloride (UG/KG)	56-23-5	0			O	0/ 109	0.0			NO
Chlorobenzene (UG/KG)	108-90-7	0			O	0/ 109	0.0			NO
Chloroethane (UG/KG)	75-00-3	0			O	0/ 109	0.0			NO
Chloroform (Trichloromethane) (UG/KG)	67-66-3	0			O	0/ 109	0.0			NO
Chloromethane (UG/KG)	74-87-3	1	4.0E+00	4.0E+00	D	1/ 109	0.9	5.6E+00	4.0E+00	NO
Dibromochloromethane (UG/KG)	124-48-1	0			O	0/ 109	0.0			NO
Dibromomethane (UG/KG)	74-95-3	0			O	0/ 23	0.0			NO
Dichlorodifluoromethane (UG/KG)	75-71-8	0			O	0/ 23	0.0			NO
Dichloromethane (Methylene Chloride) (UG/KG)	75-09-2	49	3.0E+00	6.8E+01	D	49/ 109	45.0	1.0E+01	1.0E+01	YES
Ethylbenzene (UG/KG)	100-41-4	3	1.0E+00	3.0E+00	D	3/ 109	2.8	3.1E+00	3.0E+00	NO
Ethylene Dibromide (1,2-Dibromoethane) (UG/KG	106-93-4	0			O	0/ 23	0.0			NO
FREON-113 (UG/KG)	76-13-1	0			O	0/ 28	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 3	0.0			NO
Hexane (UG/KG)	110-54-3	0			O	0/ 28	0.0			NO
Iodomethane (UG/KG)	74-88-4	0			O	0/ 28	0.0			NO
Isopropyl Benzene (UG/KG)	98-82-8	0			O	0/ 23	0.0			NO
Monobromobenzene (Phenyl bromide) (UG/KG)	108-86-1	0			O	0/ 23	0.0			NO
Naphthalene (UG/KG)	91-20-3	3	1.0E+00	6.0E+00	D	3/ 6	50.0	1.0E+01	6.0E+00	YES
Styrene (UG/KG)	100-42-5	0			O	0/ 109	0.0			NO
Tetrachloroethene (UG/KG)	127-18-4	7	2.0E+00	2.8E+01	D	7/ 109	6.4	3.7E+00	3.7E+00	YES
Toluene (UG/KG)	108-88-3	18	1.0E+00	5.1E+01	D	18/ 109	16.5	3.4E+00	3.4E+00	YES
Trichloroethylene (TCE) (UG/KG)	79-01-6	2	1.8E+01	2.0E+01	D	2/ 109	1.8	3.4E+00	3.4E+00	NO
Trichlorofluoromethane (UG/KG)	75-69-4	0			O	0/ 23	0.0			NO
Vinyl Acetate (UG/KG)	108-05-4	0			O	0/ 86	0.0			NO
Vinyl Chloride (UG/KG)	75-01-4	0			O	0/ 109	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	7	1.0E+00	3.9E+01	D	7/ 86	8.1	3.5E+00	3.5E+00	YES
m-Xylene (UG/KG)	108-38-3	0			O	0/ 11	0.0			NO
mp-Xylene (UG/KG)	mp-Xylene	23	5.0E+00	6.0E+00	X	23/ 23	100.0	6.0E+00	6.0E+00	YES
n-Butylbenzene (UG/KG)	104-51-8	0			O	0/ 23	0.0			NO
n-propylbenzene (UG/KG)	103-65-1	0			O	0/ 23	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
o-Xylene (UG/KG)	95-47-6	0			O	0/ 34	0.0			NO
p-Isopropyltoluene (UG/KG)	99-87-6	0			O	0/ 23	0.0			NO
sec-Butylbenzene (UG/KG)	135-98-8	0			O	0/ 23	0.0			NO
tert-Butylbenzene (UG/KG)	98-06-6	0			O	0/ 23	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Common Anions									
Nitrate (UG/L)	7697-37-2	738.00	2550.00	D	2/ 2	100.0		2550.00	YES
Nitrate/Nitrite (UG/L)	1497-55-8	680.00	4900.00	L	11/ 11	100.0	3510.00	4900.00	YES
Nitrite (UG/L)	14797-65-0			O	0/ 2	0.0			NO
Explosives									
1,3,5-Trinitrobenzene (UG/L)	99-35-4			O	0/ 2	0.0			NO
1,3-Dinitrobenzene (UG/L)	99-65-0			O	0/ 4	0.0			NO
2,4,6-Trinitrotoluene (UG/L)	118-96-7			O	0/ 2	0.0			NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 2	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 2	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/L)	35572-78-2			O	0/ 4	0.0			NO
HMX (UG/L)	2691-41-0			O	0/ 4	0.0			NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 4	0.0			NO
PETN (UG/L)	78-11-5			O	0/ 3	0.0			NO
RDX (UG/L)	121-82-4			O	0/ 4	0.0			NO
Tetryl (UG/L)	479-45-8			O	0/ 4	0.0			NO
Metals									
Aluminum (UG/L)	7429-90-5	68.80	148.00	D	6/ 22	27.3	163.00	148.00	YES
Antimony (UG/L)	7440-36-0	2.80	14.40	D	3/ 20	15.0	43.60	14.40	YES
Arsenic (UG/L)	7440-38-2			O	0/ 25	0.0			NO
Barium (UG/L)	7440-39-3	75.00	115.00	L	20/ 22	90.9	93.60	93.60	YES
Beryllium (UG/L)	7440-41-7			O	0/ 25	0.0			NO
Bismuth (UG/L)	7440-69-9			O	0/ 4	0.0			NO
Cadmium (UG/L)	7440-43-9	4.60	7.70	D	5/ 25	20.0	6.56	6.56	YES
Calcium (UG/L)	7440-70-2	94300.00	126000.00	L	24/ 24	100.0	110000.00	110000.00	YES
Chromium (UG/L)	7440-47-3	18.30	23.80	D	5/ 25	20.0	20.20	20.20	YES
Cobalt (UG/L)	7440-48-4			O	0/ 22	0.0			NO
Copper (UG/L)	7440-50-8	1.60	593.00	X	15/ 25	60.0	41.60	41.60	YES
Cyanide (UG/L)	57-12-5			O	0/ 4	0.0			NO
Iron (UG/L)	7439-89-6	19.00	1890.00	L	13/ 24	54.2	437.00	437.00	YES
Lead (UG/L)	7439-92-1	3.40	40.00	D	5/ 25	20.0	13.00	13.00	YES
Lithium (UG/L)	7439-93-2	2.90	2.90	D	2/ 4	50.0	604.00	2.90	YES
Magnesium (UG/L)	7439-95-4	29100.00	39600.00	L	24/ 24	100.0	34500.00	34500.00	YES
Manganese (UG/L)	7439-96-5	2.80	224.00	X	22/ 24	91.7	26.90	26.90	YES
Mercury (UG/L)	7439-97-6			O	0/ 22	0.0			NO
Molybdenum (UG/L)	7439-98-7	2.00	2.70	D	2/ 4	50.0	3980000.00	2.70	YES
Nickel (UG/L)	7440-02-0	2.10	27.10	D	5/ 25	20.0	16.30	16.30	YES

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Potassium (UG/L)	7440-09-7	2390.00	3650.00	X	20/ 26	76.9	4540.00	3650.00	YES
Selenium (UG/L)	7782-49-2	1.50	1.50	D	1/ 25	4.0	1.63	1.50	NO
Silver (UG/L)	7440-22-4	16.90	24.20	D	5/ 22	22.7	18.00	18.00	YES
Sodium (UG/L)	7440-23-5	46600.00	84200.00	L	24/ 24	100.0	66400.00	66400.00	YES
Thallium (UG/L)	7440-28-0	2.40	2.40	D	1/ 22	4.5	2.00	2.00	NO
Tin (UG/L)	7440-31-5	8.70	8.70	D	1/ 4	25.0	134.00	8.70	YES
Vanadium (UG/L)	7440-62-2	7.80	14.60	D	7/ 22	31.8	21.90	14.60	YES
Zinc (UG/L)	7440-66-6	4.50	57.70	D	9/ 25	36.0	73.70	57.70	YES
Pesticides and/or PCBs									
4,4'-DDD (UG/L)	72-54-8			O	0/ 18	0.0			NO
4,4'-DDE (UG/L)	72-55-9			O	0/ 18	0.0			NO
4,4'-DDT (UG/L)	50-29-3			O	0/ 18	0.0			NO
Aldrin (UG/L)	309-00-2			O	0/ 18	0.0			NO
Alpha Chlordane (UG/L)	5103-71-9			O	0/ 18	0.0			NO
Alpha-BHC (UG/L)	319-84-6			O	0/ 18	0.0			NO
Aroclor-1016 (UG/L)	12674-11-2			O	0/ 18	0.0			NO
Aroclor-1221 (UG/L)	11104-28-2			O	0/ 18	0.0			NO
Aroclor-1232 (UG/L)	11141-16-5			O	0/ 18	0.0			NO
Aroclor-1242 (UG/L)	53469-21-9			O	0/ 18	0.0			NO
Aroclor-1248 (UG/L)	12672-29-6			O	0/ 18	0.0			NO
Aroclor-1254 (UG/L)	11097-69-1			O	0/ 18	0.0			NO
Aroclor-1260 (UG/L)	11096-82-5			O	0/ 18	0.0			NO
Beta-BHC (UG/L)	319-85-7			O	0/ 18	0.0			NO
Delta-BHC (UG/L)	319-86-8			O	0/ 18	0.0			NO
Dieldrin (UG/L)	60-57-1			O	0/ 18	0.0			NO
Endosulfan I (UG/L)	959-98-8			O	0/ 18	0.0			NO
Endosulfan II (UG/L)	33213-65-9			O	0/ 18	0.0			NO
Endosulfan Sulfate (UG/L)	1031-07-8			O	0/ 18	0.0			NO
Endrin (UG/L)	72-20-8			O	0/ 18	0.0			NO
Endrin Aldehyde (UG/L)	7421-93-4			O	0/ 10	0.0			NO
Endrin Ketone (UG/L)	53494-70-5			O	0/ 18	0.0			NO
Gamma Chlordane (UG/L)	5103-74-2			O	0/ 18	0.0			NO
Gamma-BHC (Lindane) (UG/L)	58-89-9			O	0/ 18	0.0			NO
Heptachlor (UG/L)	76-44-8			O	0/ 18	0.0			NO
Heptachlor Epoxide (UG/L)	1024-57-3			O	0/ 18	0.0			NO
Methoxychlor (UG/L)	72-43-5			O	0/ 18	0.0			NO
Toxaphene (UG/L)	8001-35-2			O	0/ 18	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Radiological									
Americium-241 (PCI/L)	14596-10-2			O	0/ 8	0.0			NO
Antimony-124 (PCI/L)	14683-10-4			O	0/ 2	0.0			NO
Antimony-125 (PCI/L)	14234-35-6			O	0/ 2	0.0			NO
Barium-133 (PCI/L)	13981-41-4			O	0/ 2	0.0			NO
Barium-140 (PCI/L)	14798-08-4			O	0/ 2	0.0			NO
Beryllium-7 (PCI/L)	13966-02-4			O	0/ 2	0.0			NO
Bismuth-207 (PCI/L)	13982-38-2			O	0/ 6	0.0			NO
Bismuth-210 (PCI/L)	14331-79-4	0.11	0.39	D	2/ 18	11.1	21.60	0.39	YES
Bismuth-211 (PCI/L)	15229-37-5			O	0/ 2	0.0			NO
Bismuth-212 (PCI/L)	14913-49-6			O	0/ 2	0.0			NO
Bismuth-214 (PCI/L)	14733-03-0			O	0/ 2	0.0			NO
Cerium-139 (PCI/L)	CE-139			O	0/ 2	0.0			NO
Cerium-141 (PCI/L)	13967-74-3			O	0/ 2	0.0			NO
Cerium-144 (PCI/L)	14762-78-8			O	0/ 2	0.0			NO
Cesium-134 (PCI/L)	13967-70-9			O	0/ 4	0.0			NO
Cesium-137 (PCI/L)	10045-97-3			O	0/ 14	0.0			NO
Cobalt-57 (PCI/L)	13981-50-5			O	0/ 2	0.0			NO
Cobalt-58 (PCI/L)	13981-38-9			O	0/ 2	0.0			NO
Cobalt-60 (PCI/L)	10198-40-0			O	0/ 11	0.0			NO
Europium-152 (PCI/L)	14683-23-9			O	0/ 4	0.0			NO
Europium-154 (PCI/L)	15585-10-1			O	0/ 4	0.0			NO
Europium-155 (PCI/L)	14391-16-3			O	0/ 4	0.0			NO
Iodine-131 (PCI/L)	24267-56-9			O	0/ 2	0.0			NO
Iridium-192 (PCI/L)	12154-84-6			O	0/ 2	0.0			NO
Iron-59 (PCI/L)	14596-12-4			O	0/ 2	0.0			NO
Lanthanum-140 (PCI/L)	13981-28-7			O	0/ 2	0.0			NO
Lead-212 (PCI/L)	15092-94-1			O	0/ 2	0.0			NO
Lead-214 (PCI/L)	15067-28-4			O	0/ 2	0.0			NO
Manganese-54 (PCI/L)	13966-31-9			O	0/ 2	0.0			NO
Mercury-203 (PCI/L)	13982-78-0			O	0/ 2	0.0			NO
Neptunium-237 (PCI/L)	13994-20-2			O	0/ 2	0.0			NO
Niobium-95 (PCI/L)	13967-76-5			O	0/ 2	0.0			NO
Plutonium-238 (PCI/L)	13981-16-3	0.01	0.25	D	8/ 57	14.0	0.18	0.18	YES
Plutonium-238/239 (PCI/L)	PU-238/239	0.01	0.01	D	1/ 6	16.7	0.01	0.01	YES
Plutonium-239 (PCI/L)	15117-48-3			O	0/ 38	0.0			NO
Plutonium-239/240 (PCI/L)	PU-239/240	0.00	2.00	D	5/ 19	26.3	9.64	2.00	YES

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Potassium-40 (PCI/L)	13966-00-2			O	0/ 10	0.0			NO
Protactinium-233 (PCI/L)	13981-14-1			O	0/ 2	0.0			NO
Protactinium-234 (PCI/L)	15100-28-4			O	0/ 2	0.0			NO
Radium-223 (PCI/L)	15623-45-7			O	0/ 2	0.0			NO
Radium-225 (PCI/L)	13981-53-8			O	0/ 2	0.0			NO
Radium-226 (PCI/L)	13982-63-3	0.10	0.52	D	6/ 18	33.3	0.54	0.52	YES
Ruthenium-103 (PCI/L)	13968-53-1			O	0/ 2	0.0			NO
Ruthenium-106 (PCI/L)	13967-48-1			O	0/ 2	0.0			NO
Scandium-46 (PCI/L)	13967-63-0			O	0/ 2	0.0			NO
Sodium-22 (PCI/L)	13966-32-0			O	0/ 2	0.0			NO
Strontium-85 (PCI/L)	13967-73-2	25.00	25.00	D	1/ 2	50.0		25.00	YES
Strontium-89 (PCI/L)	14158-27-1			O	0/ 2	0.0			NO
Strontium-90 (PCI/L)	10098-97-2	0.50	0.50	D	3/ 18	16.7	2.13	0.50	YES
Thallium-208 (PCI/L)	14913-50-9			O	0/ 2	0.0			NO
Thorium-227 (PCI/L)	15623-47-9	0.01	0.23	X	16/ 22	72.7	84.00	0.23	YES
Thorium-228 (PCI/L)	14274-82-9	0.01	2.17	D	17/ 46	37.0	25.60	2.17	YES
Thorium-230 (PCI/L)	14269-63-7	0.01	1.99	D	19/ 43	44.2	0.48	0.48	YES
Thorium-232 (PCI/L)	7440-29-1	0.00	0.10	D	8/ 44	18.2	0.34	0.10	YES
Thorium-234 (PCI/L)	15065-10-8			O	0/ 2	0.0			NO
Tin-126 (PCI/L)	15832-50-5			O	0/ 2	0.0			NO
Tritium (PCI/L)	10028-17-8	30.00	7200.00	X	123/ 139	88.5	799.00	799.00	YES
Uranium-233/234 (PCI/L)	U-233/234	0.17	0.36	L	36/ 36	100.0	0.25	0.25	YES
Uranium-234 (PCI/L)	13966-29-5	0.20	8.14	X	19/ 24	79.2	2.02	2.02	YES
Uranium-235 (PCI/L)	15117-96-1	0.01	2.30	X	30/ 53	56.6	0.47	0.47	YES
Uranium-235/236 (PCI/L)	U-235/236			O	0/ 7	0.0			NO
Uranium-238 (PCI/L)	7440-61-1	0.13	8.25	X	52/ 59	88.1	0.41	0.41	YES
Yttrium-88 (PCI/L)	7440-65-5			O	0/ 2	0.0			NO
Zirconium-95 (PCI/L)	13967-71-0			O	0/ 2	0.0			NO
Semi-Volatile Organics									
1,2,4-Trichlorobenzene (UG/L)	120-82-1			O	0/ 18	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 32	0.0			NO
1,3-Dichlorobenzene (UG/L)	541-73-1			O	0/ 30	0.0			NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 32	0.0			NO
1-chloro-4-phenoxybenzene (UG/L)	7005-72-3			O	0/ 18	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/L)	108-60-1			O	0/ 29	0.0			NO
2,4,5-Trichlorophenol (UG/L)	95-95-4			O	0/ 18	0.0			NO
2,4,6-Trichlorophenol (UG/L)	88-06-2			O	0/ 18	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
2,4-Dichlorophenol (UG/L)	120-83-2			O	0/ 18	0.0			NO
2,4-Dimethylphenol (UG/L)	105-67-9			O	0/ 18	0.0			NO
2,4-Dinitrophenol (UG/L)	51-28-5			O	0/ 18	0.0			NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 16	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 16	0.0			NO
2-Benzyl-4-Chlorophenol (UG/L)	120-32-1			O	0/ 4	0.0			NO
2-Chloronaphthalene (UG/L)	91-58-7			O	0/ 18	0.0			NO
2-Chlorophenol (UG/L)	95-57-8			O	0/ 18	0.0			NO
2-Methylnaphthalene (UG/L)	91-57-6			O	0/ 18	0.0			NO
2-Methylphenol (UG/L)	95-48-7			O	0/ 18	0.0			NO
2-Nitroaniline (UG/L)	88-74-4			O	0/ 18	0.0			NO
2-Nitrophenol (UG/L)	88-75-5			O	0/ 18	0.0			NO
3,3'-Dichlorobenzidine (UG/L)	91-94-1			O	0/ 18	0.0			NO
3-Nitroaniline (UG/L)	99-09-2			O	0/ 18	0.0			NO
4,6-Dinitro-o-Cresol (UG/L)	534-52-1			O	0/ 18	0.0			NO
4-Bromophenyl-phenyl Ether (UG/L)	101-55-3			O	0/ 18	0.0			NO
4-Chloro-3-methylphenol (UG/L)	59-50-7			O	0/ 18	0.0			NO
4-Chloroaniline (UG/L)	106-47-8			O	0/ 18	0.0			NO
4-Methylphenol (UG/L)	106-44-5			O	0/ 18	0.0			NO
4-Nitroaniline (UG/L)	100-01-6			O	0/ 18	0.0			NO
4-Nitrophenol (UG/L)	100-02-7			O	0/ 18	0.0			NO
Acenaphthene (UG/L)	83-32-9			O	0/ 18	0.0			NO
Acenaphthylene (UG/L)	208-96-8			O	0/ 18	0.0			NO
Anthracene (UG/L)	120-12-7			O	0/ 18	0.0			NO
Benzo(a)anthracene (UG/L)	56-55-3			O	0/ 18	0.0			NO
Benzo(a)pyrene (UG/L)	50-32-8			O	0/ 18	0.0			NO
Benzo(b)fluoranthene (UG/L)	205-99-2			O	0/ 18	0.0			NO
Benzo(g,h,i)perylene (UG/L)	191-24-2			O	0/ 18	0.0			NO
Benzo(k)fluoranthene (UG/L)	207-08-9			O	0/ 18	0.0			NO
Benzoic Acid (UG/L)	65-85-0			O	0/ 13	0.0			NO
Benzyl Alcohol (UG/L)	100-51-6			O	0/ 13	0.0			NO
Bis(2-chloroethoxy)methane (UG/L)	111-91-1			O	0/ 18	0.0			NO
Bis(2-chloroethyl)ether (UG/L)	111-44-4			O	0/ 18	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/L)	117-81-7			O	0/ 21	0.0			NO
Butyl Benzyl Phthalate (UG/L)	85-68-7			O	0/ 18	0.0			NO
Carbazole (UG/L)	86-74-8			O	0/ 9	0.0			NO
Chrysene (UG/L)	218-01-9			O	0/ 18	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Di-n-butyl Phthalate (UG/L)	84-74-2			O	0/ 21	0.0			NO
Di-n-octyl Phthalate (UG/L)	117-84-0			O	0/ 18	0.0			NO
Dibenz(a,h)anthracene (UG/L)	53-70-3			O	0/ 18	0.0			NO
Dibenzofuran (UG/L)	132-64-9			O	0/ 18	0.0			NO
Diethyl Phthalate (UG/L)	84-66-2			O	0/ 18	0.0			NO
Dimethyl Phthalate (UG/L)	131-11-3			O	0/ 18	0.0			NO
Fluoranthene (UG/L)	206-44-0			O	0/ 18	0.0			NO
Fluorene (UG/L)	86-73-7			O	0/ 18	0.0			NO
Hexachlorobenzene (UG/L)	118-74-1			O	0/ 18	0.0			NO
Hexachlorobutadiene (UG/L)	87-68-3			O	0/ 18	0.0			NO
Hexachlorocyclopentadiene (UG/L)	77-47-4			O	0/ 18	0.0			NO
Hexachloroethane (UG/L)	67-72-1			O	0/ 18	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/L)	193-39-5			O	0/ 18	0.0			NO
Isophorone (UG/L)	78-59-1			O	0/ 18	0.0			NO
N-Nitroso-di-n-propylamine (UG/L)	621-64-7			O	0/ 18	0.0			NO
N-Nitrosodiphenylamine (UG/L)	86-30-6			O	0/ 18	0.0			NO
Naphthalene (UG/L)	91-20-3			O	0/ 18	0.0			NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 14	0.0			NO
Pentachlorophenol (UG/L)	87-86-5			O	0/ 21	0.0			NO
Phenanthrene (UG/L)	85-01-8			O	0/ 18	0.0			NO
Phenol (UG/L)	108-95-2			O	0/ 21	0.0			NO
Pyrene (UG/L)	129-00-0			O	0/ 18	0.0			NO
Volatile Organics									
1,1,1,2-Tetrachloroethane (UG/L)	630-20-6			O	0/ 202	0.0			NO
1,1,1-Trichloroethane (UG/L)	71-55-6	0.30	3.30	D	91/ 215	42.3	0.90	0.90	YES
1,1,2,2-Tetrachloroethane (UG/L)	79-34-5			O	0/ 213	0.0			NO
1,1,2-Trichloroethane (UG/L)	79-00-5			O	0/ 217	0.0			NO
1,1-Dichloroethane (UG/L)	75-34-3	3.50	3.50	D	1/ 213	0.5	0.34	0.34	NO
1,1-Dichloroethene (UG/L)	75-35-4	1.70	1.70	D	1/ 215	0.5	0.39	0.39	NO
1,1-Dichloropropene (UG/L)	563-58-6			O	0/ 167	0.0			NO
1,2,3-Trichlorobenzene (UG/L)	87-61-6			O	0/ 167	0.0			NO
1,2,3-Trichloropropane (UG/L)	96-18-4			O	0/ 192	0.0			NO
1,2,4-Trichlorobenzene (UG/L)	120-82-1			O	0/ 167	0.0			NO
1,2,4-Trimethylbenzene (UG/L)	95-63-6			O	0/ 167	0.0			NO
1,2-Dibromo-3-Chloropropane (UG/L)	96-12-8			O	0/ 2	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 177	0.0			NO
1,2-Dichloroethane (UG/L)	107-06-2			O	0/ 219	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
1,2-Dichloroethene (UG/L)	540-59-0	1.30	7.20	L	10/ 13	76.9	5.57	7.20	YES
1,2-Dichloropropane (UG/L)	78-87-5			O	0/ 213	0.0			NO
1,2-Diethylbenzene (UG/L)	135-01-3			O	0/ 4	0.0			NO
1,2-cis-Dichloroethene (UG/L)	156-59-2	0.50	4.00	X	102/ 182	56.0	1.08	1.08	YES
1,2-trans-Dichloroethene (UG/L)	156-60-5	1.00	3.00	D	7/ 217	3.2	0.39	0.39	NO
1,3,5-Trimethylbenzene (UG/L)	108-67-8			O	0/ 167	0.0			NO
1,3-Dichlorobenzene (UG/L)	541-73-1			O	0/ 177	0.0			NO
1,3-Dichloropropane (UG/L)	142-28-9			O	0/ 167	0.0			NO
1,3-Dichloropropene (UG/L)	542-75-6			O	0/ 167	0.0			NO
1,3-Diethylbenzene (UG/L)	141-93-5			O	0/ 4	0.0			NO
1,3-cis-Dichloropropene (UG/L)	10061-01-5	0.50	1.20	D	2/ 215	0.9	0.55	0.55	NO
1,3-trans-Dichloropropene (UG/L)	10061-02-6			O	0/ 215	0.0			NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 177	0.0			NO
1,4-Diethylbenzene (UG/L)	105-05-5			O	0/ 4	0.0			NO
1-Chlorohexane (UG/L)	544-10-5			O	0/ 33	0.0			NO
2,2-Dichloropropane (UG/L)	594-20-7			O	0/ 167	0.0			NO
2-Butanone (UG/L)	78-93-3	7.00	41.00	D	3/ 13	23.1	16.80	41.00	YES
2-Chloroethylvinylether (UG/L)	110-75-8			O	0/ 40	0.0			NO
2-Chlorotoluene (UG/L)	95-49-8			O	0/ 183	0.0			NO
2-Hexanone (UG/L)	591-78-6			O	0/ 7	0.0			NO
4-Chlorotoluene (UG/L)	106-43-4			O	0/ 173	0.0			NO
4-Methyl-2-pentanone (UG/L)	108-10-1			O	0/ 11	0.0			NO
Acetone (UG/L)	67-64-1	2.00	12.00	D	6/ 11	54.5	11.90	12.00	YES
Acetonitrile (UG/L)	75-05-8			O	0/ 4	0.0			NO
Acrolein (UG/L)	107-02-8			O	0/ 3	0.0			NO
Acrylonitrile (UG/L)	107-13-1			O	0/ 7	0.0			NO
Benzene (UG/L)	71-43-2			O	0/ 215	0.0			NO
Benzyl Chloride (UG/L)	100-44-7			O	0/ 4	0.0			NO
Bromochloromethane (UG/L)	74-97-5			O	0/ 167	0.0			NO
Bromodichloromethane (UG/L)	75-27-4	0.50	3.70	D	3/ 215	1.4	0.38	0.38	NO
Bromoform (UG/L)	75-25-2			O	0/ 214	0.0			NO
Bromomethane (UG/L)	74-83-9			O	0/ 185	0.0			NO
Carbon Disulfide (UG/L)	75-15-0			O	0/ 11	0.0			NO
Carbon Tetrachloride (UG/L)	56-23-5			O	0/ 215	0.0			NO
Chlorobenzene (UG/L)	108-90-7			O	0/ 213	0.0			NO
Chloroethane (UG/L)	75-00-3			O	0/ 185	0.0			NO
Chloroform (Trichloromethane) (UG/L)	67-66-3	0.50	7.00	D	13/ 219	5.9	0.42	0.42	YES

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Chloromethane (UG/L)	74-87-3			O	0/ 187	0.0			NO
Chlorotoluene (UG/L)	25168-05-2			O	0/ 19	0.0			NO
Dibromochloromethane (UG/L)	124-48-1			O	0/ 215	0.0			NO
Dibromomethane (UG/L)	74-95-3			O	0/ 204	0.0			NO
Dichlorodifluoromethane (UG/L)	75-71-8			O	0/ 175	0.0			NO
Dichloromethane (Methylene Chloride) (U	75-09-2	3.00	13.00	D	8/ 217	3.7	0.70	0.70	NO
Ethylbenzene (UG/L)	100-41-4	0.50	0.60	D	2/ 219	0.9	0.48	0.48	NO
Ethylene Dibromide (1,2-Dibromoethane)	106-93-4			O	0/ 2	0.0			NO
FREON-113 (UG/L)	76-13-1	2.00	34.00	X	12/ 19	63.2	29.60	34.00	YES
Hexachlorobutadiene (UG/L)	87-68-3			O	0/ 167	0.0			NO
Isopropyl Benzene (UG/L)	98-82-8			O	0/ 167	0.0			NO
Monobromobenzene (Phenyl bromide) (U	108-86-1			O	0/ 202	0.0			NO
Naphthalene (UG/L)	91-20-3			O	0/ 167	0.0			NO
Styrene (UG/L)	100-42-5			O	0/ 174	0.0			NO
Tert-butyl methyl ether (UG/L)	1634-04-4	1.20	2.40	D	4/ 24	16.7	0.61	0.61	YES
Tetrachloroethene (UG/L)	127-18-4	0.29	2.20	X	114/ 218	52.3	0.96	0.96	YES
Toluene (UG/L)	108-88-3	0.60	3.00	D	4/ 219	1.8	0.50	0.50	NO
Trichloroethylene (TCE) (UG/L)	79-01-6	0.50	5.90	X	189/ 219	86.3	2.31	2.31	YES
Trichlorofluoromethane (UG/L)	75-69-4	2.20	2.20	D	1/ 210	0.5	0.43	0.43	NO
Vinyl Acetate (UG/L)	108-05-4			O	0/ 11	0.0			NO
Vinyl Chloride (UG/L)	75-01-4			O	0/ 219	0.0			NO
Xylenes, Total (UG/L)	1330-20-7	0.50	3.60	D	9/ 212	4.2	0.56	0.56	NO
mp-Xylene (UG/L)	mp-Xylene	0.60	2.40	D	8/ 167	4.8	0.31	0.31	NO
n-Butylbenzene (UG/L)	104-51-8			O	0/ 167	0.0			NO
n-propylbenzene (UG/L)	103-65-1			O	0/ 167	0.0			NO
o-Xylene (UG/L)	95-47-6	0.40	1.30	D	5/ 167	3.0	0.27	0.27	NO
p-Isopropyltoluene (UG/L)	99-87-6			O	0/ 167	0.0			NO
sec-Butylbenzene (UG/L)	135-98-8			O	0/ 167	0.0			NO
tert-Butylbenzene (UG/L)	98-06-6			O	0/ 167	0.0			NO

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Common Anions									
Nitrate (UG/L)	7697-37-2	1.7E+02	9.4E+03	D	5/ 10	50.0	1.1E+16	9.4E+03	YES
Nitrate/Nitrite (UG/L)	1497-55-8	6.3E+00	2.0E+04	X	76/ 113	67.3	3.1E+04	2.0E+04	YES
Nitrite (UG/L)	14797-65-0	1.0E+01	7.0E+01	D	2/ 21	9.5	1.4E+01	1.4E+01	YES
Explosives									
1,3,5-Trinitrobenzene (UG/L)	99-35-4	1.1E+00	1.1E+00	D	1/ 23	4.3	1.2E+00	1.1E+00	NO
1,3-Dinitrobenzene (UG/L)	99-65-0			O	0/ 43	0.0			NO
2,4,6-Trinitrotoluene (UG/L)	118-96-7	2.6E-01	2.6E-01	D	1/ 24	4.2	9.2E-01	2.6E-01	NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 23	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 34	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/L)	35572-78-2			O	0/ 43	0.0			NO
HMX (UG/L)	2691-41-0			O	0/ 43	0.0			NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 42	0.0			NO
PETN (UG/L)	78-11-5			O	0/ 40	0.0			NO
RDX (UG/L)	121-82-4			O	0/ 41	0.0			NO
Tetryl (UG/L)	479-45-8			O	0/ 43	0.0			NO
Metals									
Aluminum (UG/L)	7429-90-5	1.2E+01	3.2E+04	X	141/ 151	93.4	4.7E+03	4.7E+03	YES
Antimony (UG/L)	7440-36-0	3.5E-01	4.2E+01	D	47/ 158	29.7	3.2E+00	3.2E+00	YES
Arsenic (UG/L)	7440-38-2	3.0E-01	9.3E+02	D	35/ 150	23.3	7.3E+00	7.3E+00	YES
Barium (UG/L)	7440-39-3	1.8E+01	3.1E+03	X	148/ 150	98.7	1.4E+02	1.4E+02	YES
Beryllium (UG/L)	7440-41-7	3.0E-02	2.3E+00	D	56/ 151	37.1	3.8E-01	3.8E-01	YES
Bismuth (UG/L)	7440-69-9	8.2E-01	2.6E+02	D	29/ 139	20.9	2.1E+01	2.1E+01	YES
Boron (UG/L)	7440-42-8	5.7E+01	1.3E+02	D	7/ 8	87.5	1.1E+02	1.3E+02	YES
Cadmium (UG/L)	7440-43-9	1.4E-01	1.3E+01	D	17/ 161	10.6	7.0E-01	7.0E-01	YES
Calcium (UG/L)	7440-70-2	1.2E+02	1.5E+06	X	198/ 198	100.0	2.0E+05	2.0E+05	YES
Chromium (UG/L)	7440-47-3	2.0E-01	4.5E+04	X	106/ 155	68.4	1.6E+03	1.6E+03	YES
Cobalt (UG/L)	7440-48-4	3.1E-01	3.0E+02	D	63/ 151	41.7	1.7E+01	1.7E+01	YES
Copper (UG/L)	7440-50-8	3.8E-01	5.1E+02	X	118/ 153	77.1	1.8E+01	1.8E+01	YES
Cyanide (UG/L)	57-12-5	5.5E+00	1.4E+01	D	3/ 46	6.5	4.7E+00	4.7E+00	YES
Iron (UG/L)	7439-89-6	1.5E-01	1.9E+05	X	186/ 199	93.5	3.2E+04	3.2E+04	YES
Lead (UG/L)	7439-92-1	4.0E-01	4.0E+01	D	62/ 162	38.3	3.9E+00	3.9E+00	YES
Lithium (UG/L)	7439-93-2	1.2E+01	4.6E+03	X	123/ 138	89.1	1.4E+02	1.4E+02	YES
Magnesium (UG/L)	7439-95-4	2.7E+01	7.2E+05	X	199/ 199	100.0	7.7E+04	7.7E+04	YES
Manganese (UG/L)	7439-96-5	3.7E-02	3.0E+03	X	190/ 199	95.5	6.2E+02	6.2E+02	YES
Mercury (UG/L)	7439-97-6	1.0E-01	1.4E+00	D	3/ 151	2.0	6.1E-02	6.1E-02	NO
Molybdenum (UG/L)	7439-98-7	4.3E-01	4.7E+02	X	82/ 134	61.2	2.0E+01	2.0E+01	YES

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Nickel (UG/L)	7440-02-0	4.4E-01	1.2E+04	X	114/ 154	74.0	4.8E+02	4.8E+02	YES
Potassium (UG/L)	7440-09-7	2.1E+00	2.1E+05	X	186/ 200	93.0	1.6E+04	1.6E+04	YES
Selenium (UG/L)	7782-49-2	1.3E+00	9.1E+00	D	11/ 149	7.4	1.7E+00	1.7E+00	YES
Silicon (UG/L)	7440-21-3	2.2E+03	1.2E+04	D	6/ 6	100.0	1.7E+04	1.2E+04	YES
Silver (UG/L)	7440-22-4	1.8E-01	2.9E+01	D	13/ 153	8.5	1.1E+00	1.1E+00	YES
Sodium (UG/L)	7440-23-5	6.8E+01	7.3E+06	X	197/ 197	100.0	3.4E+05	3.4E+05	YES
Thallium (UG/L)	7440-28-0	1.1E+00	6.9E+00	D	10/ 147	6.8	3.4E+00	3.4E+00	YES
Tin (UG/L)	7440-31-5	1.4E+00	3.6E+02	D	29/ 136	21.3	7.5E+00	7.5E+00	YES
Vanadium (UG/L)	7440-62-2	1.5E-01	2.8E+02	D	72/ 151	47.7	2.3E+01	2.3E+01	YES
Zinc (UG/L)	7440-66-6	6.1E-01	4.0E+02	X	114/ 153	74.5	4.9E+01	4.9E+01	YES
Pesticides and/or PCBs									
4,4'-DDD (UG/L)	72-54-8			O	0/ 62	0.0			NO
4,4'-DDE (UG/L)	72-55-9			O	0/ 62	0.0			NO
4,4'-DDT (UG/L)	50-29-3			O	0/ 62	0.0			NO
Aldrin (UG/L)	309-00-2			O	0/ 62	0.0			NO
Alpha Chlordane (UG/L)	5103-71-9	3.2E-02	6.9E-02	D	3/ 62	4.8	1.1E-01	6.9E-02	NO
Alpha-BHC (UG/L)	319-84-6			O	0/ 62	0.0			NO
Aroclor-1016 (UG/L)	12674-11-2			O	0/ 62	0.0			NO
Aroclor-1221 (UG/L)	11104-28-2			O	0/ 62	0.0			NO
Aroclor-1232 (UG/L)	11141-16-5			O	0/ 62	0.0			NO
Aroclor-1242 (UG/L)	53469-21-9			O	0/ 62	0.0			NO
Aroclor-1248 (UG/L)	12672-29-6			O	0/ 62	0.0			NO
Aroclor-1254 (UG/L)	11097-69-1			O	0/ 62	0.0			NO
Aroclor-1260 (UG/L)	11096-82-5			O	0/ 62	0.0			NO
Beta-BHC (UG/L)	319-85-7			O	0/ 62	0.0			NO
Delta-BHC (UG/L)	319-86-8			O	0/ 62	0.0			NO
Dieldrin (UG/L)	60-57-1			O	0/ 62	0.0			NO
Endosulfan I (UG/L)	959-98-8			O	0/ 62	0.0			NO
Endosulfan II (UG/L)	33213-65-9			O	0/ 62	0.0			NO
Endosulfan Sulfate (UG/L)	1031-07-8			O	0/ 59	0.0			NO
Endrin (UG/L)	72-20-8			O	0/ 62	0.0			NO
Endrin Aldehyde (UG/L)	7421-93-4			O	0/ 48	0.0			NO
Endrin Ketone (UG/L)	53494-70-5			O	0/ 62	0.0			NO
Gamma Chlordane (UG/L)	5103-74-2			O	0/ 62	0.0			NO
Gamma-BHC (Lindane) (UG/L)	58-89-9			O	0/ 62	0.0			NO
Heptachlor (UG/L)	76-44-8			O	0/ 62	0.0			NO
Heptachlor Epoxide (UG/L)	1024-57-3			O	0/ 62	0.0			NO

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Methoxychlor (UG/L)	72-43-5			O	0/ 62	0.0			NO
Toxaphene (UG/L)	8001-35-2			O	0/ 62	0.0			NO
Radiological									
Americium-241 (PCI/L)	14596-10-2	6.8E-02	1.7E-01	D	6/ 43	14.0	2.9E+00	1.7E-01	YES
Bismuth-207 (PCI/L)	13982-38-2			O	0/ 50	0.0			NO
Bismuth-210 (PCI/L)	14331-79-4	1.2E-01	2.6E-01	D	2/ 55	3.6	8.0E+00	2.6E-01	NO
Bismuth-211 (PCI/L)	15229-37-5			O	0/ 4	0.0			NO
Bismuth-212 (PCI/L)	14913-49-6			O	0/ 4	0.0			NO
Bismuth-214 (PCI/L)	14733-03-0			O	0/ 4	0.0			NO
Cesium-134 (PCI/L)	13967-70-9			O	0/ 4	0.0			NO
Cesium-137 (PCI/L)	10045-97-3			O	0/ 56	0.0			NO
Cobalt-60 (PCI/L)	10198-40-0			O	0/ 56	0.0			NO
Europium-152 (PCI/L)	14683-23-9			O	0/ 4	0.0			NO
Europium-154 (PCI/L)	15585-10-1			O	0/ 4	0.0			NO
Europium-155 (PCI/L)	14391-16-3			O	0/ 4	0.0			NO
Lead-212 (PCI/L)	15092-94-1			O	0/ 4	0.0			NO
Lead-214 (PCI/L)	15067-28-4			O	0/ 4	0.0			NO
Neptunium-237 (PCI/L)	13994-20-2			O	0/ 4	0.0			NO
Plutonium-238 (PCI/L)	13981-16-3	9.0E-03	1.9E+00	D	8/ 62	12.9	2.4E-01	2.4E-01	YES
Plutonium-238/239 (PCI/L)	PU-238/239			O	0/ 2	0.0			NO
Plutonium-239 (PCI/L)	15117-48-3			O	0/ 5	0.0			NO
Plutonium-239/240 (PCI/L)	PU-239/240	3.0E-03	1.8E-01	D	12/ 52	23.1	5.4E-01	1.8E-01	YES
Plutonium-242 (PCI/L)	13982-10-0	1.1E-01	1.1E-01	D	1/ 2	50.0		1.1E-01	YES
Potassium-40 (PCI/L)	13966-00-2	1.3E+02	2.6E+02	D	5/ 54	9.3	1.4E+02	1.4E+02	YES
Protactinium-233 (PCI/L)	13981-14-1			O	0/ 4	0.0			NO
Protactinium-234 (PCI/L)	15100-28-4			O	0/ 4	0.0			NO
Radium-223 (PCI/L)	15623-45-7			O	0/ 4	0.0			NO
Radium-225 (PCI/L)	13981-53-8			O	0/ 4	0.0			NO
Radium-226 (PCI/L)	13982-63-3	1.3E-01	3.9E+01	X	50/ 66	75.8	2.4E+00	2.4E+00	YES
Radium-228 (PCI/L)	15262-20-1	5.7E-01	1.7E+01	L	8/ 8	100.0	4.5E+01	1.7E+01	YES
Strontium-89 (PCI/L)	14158-27-1			O	0/ 4	0.0			NO
Strontium-90 (PCI/L)	10098-97-2	7.5E-01	4.2E+01	D	8/ 57	14.0	2.2E+00	2.2E+00	YES
Thallium-208 (PCI/L)	14913-50-9			O	0/ 4	0.0			NO
Thorium-227 (PCI/L)	15623-47-9	5.8E-02	5.8E-02	D	1/ 5	20.0	2.4E+18	5.8E-02	YES
Thorium-228 (PCI/L)	14274-82-9	2.0E-02	8.5E+00	X	42/ 57	73.7	6.9E+01	8.5E+00	YES
Thorium-230 (PCI/L)	14269-63-7	4.4E-03	4.1E+00	L	45/ 59	76.3	5.4E-01	5.4E-01	YES
Thorium-232 (PCI/L)	7440-29-1	5.0E-04	2.1E+00	L	33/ 66	50.0	7.2E-01	7.2E-01	YES

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Thorium-234 (PCI/L)	15065-10-8			O	0/ 4	0.0			NO
Tritium (PCI/L)	10028-17-8	3.0E+00	2.8E+06	X	4473/4488	99.7	2.1E+05	2.1E+05	YES
Uranium-233 (PCI/L)	13968-55-3	2.7E-02	1.6E+01	D	3/ 3	100.0	1.6E+62	1.6E+01	YES
Uranium-233/234 (PCI/L)	U-233/234	1.5E-01	9.3E-01	D	5/ 5	100.0	2.7E+00	9.3E-01	YES
Uranium-234 (PCI/L)	13966-29-5	3.3E-02	6.7E+01	X	61/ 70	87.1	2.1E+00	2.1E+00	YES
Uranium-235 (PCI/L)	15117-96-1	7.8E-03	8.3E+00	D	20/ 43	46.5	6.9E+00	6.9E+00	YES
Uranium-235/236 (PCI/L)	U-235/236	3.7E-02	4.7E-02	D	2/ 26	7.7	9.6E-02	4.7E-02	YES
Uranium-238 (PCI/L)	7440-61-1	2.9E-02	6.6E+00	L	59/ 77	76.6	5.9E-01	5.9E-01	YES
Semi-Volatile Organics									
1,2,4-Trichlorobenzene (UG/L)	120-82-1			O	0/ 65	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 99	0.0			NO
1,3-Dichlorobenzene (UG/L)	541-73-1	3.0E+00	3.0E+00	D	1/ 98	1.0	2.7E+00	2.7E+00	NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 99	0.0			NO
1-chloro-4-phenoxybenzene (UG/L)	7005-72-3			O	0/ 65	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/L)	108-60-1			O	0/ 119	0.0			NO
2,4,5-Trichlorophenol (UG/L)	95-95-4			O	0/ 65	0.0			NO
2,4,6-Trichlorophenol (UG/L)	88-06-2			O	0/ 65	0.0			NO
2,4-Dichlorophenol (UG/L)	120-83-2			O	0/ 65	0.0			NO
2,4-Dimethylphenol (UG/L)	105-67-9			O	0/ 65	0.0			NO
2,4-Dinitrophenol (UG/L)	51-28-5			O	0/ 65	0.0			NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 42	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 31	0.0			NO
2-Benzyl-4-Chlorophenol (UG/L)	120-32-1			O	0/ 44	0.0			NO
2-Chloronaphthalene (UG/L)	91-58-7			O	0/ 65	0.0			NO
2-Chlorophenol (UG/L)	95-57-8			O	0/ 65	0.0			NO
2-Methylnaphthalene (UG/L)	91-57-6	6.0E+00	6.0E+00	D	1/ 69	1.4	5.2E+00	5.2E+00	NO
2-Methylphenol (UG/L)	95-48-7			O	0/ 65	0.0			NO
2-Nitroaniline (UG/L)	88-74-4			O	0/ 65	0.0			NO
2-Nitrophenol (UG/L)	88-75-5			O	0/ 65	0.0			NO
3,3'-Dichlorobenzidine (UG/L)	91-94-1			O	0/ 66	0.0			NO
3-Nitroaniline (UG/L)	99-09-2			O	0/ 65	0.0			NO
4,6-Dinitro-o-Cresol (UG/L)	534-52-1			O	0/ 65	0.0			NO
4-Bromophenyl-phenyl Ether (UG/L)	101-55-3			O	0/ 65	0.0			NO
4-Chloro-3-methylphenol (UG/L)	59-50-7			O	0/ 65	0.0			NO
4-Chloroaniline (UG/L)	106-47-8			O	0/ 65	0.0			NO
4-Methylphenol (UG/L)	106-44-5	1.2E+01	6.1E+01	D	2/ 65	3.1	6.2E+00	6.2E+00	NO
4-Nitroaniline (UG/L)	100-01-6			O	0/ 64	0.0			NO

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4-Nitrophenol (UG/L)	100-02-7			O	0/ 65	0.0			NO
Acenaphthene (UG/L)	83-32-9	1.0E+00	1.0E+00	D	1/ 72	1.4	5.6E+00	1.0E+00	NO
Acenaphthylene (UG/L)	208-96-8			O	0/ 72	0.0			NO
Anthracene (UG/L)	120-12-7			O	0/ 72	0.0			NO
Benzo(a)anthracene (UG/L)	56-55-3			O	0/ 73	0.0			NO
Benzo(a)pyrene (UG/L)	50-32-8			O	0/ 73	0.0			NO
Benzo(b)fluoranthene (UG/L)	205-99-2			O	0/ 73	0.0			NO
Benzo(g,h,i)perylene (UG/L)	191-24-2			O	0/ 73	0.0			NO
Benzo(k)fluoranthene (UG/L)	207-08-9			O	0/ 73	0.0			NO
Benzoic Acid (UG/L)	65-85-0	1.0E+00	8.9E+02	D	2/ 62	3.2	3.7E+01	3.7E+01	NO
Benzyl Alcohol (UG/L)	100-51-6			O	0/ 62	0.0			NO
Bis(2-chloroethoxy)methane (UG/L)	111-91-1			O	0/ 65	0.0			NO
Bis(2-chloroethyl)ether (UG/L)	111-44-4			O	0/ 65	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/L)	117-81-7	1.0E+00	9.5E+02	D	12/ 66	18.2	1.8E+01	1.8E+01	YES
Butyl Benzyl Phthalate (UG/L)	85-68-7			O	0/ 66	0.0			NO
Carbazole (UG/L)	86-74-8			O	0/ 50	0.0			NO
Chrysene (UG/L)	218-01-9			O	0/ 73	0.0			NO
Di-n-butyl Phthalate (UG/L)	84-74-2	6.0E-01	3.0E+00	D	5/ 65	7.7	5.6E+00	3.0E+00	YES
Di-n-octyl Phthalate (UG/L)	117-84-0			O	0/ 66	0.0			NO
Dibenz(a,h)anthracene (UG/L)	53-70-3			O	0/ 73	0.0			NO
Dibenzofuran (UG/L)	132-64-9			O	0/ 69	0.0			NO
Diethyl Phthalate (UG/L)	84-66-2	5.0E-01	5.0E-01	D	1/ 65	1.5	5.6E+00	5.0E-01	NO
Dimethyl Phthalate (UG/L)	131-11-3			O	0/ 65	0.0			NO
Fluoranthene (UG/L)	206-44-0	9.0E-01	9.0E-01	D	1/ 72	1.4	5.5E+00	9.0E-01	NO
Fluorene (UG/L)	86-73-7	2.0E+00	2.0E+00	D	1/ 72	1.4	5.4E+00	2.0E+00	NO
Hexachlorobenzene (UG/L)	118-74-1			O	0/ 65	0.0			NO
Hexachlorobutadiene (UG/L)	87-68-3			O	0/ 65	0.0			NO
Hexachlorocyclopentadiene (UG/L)	77-47-4			O	0/ 65	0.0			NO
Hexachloroethane (UG/L)	67-72-1			O	0/ 65	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/L)	193-39-5			O	0/ 73	0.0			NO
Isophorone (UG/L)	78-59-1			O	0/ 65	0.0			NO
N-Nitroso-di-n-propylamine (UG/L)	621-64-7			O	0/ 65	0.0			NO
N-Nitrosodiphenylamine (UG/L)	86-30-6			O	0/ 65	0.0			NO
Naphthalene (UG/L)	91-20-3	5.0E+00	5.0E+00	D	1/ 72	1.4	5.5E+00	5.0E+00	NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 23	0.0			NO
Pentachlorophenol (UG/L)	87-86-5			O	0/ 65	0.0			NO
Phenanthrene (UG/L)	85-01-8	3.0E+00	3.0E+00	D	1/ 72	1.4	5.2E+00	3.0E+00	NO

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Phenol (UG/L)	108-95-2	1.0E+00	2.0E+00	D	2/ 65	3.1	5.4E+00	2.0E+00	NO
Pyrene (UG/L)	129-00-0	6.0E-01	6.0E-01	D	1/ 72	1.4	5.5E+00	6.0E-01	NO
Volatile Organics									
1,1,1,2-Tetrachloroethane (UG/L)	630-20-6			O	0/ 211	0.0			NO
1,1,1-Trichloroethane (UG/L)	71-55-6	4.0E-01	7.0E+00	D	20/ 264	7.6	5.3E-01	5.3E-01	YES
1,1,2,2-Tetrachloroethane (UG/L)	79-34-5			O	0/ 261	0.0			NO
1,1,2-Trichloroethane (UG/L)	79-00-5			O	0/ 264	0.0			NO
1,1-Dichloroethane (UG/L)	75-34-3	2.0E+00	2.0E+00	D	1/ 263	0.4	6.5E-01	6.5E-01	NO
1,1-Dichloroethene (UG/L)	75-35-4			O	0/ 264	0.0			NO
1,2,3-Trichloropropane (UG/L)	96-18-4			O	0/ 185	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 154	0.0			NO
1,2-Dichloroethane (UG/L)	107-06-2			O	0/ 265	0.0			NO
1,2-Dichloroethene (UG/L)	540-59-0	1.8E+00	3.5E+01	D	10/ 33	30.3	7.4E+00	7.4E+00	YES
1,2-Dichloropropane (UG/L)	78-87-5			O	0/ 263	0.0			NO
1,2-Diethylbenzene (UG/L)	135-01-3			O	0/ 47	0.0			NO
1,2-cis-Dichloroethene (UG/L)	156-59-2	9.1E-01	1.7E+01	D	46/ 166	27.7	1.3E+00	1.3E+00	YES
1,2-trans-Dichloroethene (UG/L)	156-60-5	8.5E-01	1.0E+01	D	13/ 248	5.2	7.3E-01	7.3E-01	YES
1,3-Dichlorobenzene (UG/L)	541-73-1			O	0/ 154	0.0			NO
1,3-Diethylbenzene (UG/L)	141-93-5			O	0/ 43	0.0			NO
1,3-cis-Dichloropropene (UG/L)	10061-01-5			O	0/ 254	0.0			NO
1,3-trans-Dichloropropene (UG/L)	10061-02-6			O	0/ 264	0.0			NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 154	0.0			NO
1,4-Diethylbenzene (UG/L)	105-05-5			O	0/ 43	0.0			NO
1-Chlorohexane (UG/L)	544-10-5			O	0/ 160	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/L)	108-60-1			O	0/ 4	0.0			NO
2-Butanone (UG/L)	78-93-3	6.0E+00	6.5E+01	D	12/ 130	9.2	5.1E+00	5.1E+00	YES
2-Chloroethylvinylether (UG/L)	110-75-8			O	0/ 187	0.0			NO
2-Chlorotoluene (UG/L)	95-49-8			O	0/ 161	0.0			NO
2-Hexanone (UG/L)	591-78-6	1.0E+00	1.0E+00	D	1/ 33	3.0	5.4E+00	1.0E+00	NO
4-Chlorotoluene (UG/L)	106-43-4			O	0/ 139	0.0			NO
4-Methyl-2-pentanone (UG/L)	108-10-1			O	0/ 76	0.0			NO
Acetone (UG/L)	67-64-1	1.0E+00	1.7E+01	D	23/ 75	30.7	9.2E+00	9.2E+00	YES
Acetonitrile (UG/L)	75-05-8			O	0/ 48	0.0			NO
Acrylonitrile (UG/L)	107-13-1			O	0/ 48	0.0			NO
Benzene (UG/L)	71-43-2	2.5E+00	2.5E+00	D	1/ 275	0.4	1.2E+00	1.2E+00	NO
Benzyl Chloride (UG/L)	100-44-7			O	0/ 11	0.0			NO
Bromochloromethane (UG/L)	74-97-5	2.6E+01	2.6E+01	D	1/ 1	100.0		2.6E+01	YES

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Bromodichloromethane (UG/L)	75-27-4			O	0/ 264	0.0			NO
Bromoform (UG/L)	75-25-2			O	0/ 264	0.0			NO
Bromomethane (UG/L)	74-83-9			O	0/ 65	0.0			NO
Carbon Disulfide (UG/L)	75-15-0			O	0/ 76	0.0			NO
Carbon Tetrachloride (UG/L)	56-23-5	1.5E+00	1.5E+00	D	1/ 264	0.4	8.6E-01	8.6E-01	NO
Chlorobenzene (UG/L)	108-90-7	1.0E+00	1.0E+00	D	1/ 266	0.4	1.2E+00	1.0E+00	NO
Chloroethane (UG/L)	75-00-3			O	0/ 81	0.0			NO
Chloroform (Trichloromethane) (UG/L)	67-66-3	5.8E-01	1.1E+00	D	4/ 265	1.5	5.5E-01	5.5E-01	NO
Chloromethane (UG/L)	74-87-3	3.4E+00	3.4E+00	D	1/ 80	1.3	3.7E+00	3.4E+00	NO
Chlorotoluene (UG/L)	25168-05-2			O	0/ 50	0.0			NO
Dibromochloromethane (UG/L)	124-48-1			O	0/ 259	0.0			NO
Dibromomethane (UG/L)	74-95-3	2.8E+00	2.8E+00	D	1/ 213	0.5	1.0E+00	1.0E+00	NO
Dichlorodifluoromethane (UG/L)	75-71-8			O	0/ 34	0.0			NO
Dichloromethane (Methylene Chloride)	75-09-2	1.0E+00	6.1E+02	D	46/ 264	17.4	3.3E+00	3.3E+00	YES
Ethylbenzene (UG/L)	100-41-4			O	0/ 276	0.0			NO
FREON-113 (UG/L)	76-13-1	2.2E+00	2.2E+00	D	1/ 149	0.7	1.1E+00	1.1E+00	NO
Fluorobenzene (UG/L)	462-06-6	3.9E+01	3.9E+01	D	1/ 1	100.0		3.9E+01	YES
Hexane (UG/L)	110-54-3			O	0/ 4	0.0			NO
Iodomethane (UG/L)	74-88-4			O	0/ 4	0.0			NO
Monobromobenzene (Phenyl bromide)	108-86-1			O	0/ 210	0.0			NO
O-Chloroflurobenzene (UG/L)	348-51-6	3.2E+01	3.2E+01	D	1/ 1	100.0		3.2E+01	YES
Styrene (UG/L)	100-42-5			O	0/ 33	0.0			NO
Tetrachloroethene (UG/L)	127-18-4	3.0E-01	2.5E+01	D	50/ 264	18.9	2.4E+00	2.4E+00	YES
Toluene (UG/L)	108-88-3	1.0E+00	8.0E+00	D	8/ 276	2.9	1.2E+00	1.2E+00	NO
Trichloroethylene (TCE) (UG/L)	79-01-6	6.0E-01	4.6E+01	X	139/ 273	50.9	4.7E+00	4.7E+00	YES
Trichlorofluoromethane (UG/L)	75-69-4			O	0/ 221	0.0			NO
Vinyl Acetate (UG/L)	108-05-4			O	0/ 76	0.0			NO
Vinyl Chloride (UG/L)	75-01-4			O	0/ 265	0.0			NO
Xylenes, Total (UG/L)	1330-20-7			O	0/ 270	0.0			NO

APPENDIX J

Data Review and Additional Field Work

Some of the historical analytical results from samples taken within the Phase I property area are elevated with respect to a risk-based comparison criterion. The specific comparison level used was three times the 10^{-5} RBGV plus background. Twenty-three sample locations were identified with results for Plutonium 238 (3 locations), Thorium 230 (1 location) and Thorium 232 (19 locations) above the comparison values. These results have been included in the Residual Risk Evaluation for this property and the report indicates that the risk remains within acceptable levels. However, in some cases the results are significantly elevated above guideline values and warrant additional evaluation. Table 1 lists the locations with the exceedance, the contaminant that exceeds the comparison value, the observed result, the Project Code, Date the Sample was collected, Method Code, and Method Description. Figure 1 illustrates the sample locations. The process followed to determine what locations warranted additional field activities and the results of those activities are summarized here.

Locations 288, I13831, S0788, S0986, S0985, SCR450
Based on evaluation of other nearby sample results or other known conditions, DOE and the regulators agreed that these locations did not warrant additional field investigation. Information considered for each sample location is summarized as follows:

- Location 288 was sampled in 1984. This is a borehole sample appearing in the excavation footprint of PRS 421. Multiple boring locations surrounding the spot are flagged as being removed. Original depth is unknown.
- Location I13831 was sampled in 1999. It is a borehole location at the edge of the soil removed for installation of the drain. According to information in MEIMS the depth was 0-.3 feet. This location is surrounded by sample locations that have been flagged as removed.
- Location S0788 was sampled in 1984. It is a surface location previously binned with the Salt Storage Building as requiring No Further Assessment.
- Location S0986 was sampled in1983. It is a surface sample surrounded by multiple sample locations.
- Location S0985 was sampled in 1984. It is a surface sample location apparently in the road with multiple sample locations surrounding the original spot.
- Location SCR450 was sampled in 1992 and is under a concrete pad that was investigated as part of the recent verification sample effort at PRS 276. The original contaminant concentrations were not found.

Locations S0777 & S0598
Sample results from the Rad Site Survey indicate low level Thorium 232 results (3.71 & 4.3 pCi/g respectively). These locations are separated from other PRS boundaries and were not likely considered for inclusion as a PRS due to the low levels indicated. Other single sample results from the Rad Site Survey were made PRSs early in the ER process at Mound due to results that were significantly higher. DOE and the regulators agreed that a FIDLER survey of the

area surrounding the above sample locations would be conducted out to a radius of 25'.

Locations S1044, S1006, S1007, S1043, SCR 394, & MND08-0023
These locations are all in the PRS 406 boundary. PRS 406 was binned NFA by the core team in March 1996. The binning was based on data collected from the OU-5 New Property Investigation. The historical information from the Rad Site Survey led to the Remedial Investigation effort on the OU-5 New Property. Sample location SCR 394 is reported to be a borehole at 0' depth. Only one interval is reported in the database. Sample location MND08-0023 is reported to be a borehole over the interval 0-0.8' in depth. Only one interval is reported in the database. DOE and the regulators agreed that a FIDLER survey of the area surrounding the above sample locations (S1044, S1006, S1007, MND08-0023) would be conducted out to a radius of 25'.

Locations SCR 342, SCR 366, 91CC, 185SW, 74-H
These locations are in the PRS 407 area. PRS 407 and 281 were closed with the approval of the Building 21 OSC Report. Remediation was performed at PRS 407 based on the results of characterization conducted in June 1995 and reported in the Building 21 and Surrounding Soils Data Report. The investigation also determined other areas within the sample grid did not require remediation. Sample location 185SW is reported to be a borehole from 0-1' in depth Sample locations SCR 342 & SCR 366 are boreholes with multiple reported intervals and no depth information in the database. These two locations are in the middle of the drainage ditch and have likely been disturbed by the installation of the concrete drainage controls. DOE and the regulators agreed that a FIDLER survey of the area surrounding the above sample location (74-H) would be conducted out to a radius of 25'.

Locations S0982, 74-K, 74-J, & 304-19
These locations are in the PRS 304 area. PRS 313 & 304 were binned NFA by the Core Team in February 1997. PRS 304 was later rebinned removal action and an OSC report was approved by the Core Team in December 1998 (PRS 313 remained NFA) Sample location 304-19 is a Thorium 230 result of 7.51 pCi/g with a detection limit of 5.8 pCi/g. It was collected in the 0-1 foot interval of the borehole in October 1998. This sample was also reported in the OSC report as sample id 004386. Sample location S0982 was specifically investigated in conjunction with PRS 313. A diamond pattern of boreholes was drilled around this location on a 10' radius to 4' in depth. The results of this investigation reported in the Other Soils Characterization Report in May 1996 indicate "no radiological, organic, or inorganic compounds in concentrations exceeding the action levels". Sample location S0982 is essentially coincident with location 74-K Sample locations 74-H, 74-J & 74-K are reported to be near surface locations in the Site Survey Sub-Report – Mound Sub-Section 4. DOE and the regulators agreed that a FIDLER survey of the area surrounding the above sample locations (74-J) would be conducted out to a radius of 25'.

FIDLER Survey Results

During the FIDLER survey for locations S0598 and S1006/S1007, an isolated spot within the 25' radius circle around the S1006/S1007 location (the only remaining location with historical elevated results for Plutonium 238) indicated a FIDLER reading slightly above background and a sample was sent for gamma spec analysis. The results indicated a level of 4.07 pCi/g of Thorium 232. DOE and the regulators agreed that the soil in the area would be scooped up and the area confirmed clean via FIDLER survey. The elevated result from the initial FIDLER survey within the 25' circle surrounding sample location S1006/S1007 was removed. Initially the area was hand dug. During this excavation a large bush was removed and FIDLER surveys of the area under the bush indicated additional areas of contamination. The FIDLER was used to continue surveying the surrounding vicinity and the resulting contamination area was on a T shaped line about 25' long and 2' wide. Contamination was not consistent along this area and the highest gamma spec result taken at the highest FIDLER location indicated about 7 pCi/g of Thorium 232. Due to the expanded size of the removal area, a track hoe excavator was brought in to complete the excavation of material. Figure 2 depicts the area in question along with other features including sample locations within the excavation that were analyzed via gamma spectrometry. The excavation boundary was surveyed in, however the majority of soil removed was from the central areas. The outer areas were disturbed by the excavator and therefore included within the boundary. The results of the gamma spectrometry surveys indicate no additional contamination above cleanup objectives and the data are included in Table 2.

The FIDLER surveys surrounding the remaining sample locations were conducted on July 11. There were no indications of additional areas of elevated contamination from this FIDLER survey.

Table 3 lists the twenty-three locations examined and their disposition.

Table 1: Sample Results Exceeding Guideline Values

Project Code	Sample Location	Contaminant	Result	Units	Method Code	Date Collected	Method Description
RSS	S1006	Plutonium-238	396.4	PCI/G	PD80030-1343	01-Mar-82	PD80030-1343, Pu, U, Th & Pb-210 in Solid Samples
RSS	S1007	Plutonium-238	216.3	PCI/G	PD80030-1343	01-Mar-82	PD80030-1343, Pu, U, Th & Pb-210 in Solid Samples
RSS	S0788	Plutonium-238	234	PCI/G	PD80030-1343	01-Sep-84	PD80030-1343, Pu, U, Th & Pb-210 in Solid Samples
SCRDATA	304-19	Thorium-230	7.51	PCI/G	GERMANIUM	22-Oct-98	Germanium Detector Screen, Radioisotopes
RSS	S0598	Thorium-232	4.3	PCI/G	PD80030-3605	01-Oct-83	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S0777	Thorium-232	3.71	PCI/G	PD80030-3605	01-Sep-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
BLDG21	185SW	Thorium-232	4.95	PCI/G	NDI1986	- -	NDI1986, Gamma Spectrometry
OU6RECON	MND08-0023	Thorium-232	11.3	PCI/G	BICRON	17-Aug-89	Bicron Detector Screening, Pu & Th
SCRDATA	SCR366	Thorium-232	7.3	PCI/G	BICRON	31-May-89	Bicron Detector Screening, Pu & Th
SCRDATA	SCR342	Thorium-232	9.3	PCI/G	BICRON	02-Jun-89	Bicron Detector Screening, Pu & Th
PRS407VERF	I13831	Thorium-232	5.24	PCI/G	NAS 1960	01-Jun-99	NAS 1960, Thorium Isotopes / Strontium-90
RSS	S0982	Thorium-232	14.94	PCI/G	PD80030-3605	01-Jul-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S0985	Thorium-232	7.73	PCI/G	PD80030-3605	01-Jul-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S0986	Thorium-232	7.13	PCI/G	PD80030-3605	01-Oct-83	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S1043	Thorium-232	5.8	PCI/G	PD80030-3605	01-Aug-85	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S1044	Thorium-232	5.6	PCI/G	PD80030-3605	01-May-85	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	74-H	Thorium-232	80.1	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	74-J	Thorium-232	20.9	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	74-K	Thorium-232	15	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	288	Thorium-232	5.9	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
SCRDATA	SCR450	Thorium-232	4.8	PCI/G	BICRON	17-Jun-92	Bicron Detector Screening, Pu & Th
BLDG21	91CC	Thorium-232	6.16	PCI/G	NDI1986	12-Dec-94	NDI1986, Gamma Spectrometry
SCRDATA	SCR394	Thorium-232	24.4	PCI/G	BICRON	20-Oct-93	Bicron Detector Screening, Pu & Th

Table 2: Phase I Sampling from Area near S1006/S1007

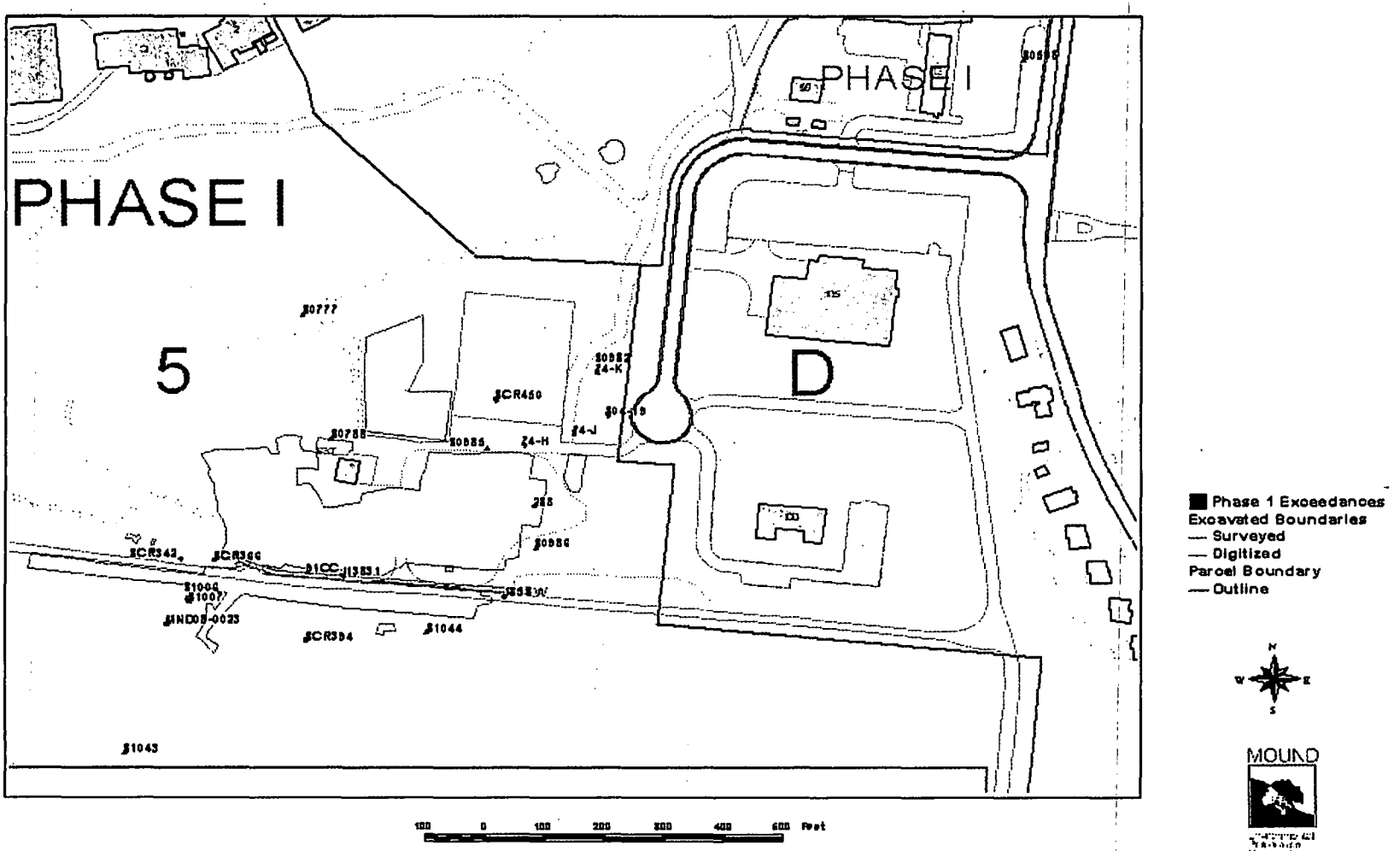
Results in pCi/g

Lab Sample ID	Sample Location	Co-60	Cs-137	Pb-210	Ra-226	Ac-227	Th-230	Th-230 MDA	Th-232	Pu-238	Pu-238 MDA	Am-241	U-235	U-238	Comments
ML14335	421-718-1	0	0.04	0.33	1.6	0	0	**9.14**	1.46	13.86	**54.23**	0			
ML14336	421-718-2	0	0.01	0.94	2.13	0	0	**8.9**	0.89	0	**24.4**	0			
ML14337	421-718-3	0.02	0.1	1.56	2.29	0	0	**8.11**	0.71	0	**17.93**	0.08			
ML14338	421-718-4	0	0	1.34	2.03	0	4.79	**7.24**	0.97	20.87	**15.69**	0.1			
ML14339	421-718-5	0.01	0	0.97	1.18	0	2.79	**5.08**	0.94	4.08	**13.85**	0			
ML14340	421-718-6	0	0.02	2.05	2.61	0.04	0	**8.46**	1	4.85	**17.54**	0			
ML14341	421-718-7	0	0.07	0.63	1.3	0	5.34	**9.87**	1.13	9.94	**22.52**	0			
ML14342	421-718-8	0	0.08	0.79	1.89	0	2.08	**9.21**	0.9	4.24	**25.79**	0.04			
ML14343	421-718-9	0	0.07	1.4	1.18	0.12	1.97	**6.84**	1.15	10.53	**15.58**	0.1			
ML14344	421-718-10	0.01	0.1	0.88	2.03	0.06	5.23	**8.32**	1.13	0	**56.56**	0.07			

Table 3: Sample Locations and Dispositions

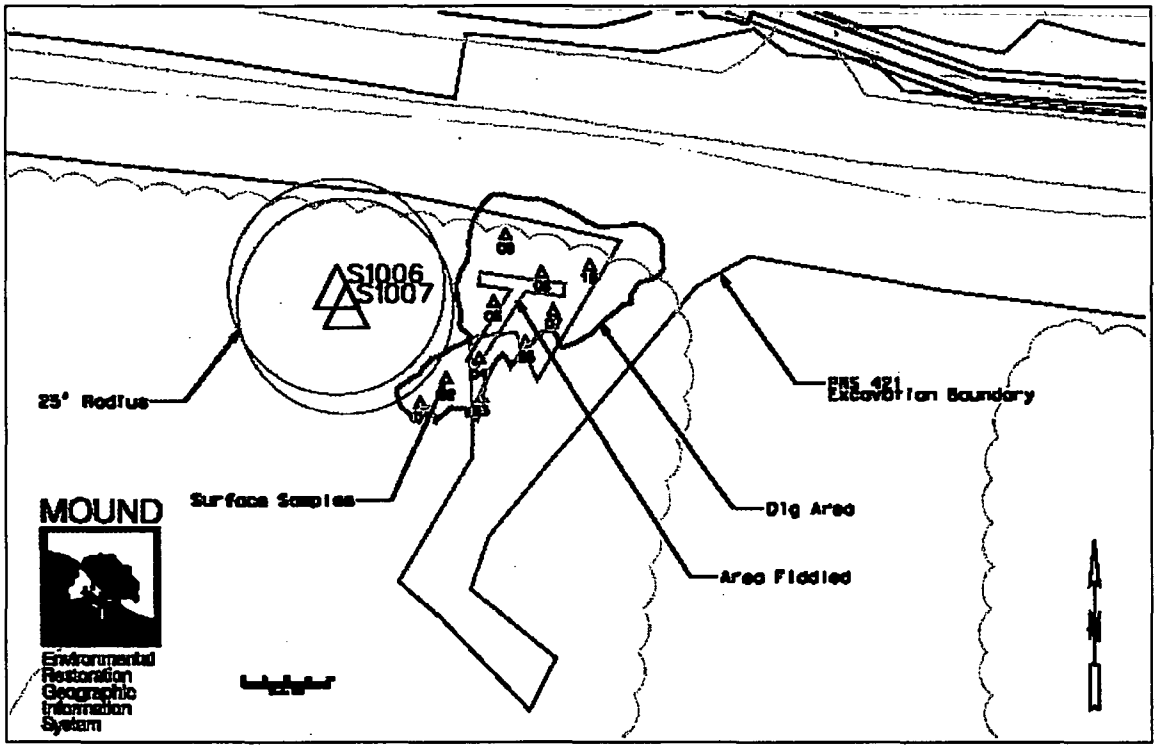
Sample Location	Contaminant	Result	Units	Disposition
S1006	Plutonium-238	396.4	PCI/G	Fidler survey
S1007	Plutonium-238	216.3	PCI/G	Fidler survey
S0788	Plutonium-238	234	PCI/G	No field work, use nearby data
304-19	Thorium-230	7.51	PCI/G	No field work, use nearby data
S0598	Thorium-232	4.3	PCI/G	Fidler survey
S0777	Thorium-232	3.71	PCI/G	Fidler survey
185SW	Thorium-232	4.95	PCI/G	No field work, use nearby data
MND08-0023	Thorium-232	11.3	PCI/G	Fidler survey
SCR366	Thorium-232	7.3	PCI/G	No field work, use nearby data
SCR342	Thorium-232	9.3	PCI/G	No field work, use nearby data
I13831	Thorium-232	5.24	PCI/G	No field work, use nearby data
S0982	Thorium-232	14.94	PCI/G	No field work, use nearby data
S0985	Thorium-232	7.73	PCI/G	No field work, use nearby data
S0986	Thorium-232	7.13	PCI/G	No field work, use nearby data
S1043	Thorium-232	5.8	PCI/G	No field work, use nearby data
S1044	Thorium-232	5.6	PCI/G	Fidler survey
74-H	Thorium-232	80.1	PCI/G	Fidler survey
74-J	Thorium-232	20.9	PCI/G	Fidler survey
74-K	Thorium-232	15	PCI/G	No field work, use nearby data
288	Thorium-232	5.9	PCI/G	No field work, use nearby data
SCR450	Thorium-232	4.8	PCI/G	No field work, use nearby data
91CC	Thorium-232	6.16	PCI/G	No field work, use nearby data
SCR394	Thorium-232	24.4	PCI/G	No field work, use nearby data

Figure 1: Phase I Hot Spot Exceedances



08/01/02

Figure 2: Removal Area and Associated Sample Locations



APPENDIX K

Data Qualifiers

CLP Laboratory Data Qualifiers and their Used in the RRE

Inorganic Chemical Data	Definition	Included in RRE?
B	Reported value is <CRDL[a], but >IDL[b].	Yes
U	Compound was analyzed for but not detected.	Yes[c]
E	Value is estimated due to matrix interference.	Yes
N	Spiked sample not within control limits.	Yes
J	Value is an estimated quantity.	Yes
R	Quality control indicates that data is unusable.	No

Organic Chemical Data	Definition	Included in RRE?
U	Compound was analyzed for but not detected.	Yes[c]
J	Value is estimated, spectral identification criteria are met but the value is <CRDL.	Yes
B	Analyte found in associated blank as well as in sample.	Yes[e]
E	Concentration exceeds calibration range of GC/MS[d] instrument.	Yes
D	Compound identified in an analysis at a secondary dilution factor	Yes

a. CRDL means contract required detection limits
b. IDL means instrument detection limits
c. "U" qualified data, 1/2 result or 1/2 the detection limit is used in RRE calculations.
d. GC/MS means Gas Chromatograph/Mass Spectrometry
e. "B" qualified organic results. If blank sample contained a common lab contaminant, result considered positive only if concentration exceeded 10x the amount detected in the blank. If blank sample contained a constituent that is not a common lab contaminant, result considered positive only if concentration exceeded 5X the amount detected in the blank.

Phase I

Residual Risk Evaluation

Public Review Draft

September 2002

Mound Plant

Miamisburg, Ohio

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Acronyms

ARAR	Applicable or Relevant and Appropriate Requirement
BVA	Buried Valley Aquifer
CAS	Chemical Abstracts System
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
COPCs	constituents of potential concern
CSF	cancer slope factor
DOE	Department of Energy
EPC	exposure point concentration
FOD	Frequency of Detection
FFA	Federal Facilities Agreement
GV	Guideline Value
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index

Acronyms
(continued)

HQ	Hazard Quotient
IRIS	Integrated Risk Information System
LOAEL	lowest observed adverse effects level
MEIMS	Mound Environmental Information Management System
MMCIC	Miamisburg Mound Community Improvement Corporation
NCEA	National Center for Environmental Assessment
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	not detected
NOAEL	no observed adverse effect level
OEPA	Ohio Environmental Protection Agency
PAH	polycyclic aromatic hydrocarbon
pCi	picoCuries
PRS	Potential Release Site
RAGS	Risk Assessment Guidance for Superfund
R_fC	reference concentration factor
R_fD	reference dose factor
RME	reasonable maximum exposure
RRE	Residual Risk Evaluation
RREM	Residual Risk Evaluation Methodology
SVOCs	semi-volatile organic compounds
TCLP	Toxic Characteristic Leachate Procedure
UCL	upper confidence limit
USEPA	U.S. Environmental Protection Agency
UTL	upper tolerance limit
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

This report was prepared using the Mound 2000 Residual Risk Evaluation Methodology [(RREM) Reference 2] to quantify the potential for cancer and non-cancer health effects from long-term, low-level exposures to site-related contaminants in Phase I. A Residual Risk Evaluation (RRE) quantifies human health risks and non-cancer health effects associated with residual levels of contamination remaining within an area to ensure that current and future users of the land will not be exposed to contaminant levels that are unacceptable. In the future, Phase I may be used for commercial or industrial land use. In the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, USEPA 1990), the United States Environmental Protection Agency (USEPA) defines the acceptable risk range as 10^{-4} (increased cancer incidence of 1 in 10,000) to 10^{-6} (increased cancer incidence of 1 in 1,000,000) with a departure at 10^{-6}, and a Hazard Index (HI) of one is defined as the acceptable threshold for non-cancer health effects. The acceptable threshold for non-cancer constituents is a HI of less than or equal to one. Therefore, total risk, background risk, and incremental risk were calculated for current and future exposure scenarios for a Construction Worker and a Site Employee working in Phase I.

The terms "release block," "parcel," and "phase" are used in this report to designate portions of the Mound property to be evaluated for transfer. To streamline the transfer process, the Mound property was initially divided into 19 "release blocks", which were contiguous tracts of property designated for release. RREs must be completed before the transfer of a release block, parcel, or phase can be completed. RRE reports have been completed for Release Blocks D and H and Parcels 3 and 4. In 1997 - 1998 the remaining release blocks were reconfigured into 10 "parcels," and in 2002 into three "phases" to shorten the schedule for site transfer.

Overall total, background, and incremental cancer risks and non-cancer hazards are presented in Tables 34-36 (for convenience, these tables are also presented in this section). The risk values in the table are broken out by media (i.e., groundwater, air, and soil) and are the sum of risks for all pathways for the Construction Worker and Site Employee Scenarios. Overall cancer and non-cancer risks associated with exposure to soil and air in both the current and future use scenarios fall within the acceptable risk range of 10^{-4} to 10^{-6} and a HI of less than 1 for both potential receptors.

Cumulative incremental cancer risks are within the acceptable risk range for the current and future Construction Worker Scenario. Cumulative incremental non-cancer hazards for the current Construction Worker Scenario meet the acceptable level. Cumulative incremental non-cancer hazards exceed the acceptable HI of one for the future Construction Worker.

Cumulative incremental cancer risks are within the acceptable risk range for the current Site Employee Scenario. The cumulative incremental risk for the future Site Employee is at the limit of the acceptable risk range. Cumulative incremental non-cancer hazards for the current Site Employee Scenario meet the acceptable level. Cumulative incremental non-cancer hazards exceed the acceptable HI of one for the future Site Employee.

Where non-cancer hazards exceed acceptable levels, they are driven by exposure to groundwater and are most likely due to the conservative assumptions used in the flow tube model to assess future groundwater. These assumptions are likely to result in an overestimation of future groundwater risk. Details of the uncertainties associated with the assessment of future exposure to groundwater are provided in Section 6, Uncertainties. Given the conservative nature of the RRE and the associated uncertainties, the risks presented in Tables 34-36 represent the upper-bound plausible limit of risks (worst case scenario) for Phase I.

Table 34: Total Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	1.7E-01	**1.3E-05**
			Dermal Contact	1.6E-03	3.5E-07
			Inhalation of Dust	NA	2.6E-08
			Inhalation of VOCs	NA	NA
			External	NA	**3.8E-05**
			Soil Total Risk	1.7E-01	**5.1E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.7E-01	**5.1E-06**
			Dermal Contact	3.1E-01	**1.3E-06**
			Inhalation while Showering	4.8E-07	6.7E-10
			Current Groundwater Total Risk	**8.7E-01**	**6.4E-06**
	Future Groundwater	Chemical & Radiological	Oral	**5.2E+00**	**2.3E-05**
			Dermal Contact	9.4E-01	**2.3E-06**
			Inhalation while Showering	1.4E-05	4.6E-08
			Future Groundwater Total Risk	**6.1E+00**	**2.6E-05**
	Air*	Radiological	Inhalation	NA	2.1E-07
			Air Total Risk	NA	2.1E-07
			Cumulative Total Current Risk	**1.0E+00**	**5.8E-05**
			Cumulative Total Future Risk	**6.3E+00**	**7.7E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	1.4E-02	**9.2E-06**
			Inhalation of Dust	NA	1.4E-07
			Inhalation of VOCs	NA	NA
			External	NA	**4.4E-05**
			Soil Total Risk	1.4E-02	**5.3E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.7E-01	**3.1E-05**
			Current Groundwater Total Risk	5.7E-01	**3.1E-05**
	Future Groundwater	Chemical & Radiological	Oral	**5.2E+00**	**1.2E-04**
			Future Groundwater Total Risk	**5.2E+00**	**1.2E-04**
	Air*	Radiological	Inhalation	NA	**1.0E-06**
			Air Total Risk	NA	**1.0E-06**
			Cumulative Total Current Risk	5.8E-01	**8.5E-05**
			Cumulative Total Future Risk	**5.2E+00**	**1.7E-04**

HI: Hazard Index
NA - not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls - below land surface
VOCs - volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 35: Background Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	2.7E-02	**5.7E-06**
			Dermal Contact	6.0E-05	NA
			Inhalation of Dust	NA	6.9E-09
			Inhalation of VOCs	NA	NA
			External	NA	**2.8E-05**
			Soil Total Risk	2.7E-02	**3.4E-05**
	Current Groundwater	Chemical & Radiological	Oral	1.4E-02	**1.6E-06**
			Dermal Contact	3.1E-04	NA
			Inhalation While Showering	NA	NA
			Current Groundwater Total Risk	1.5E-02	**1.6E-06**
	Future Groundwater	Chemical & Radiological	Oral	6.1E-01	**2.6E-06**
			Dermal Contact	1.1E-02	4.6E-10
			Inhalation While Showering	NA	9.7E-10
			Future Groundwater Total Risk	6.2E-01	**2.6E-06**
	Air*	Radiological	Inhalation	NA	7.7E-09
			Air Total Risk	NA	7.7E-09
			Cumulative Background Current Risk	4.2E-02	**3.6E-05**
			Cumulative Background Future Risk	**6.5E-01**	**3.7E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	1.4E-02	**5.2E-06**
			Inhalation of Dust	NA	4.1E-08
			Inhalation of VOCs	NA	NA
			External	NA	**3.1E-05**
			Soil Total Risk	1.4E-02	**3.7E-05**
	Current Groundwater	Chemical & Radiological	Oral	1.4E-02	**1.1E-05**
			Current Groundwater Total Risk	1.4E-02	**1.1E-05**
	Future Groundwater	Chemical & Radiological	Oral	6.1E-01	**2.1E-05**
			Future Groundwater Total Risk	6.1E-01	**2.1E-05**
	Air*	Radiological	Inhalation	NA	3.9E-08
			Air Total Risk	NA	3.9E-08
			Cumulative Background Current Risk	2.8E-02	**4.8E-05**
			Cumulative Background Future Risk	**6.2E-01**	**5.7E-05**

HI: Hazard Index
NA - not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls - below land surface
VOCs - volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 36: Incremental Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	1.4E-01	**7.4E-06**
			Dermal Contact	1.6E-03	3.5E-07
			Inhalation of Dust	NA	2.0E-08
			Inhalation of VOCs	NA	NA
			External	NA	**9.5E-06**
			Soil Total Risk	1.4E-01	**1.7E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.5E-01	**3.5E-06**
			Dermal Contact	3.1E-01	**1.3E-06**
			Inhalation While Showering	4.8E-07	NA
			Current Groundwater Total Risk	**8.6E-01**	**4.8E-06**
	Future Groundwater	Chemical & Radiological	Oral	**4.6E+00**	**2.0E-05**
			Dermal Contact	9.3E-01	**2.3E-06**
			Inhalation While Showering	1.4E-05	4.5E-08
			Future Groundwater Total Risk	**5.5E+00**	**2.2E-05**
	Air*	Radiological	Inhalation	NA	2.0E-07
			Air Total Risk	NA	2.0E-07
			Cumulative Incremental Current Risk	1.0E+00	**2.2E-05**
			Cumulative Incremental Future Risk	**5.7E+00**	**4.0E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	4.6E-04	**4.0E-06**
			Inhalation of Dust	NA	9.7E-08
			Inhalation of VOCs	NA	NA
			External	NA	**1.2E-05**
			Soil Total Risk	4.6E-04	**1.6E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.5E-01	**2.6E-05**
			Current Groundwater Total Risk	5.5E-01	**2.6E-05**
	Future Groundwater	Chemical & Radiological	Oral	**4.6E+00**	**9.3E-05**
			Future Groundwater Total Risk	**4.6E+00**	**9.3E-05**
	Air*	Radiological	Inhalation	NA	9.9E-07
			Air Total Risk	NA	9.9E-07
			Cumulative Incremental Current Risk	5.5E-01	**4.3E-05**
			Cumulative Incremental Future Risk	**4.6E+00**	**1.1E-04**

HI: Hazard Index
NA: not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls: below land surface
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

1.0 INTRODUCTION

The U.S. Department of Energy's (DOE) Mound Plant is located on a 306-acre parcel of land within the City of Miamisburg, Ohio, about 10 miles southwest of Dayton, Ohio. Figure 1 shows the vicinity of the Mound Plant. The plant is located approximately 2,000 feet east of the Great Miami River and partially overlies the Great Miami Buried Valley Aquifer (BVA). Since 1948, Mound has operated as a research, development, and production facility in support of DOE's weapons and energy programs. Mound's past weapons program mission included process development, production engineering, and manufacturing and surveillance of detonators, explosives, and nuclear components. Mound's current mission is to support DOE's efforts in environmental management and to transition the site, in cooperation with the City of Miamisburg, from a Cold War production facility to commercial or industrial use.

Phase I, the subject of this report, consists of an approximately 53.8-acre parcel of land. A map of Phase I is included as Figure 2. In this report residual risk at Phase I is evaluated for both current and future commercial/industrial use of the parcel.

During past operations at the Mound facility, the release of hazardous materials occurred. During subsequent facility investigations, over 400 Potential Release Sites (PRSs) have been identified. Since contamination at the Mound Plant occurred at discrete PRSs rather than being widespread across the site, a new decision-making process was formulated for Mound. The new process is known formally as the "removal site evaluation process" and informally as the "Mound 2000 Process". The Mound 2000 Process is consistent with the Federal Facilities Agreement (FFA) signed by DOE, the U. S. Environmental Protection Agency (USEPA), and the Ohio Environmental Protection Agency (OEPA), in accordance with the Comprehensive Environmental Response, Compensation and Liabilities Act (CERCLA) as defined in the National Contingency Plan [NCP (Reference 1)].

This report was developed using the Mound 2000 Residual Risk Evaluation Methodology [RREM (Reference 2)] to quantify the potential for cancer and non-cancer health effects from long-term, low-level exposures to site-related contaminants in Phase I. A Residual Risk Evaluation (RRE) assesses human health risks associated with residual levels of contamination remaining within an area to ensure that future users of the land will not be exposed to contaminant levels that would pose unacceptable risks and/or adverse health effects. The Phase I RRE results will be used by risk managers, together with Applicable or Relevant and Appropriate Requirements

(ARARs), to determine the need for additional site remediation or to demonstrate that a parcel is ready for release and economic redevelopment.

1.1 Purpose of Residual Risk Evaluation

The purpose of the Phase I RRE is to assess risks associated with residual levels of contamination remaining after all necessary remedial actions within Phase I have been taken. Although the RRE method was developed specifically for use at Mound, the method is consistent with the CERCLA baseline risk assessment method to ensure that future users of the land will not be exposed to contaminant levels that would pose unacceptable risks.

1.2 Scope of the Phase I RRE

The Phase I RRE was completed using the Mound 2000 RREM (Reference 2) and includes an evaluation of human health risk for residual contamination in the parcel. Since commercial/industrial use of Phase I is anticipated, receptor scenarios were selected to represent reasonable maximum exposures (RMEs) in a commercial/industrial setting. RME exposure assumptions are conservative and are therefore, not likely to underestimate residual risk. Residual contaminants in Phase I were evaluated for two potential receptor groups: Construction Workers, who may be directly exposed to soil, groundwater, and air for an exposure duration of five years, and Site Employees, such as office workers, who may be exposed to soil, groundwater, and air for an exposure duration of 25 years. The Construction Worker and Site Employee were assumed to utilize groundwater from the Mound Plant production wells for their potable water supply while at work. Exposure assumptions for the Construction Worker and Site Employee Scenarios are site-specific adaptations of the standard scenarios presented in USEPA's Risk Assessment Guidance for Superfund (RAGS), Part A (Reference 3). The assumptions used in the evaluation are presented in Table 14.

Phase I residual risks were calculated as total, background, and incremental risk. Total risk was calculated using the total concentration of identified constituents of potential concern (COPCs) detected in Phase I. Background risk was calculated based on background levels of the COPCs as documented in the RREM (Reference 2) and incremental risk was calculated as total risk minus background risk. Incremental risk is used to assess the increase in risk above background levels due to contaminant releases from past Mound Plant operations.

1.3 Organization of Report

The RREM provides a framework for evaluating potential human health risks associated with residual levels of contamination. Although the RREM is similar to a traditional CERCLA baseline risk assessment, it serves a different purpose and, therefore, is not identical.

The RREM consists of five elements, including:

- identification of the contaminants to be evaluated,
- exposure assessment,
- toxicity assessment,
- risk characterization, and
- evaluation of potential cumulative risks.

The following sections describe each of these elements in more detail starting with Section 2.0, Data Compilation and Evaluation, which describes the methods used to compile Phase I data and identify contaminants to be evaluated in the RRE. Section 3.0, Exposure Assessment, summarizes the pathways through which hazardous substances may reach potential receptors and intake assumptions that will be used to quantify exposure. In Section 4.0, Toxicity Assessment, exposure point concentrations (EPCs), intake equations, and toxicological reference values are presented. Information from the exposure assessment is combined with information from the toxicity assessment to characterize human health risks in Section 5.0, Risk Characterization. Section 6.0, Uncertainties, presents some of the sources of uncertainty inherent in risk assessments and in the RRE. Section 7.0, References, contains a list of all documents cited in this report.

2.0 DATA COMPILATION AND EVALUATION

Identification of contaminants to be carried through the RRE calculations is a multi-step process. All available sampling data from within the Phase I boundaries were compiled from the Mound Environmental Information Management System (MEIMS). There were 58,950 soil measurement records and 47,819 groundwater measurement records. All available information and results were reviewed to ensure that only analytical data of sufficient quality and confidence were used in the quantitative portion of the risk assessment. Data determined to be of insufficient quality for use in the risk assessment were removed from the data set and segregated based on the following criteria. Quality assurance (field duplicates, field blanks) were segregated from the data set.

Measurements associated with soil that was subsequently removed from the site during remedial action were segregated from the data set. Measurement results that were qualified as "R" ("rejected" by the laboratory or data validator) were segregated from the data set. Parameters that do not contribute to risk calculations (pH, ion counts, anions, Toxic Characteristic Leachate Procedure (TCLP)) were segregated from the data set. Measurement records with inconsistencies in the database elements (problems in Chemical Abstracts System (CAS) name, unacceptable/inconsistent units of measure, non-numeric results) were segregated from the data set. Measurement results from the DOE Site Survey Project and results from Portable X-Ray Flouresence in the Other Soils project were judged to be lacking in quality for risk assessment purposes and segregated from the data set. Historical data that is no longer representative of current conditions, based on trends of subsequent analytical results, were segregated from the data set.

At some locations, multiple measurements were made of the same sample. One measurement was retained for risk calculations. For radionuclides, the following hierarchy was established, in order of preference:

1. Offsite laboratory, alpha spectrometry
2. Onsite laboratory, alpha spectrometry
3. Offsite laboratory, gamma spectrometry
4. Onsite laboratory, gamma spectrometry

For measurements of chemical concentrations, the result with the lowest detection limit was retained.

Analytical results not segregated were determined to be of sufficient quality for use in the risk assessment. This data was the basis for the risk calculations and can be found on the attached CD-Rom. Data that was segregated (based on the criteria discussed above) and was not used in the risk calculations can also be found on the CD-Rom.

Subsequent to the start of the Phase I risk evaluation process, several isolated locations were identified in Phase I with elevated radionuclide concentrations. Some of the historical analytical results from samples taken within the Phase I property area are elevated with respect to a risk-based comparison criterion. The specific comparison level used was three times the 10^{-5} RBGV plus background. Twenty-three sample locations were identified with results for Plutonium 238 (3 locations), Thorium 230 (1 location) and Thorium 232 (19 locations) above the comparison values. These results have been included in the Residual Risk Evaluation for this property and the report

indicates that the risk remains within acceptable levels. However, in some cases the results are significantly elevated above guideline values and warrant additional evaluation. The process followed to determine what locations warranted additional field activities and the results of those activities are summarized in Appendix J.

2.1 Data Quality Assessment

Samples collected for the Environmental Restoration Program were analyzed according to methods outlined in a Quality Assurance Project Plan (References 4, 5, 6, 7, and 8). Since some of the data used to characterize residual contaminant concentrations in Phase I were collected for other programs, not all data used in the risk assessment experienced the same level of rigor with respect to Quality Assurance/Quality Control evaluation and data validation. As described in Section 2.0, data judged to be of insufficient quality for the risk evaluation were separated from the data set and not used in the risk calculations.

2.2 Environmental Media Considered and Data Availability

Field investigations conducted for Phase I are listed in Table 1. Samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), inorganic compounds, common anions, polychlorinated biphenyls, explosives, pesticides, and radionuclides. Environmental media that were evaluated include surface soil (0-2 ft below land surface), subsurface soil (greater than 2 feet below land surface), air, and groundwater. Phase I does not contain surface water in bodies or sediment.

Current groundwater exposures were estimated using data collected from the Mound Plant production wells (Wells 0271 and 0076), which are finished in the BVA. The concentration of constituents in future groundwater was estimated using a Flow Tube model that assumes all contaminants currently detected in the Bedrock Aquifer of the Mound Plant property migrate to the BVA. The concentrations of contaminants in future groundwater were estimated by adding modeled contaminant concentrations detected in the Bedrock Aquifer to the lower of the 95% upper confidence limit (UCL) or maximum detected concentration in the Mound Plant production wells. This method is described in more detail in Appendix B.

The approach used to estimate potential cumulative risk from exposure to air is the same method as was used for Release Blocks D and H and Parcels 3 and 4. Potential cumulative risks due to contaminants released to the air are discussed in more detail in Appendix A.

2.3 Data Analysis

For each constituent detected in Phase I soil and current groundwater, the 95% UCL of the mean was calculated to estimate the potential concentration that receptors in the area may be exposed to. The concentration used to calculate risk is known as the EPC.

The 95% UCL for each constituent was calculated in accordance with the Mound 2000 RREM (Reference 2), Gilbert's Statistical Methods for Environmental Pollution Monitoring (Reference 9), and the Supplemental Guidance to RAGS: Calculating the Concentration Term (Reference 10). Before calculating the 95% UCL, the distribution of the data set was determined. If data were found to be normally distributed, the EPC was calculated as the 95% UCL of the arithmetic mean of the data, using the Student's t-statistic (Reference 10). The 95% UCL of the arithmetic mean was calculated as follows:

$$95\%\ UCL = Mean + t(s/n^{1/2})$$

Where:

t = t-statistic (Table A2, Reference 9)
s = standard deviation
n = number of observations in the data set

If the data follows a lognormal distribution, the data must first be transformed using the natural log function. The 95% UCL is then calculated using the H-Statistic. The 95% UCL equation of the arithmetic mean for lognormal distributions was calculated as follows:

$$95\%\ UCL = e^{Mean + 0.5\ s^2 + H(s/(n-1)^{1/2})}$$

Where:

H = H statistic (Table A12, Reference 9)
s = standard deviation
n = number of observations in the data set
e = constant (base of the natural logarithm)
mean = mean of the transformed data

The 95% UCL for data sets in which the distribution is not normal or lognormal was determined by assuming a lognormal distribution. USEPA guidance states that most environmental data sets are log normally distributed; therefore, it is reasonable to assume a lognormal distribution (Reference 10).

If the 95% UCL exceeded the maximum value observed, the maximum value was used as the EPC. If a data set had less than twenty observations (n less than 20), the maximum detected concentration was used as the EPC. For both chemical and radiological constituents, "not detected" (ND, qualified as U or UJ) results were included in the calculations of the mean and 95% UCLs as one-half the detection limit. Samples reported as ND or zero with no detection limit were not utilized in calculating a 95% UCL.

Blind field duplicates are collected to assess variability in the sampling process. They are used in the data quality assessment but were not included in the calculation of the EPCs. For radionuclides, zero or negative results with no detection limits were excluded from the data set. For data qualified as "J", the reported value was used in the 95% UCL calculations. Data flagged with an "R", meaning rejected, were not used in the Phase I database. An explanation of the laboratory data qualifiers used in the Phase I database is presented in Appendix K.

2.4 Screening Process for the Selection of Contaminants of Potential Concern

The constituent screening methods described below were used to generate a final list of COPCs for each media and receptor. All constituents with a Frequency of Detection (FOD) greater than 5% were listed in a constituent table for each media and receptor. The constituent summary tables also provide minimum detected concentrations, maximum detected concentrations, frequency of detection, and the decision and rationale to include or exclude a constituent from further consideration in the RRE.

To make the COPC selection process easier to follow, separate tables are provided for each receptor and the respective exposure scenario (Construction Worker and Site Employee) for current/future soil, current groundwater, and future groundwater. The first table for each receptor and media identifies initial COPCs by comparing the maximum concentration detected in a given media to background values and Mound Guideline Values (GVs) for the given receptor. The second table identifies final COPCs to be carried through the RRE by comparing the EPCs for the COPCs carried through from the first screening table to background values. Tables 2 and 3 identify the COPCs in soil

for the Construction Worker Scenario and Tables 4 and 5 identify COPCs in soil for the Site Employee Scenario. Tables 6 and 7 identify the COPCs in current groundwater for the Construction Worker Scenario and Table 8 and 9 identify COPCs in current groundwater for the Site Employee Scenario. Tables 10 and 11 identify the COPCs in future groundwater for the Construction Worker Scenario, and Tables 12 and 13 identify the COPCs in future groundwater for the Site Employee Scenario.

For the future groundwater screening process, the final Flow Tube modeled concentrations for COPCs were compared to background concentrations. If the modeled concentrations were less than background, the COPC was not carried through the RRE process. Nitrate, arsenic, manganese, thorium-232, and uranium-238 had future concentrations less than background and were screened out of the risk calculations.

2.4.1 Screening Constituents Based on Frequency of Detection

Constituents were evaluated for their frequency of detection. Frequency of detection was evaluated as the number of detections divided by the total number of samples analyzed for a constituent. Infrequent detection was defined as five percent or less. This is equivalent to one detect in 20 samples. If there were an insufficient number of samples (e.g. less than 20) to determine whether the frequency of detection is five percent or less, the contaminant was not eliminated on the basis of frequency of detection. A listing of all Phase I constituents and the frequency of detection analysis is provided in Appendix I.

2.4.2 Screening Constituents Based on Background

Site-specific background concentrations described as the 95% Upper Tolerance Limit (UTL) of the background sample results for each constituent were calculated for Mound Plant soil and groundwater, and presented in Tables 37 and 38. Constituents with a maximum detected concentration exceeding their level in background were identified as initial COPCs and carried to the next screening step of the RRE. Constituents with maximum concentrations less than their background concentration were not carried though the RRE. These background concentrations were also used to quantify background risk. If no background value was available for a particular constituent (e.g., many organic compounds), the constituent was carried through to the next screening step of the RRE.

For COPCs carried through from the first screening table, the 95% UCL was compared

to background to determine whether the 95% UCL was below background. If the 95% UCL was below the background value for the constituent, the constituent was not identified as a COPC in the RRE. Eliminating these constituents is consistent with the Mound 2000 RREM and focuses the RRE on constituents detected above background.

2.4.3 Screening Constituents Based on Guideline Values

Soil and groundwater constituents with maximum detected concentrations greater than background values were compared to risk-based guideline values (GVs) for the Mound Facility (Reference 11). GVs are media-specific concentrations of constituents that correspond to specific human health risk levels for specified exposure scenarios. GVs were developed for Construction Worker and Site Employee Scenarios (see References 11and 12 for the detailed derivation of GVs). Detected constituents were screened against Construction Worker and Site Employee GVs to determine COPCs to be retained for the quantitative risk assessment for each of the identified receptors.

The GVs used to screen COPCs were developed specifically for Mound, and were approved by DOE, USEPA, and OEPA after a public review. The GVs correspond to the $1x10^{-6}$ risk level for carcinogens and radionuclides. A $1x10^{-6}$ risk level represents the probability of an incremental increase of one person in one million people developing cancer as a result of exposure to the GV concentrations. Since the acceptable risk level for cancer constituents specified in the NCP is a range of $1x10^{-4}$ to $1x10^{-6}$ (increased cancer risk of 1 human in 10,000 to 1 human in 1 million), screening COPCs against the whole GV is protective. The acceptable threshold for non-cancer constituents is a Hazard Index (HI) of less than or equal to one. The GVs were calculated for a HI of one.

A Hazard Quotient (HQ) of 1 indicates an EPC below which no adverse effects to humans are expected. To account for the possibility of more than one non-cancer constituent, COPCs were screened using 1/10 the GV. Cancer-causing constituents that exceed their GVs and non-cancer constituents that exceed one-tenth of their GV were carried to the next step of the risk calculations.

Some of the radionuclides are designated as +D to indicate that cancer risk estimates and GVs include contributions from the radionuclide's short-lived decay products, or daughters. (This practice is consistent with USEPA Health Effects Assessment Summary Tables (HEAST)) Some of the radionuclides are designated "long-lived

decay." The GVs for these radionuclides include contributions from all of the radionuclides' decay products to a stable isotope. These calculations assumed equal activity concentrations (i.e. secular equilibrium) with the principal or parent nuclide in the environment. Data demonstrating secular equilibrium are presented in Appendix H.

2.4.4 Screening Constituents Based on Essential Human Nutrients

According to RAGS Part A (Reference 3): "Chemicals that are (1) essential human nutrients, (2) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (3) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the site) need not be considered further in the quantitative risk assessment." Calcium, chloride, iron, magnesium, potassium, and sodium are considered essential nutrients to humans. These compounds were detected in the Phase I area at levels below or slightly elevated above background levels and are toxic only at very high doses. Concentrations of these compounds in onsite media would not be expected to result in intakes associated with a toxic response. Therefore, these compounds were eliminated as COPCs for Phase I.

2.4.5 Additional Screening Procedures

In accordance with the RREM, additional screening procedures were used to evaluate Phase I constituents. For example, in accordance with USEPA's Functional Guideline for Organics (Reference 13), if a blank contains measurable levels of a common laboratory contaminant, then the associated sample results were considered as positive results only if concentration in the samples exceeded ten times the concentration in the blank. If the concentration of a common laboratory contaminant was less than ten times the blank concentration, the constituent was considered to be an artifact of laboratory handling and was not included in the RRE. Common laboratory contaminants include acetone, 2-butanone, methylene chloride, toluene, and phthalate esters.

2.4.6 Screening Procedures for Future Groundwater

To estimate the future concentration of groundwater COPCs, the Flow Tube model was applied to bedrock well data based on the maximum concentration detected. This procedure is discussed in detail in Appendix B. In accordance with the RREM, an initial screen was necessary to determine which constituents were to be carried through the Flow Tube model. All constituents detected in bedrock wells were screened for frequency of detection as well as a comparison to background and GVs. Constituents

that exceeded these criteria were retained for Flow Tube modeling. In addition, constituents that were identified as COPCs in the current groundwater RRE were retained for Flow Tube modeling. To obtain a final estimated future groundwater concentration for each COPC, the maximum concentrations detected in a given bedrock Flow Tube were modeled for future contribution to the BVA and added to the EPC (lower of the 95% UCL or the maximum concentration) detected in the production wells. The estimated future maximum constituent concentrations in the BVA are presented in Appendix B.

An additional screening step was required to determine the final COPCs to carry through the RRE process for future groundwater. The future modeled concentration for each identified COPC was compared to background. Nitrate, arsenic, manganese, thorium-232,and uranium-238 had future modeled concentrations less than the respective background concentrations. These constituents were screened out and not evaluated in the risk calculations.

3.0 EXPOSURE ASSESSMENT

The goal of the RRE exposure assessment is to estimate the type and magnitude of contaminant exposures for specific receptors that may occur under current conditions and in the future. The information gathered in the exposure assessment is integrated with toxicity information to characterize potential risks associated with exposure to residual contamination in Phase I.

3.1 Characterization of Exposure Setting

Phase I includes thirteen existing buildings and explosives magazines and twenty-five former production-era building sites including buildings, explosives storage magazines, and an electrical generator. The properties in Phase I have supported a number of operations: explosives testing and production-related activities, administrative activities (i.e. offices and site security operations), utilities operations, waste processing operations (the Burn Area), and cleanup waste storage operations.

Phase I also includes building sites for around nine buildings constructed in 1947 to support the construction of the original site buildings. An additional building location includes the site of a building that was transferred from Dayton Unit III to the Mound Site in 1949. This building was later moved to another location on the Mound site and is known as "Building 19". The building sites dating from the construction era include a

storage warehouse, an explosives and detonator storage operation for construction-related explosives, a quonset-type building, and some additional temporary buildings.

Phase I lands have also been used for various waste and non-waste storage activities including waste container management, equipment management, and other general plant uses.

General information on the Mound Plant, as well as specific information on buildings and PRSs within Phase I, is included in Appendices F and G.

3.2 Identifying Exposure Pathways

Although many exposure pathways are possible, the RRE focuses on those pathways that are likely to occur and are likely to contribute significantly to the overall risk. When identifying exposure pathways, it is important to keep in mind the four elements of an exposure pathway. An exposure pathway consists of (1) a source of chemical release; (2) transport media, (3) a point of potential human contact with the contaminant or contaminated media, and (4) an exposure route (e.g. ingestion). If any of these elements is missing or eliminated, the pathway will be incomplete and exposure will not occur.

A pictorial representation of the exposure pathways identified for potential receptors is included in a conceptual site model for Phase I (Figure 3). The conceptual site model summarizes the pathways that hazardous substances may take to reach potential receptors. Exposure assumptions used to evaluate potential exposure pathways were drawn from the Mound Plant Risk-Based Guideline Values (Reference 11) and the Mound 2000 RREM (Reference 2). Exposure assumptions used to quantify contaminant exposures are summarized in Table 14.

3.3 Identifying Exposure Scenarios

DOE, its regulators, and its stakeholders have agreed that the future use of the Mound Plant property will be commercial/industrial. Receptor scenarios were selected that represent reasonable exposures in a commercial/industrial setting. Consistent with the RREM, two scenarios are presented in this RRE: the Construction Worker Scenario and the Site Employee Scenario.

Residual contamination in Phase I was evaluated for two potential use scenarios for adult Construction Workers and adult Site Employees. It was assumed that

Construction Workers and Site Employees could potentially be exposed to soil, air, and groundwater. The evaluation of risk associated with exposure to residual contamination in Phase I for these receptors will indicate whether economic redevelopment can be safely conducted in the area.

3.3.1 Construction Worker Scenario

Since it is reasonable to assume that construction activities could occur within Phase I, adult Construction Workers were identified as potential receptors. During construction activities, these receptors could be exposed to residual contamination present in soil at or below the land surface. Potential exposure pathways include incidental soil ingestion, dermal contact, external radiation exposure, and inhalation of airborne dust and vapors.

It was also assumed that Construction Workers would use the BVA groundwater for a drinking water supply and for showering. Exposure pathways include ingestion and inhalation of vapors and dermal contact with groundwater while showering.

Exposure pathways evaluated for the Construction Worker for both current and future scenarios, include:

- incidental ingestion of soil at or below land surface,
- external exposure to ionizing radiation from radionuclides in soil at or below land surface,
- inhalation of airborne contaminated dust,
- inhalation of volatile emissions from soil,
- dermal contact with contaminated soil,
- ingestion of contaminated groundwater as drinking water,
- inhalation of volatile contaminants from groundwater while showering at work, and
- dermal contact with contaminated groundwater while showering at work.

The following are potential exposure pathways that were judged to be not as significant as those above and are therefore not quantitatively addressed:

- incidental ingestion of groundwater,
- inhalation of volatile emissions from groundwater, and
- dermal contact with groundwater.

If these exposure pathways were found to be significant, the risks would be managed.

The parameters used to evaluate these pathways and their references are provided in

Table 14. Construction Workers were assumed to be on the property eight hours per day, 250 days per year over a 5-year period. Since Construction Workers are assumed to be adults, a body weight of 70-kilograms was used to assess exposure to chemical contaminants.

3.3.2 Site Employee Scenario

Although exposures will vary depending on the type of work performed, it is reasonable to assume that a Site Employee at Phase I will be exposed to residual contamination left on the property. Such occupations are not expected to involve direct work with surrounding soil, as would be expected with the Construction Worker. The exposure routes evaluated for the Site Employee Scenario are similar to those evaluated for the Construction Worker except the Site Employee is assumed to work indoors and therefore have less exposure to site soil. Potential soil exposure pathways include incidental soil ingestion, external radiation exposures, and inhalation of airborne dust and vapors. Site Employees were assumed to use BVA groundwater for potable water supply, but are not expected to shower at work. The exposure pathways evaluated for the future Site Employee Scenario include:

- incidental ingestion of soil 0-2 feet below land surface,
- external exposure to ionizing radiation from radionuclides in soil 0-2 feet below land surface,
- inhalation of airborne contaminated dust,
- inhalation of volatile emissions from soil, and
- ingestion of contaminated groundwater as drinking water.

The site employee scenario assumes that a worker will be employed in an office or commercial setting, with the majority of working hours spent indoors. Such occupations are not expected to involve direct work with surrounding soils, as would be expected with the construction worker scenario. As a result, potential dermal exposure to soils would be minimal or non-existent. Hence, it can reasonably be assumed that dermal contact is not a viable pathway for the site employee scenario.

The parameters used to evaluate these pathways and their references are provided in Table 14. Site Employees were assumed to be on the property eight hours per day, 250 days per year over a 25-year period. Since Site Employees were assumed to be adults, a body weight of 70-kilograms was used to assess exposure to chemical contaminants.

3.4 Human Intake Equations and Assumptions

This section presents the exposure equations and assumptions used to derive contaminant-specific intake estimates for the populations and exposure pathways evaluated in the risk assessment. The use of the intake equations presented in this section is in accordance with methods presented by USEPA in RAGS Part A (Reference 3) and the RREM (Reference 2). Exposure assumptions have been developed to represent high-end RME conditions. Exposure assumptions for each of the potential receptors, and corresponding guidance or rationale used in this assessment are presented in Table 14.

For chemicals, exposure generally refers to the intake (e.g., inhalation, ingestion, dermal absorbed dose) of the chemical, expressed in units of mg/kg-day. Toxicity values for chemicals are generally expressed in these terms; therefore, the product of the intake estimate with the toxicity value yields a risk value.

The approach used to estimate intake for chemical contaminants largely applies to radionuclides. However, there are a few key differences in the methods. For example, in addition to the ingestion, inhalation, and direct contact pathways considered for chemical contaminants, external exposure to penetrating radiation was also evaluated for radionuclides. Equations for estimating the intake of radionuclides have been modified by omitting the body weight and averaging time from the denominator. The slope factors for radionuclides are expressed as the average risk per unit intake or exposure for an individual in a stationary population; therefore, radionuclide intakes and slope factors are not expressed as a function of body weight and time.

Another key difference in the method used to assess radiological risk is the inclusion of short-lived decay products, or daughter products, for radionuclides designated with the suffix "+D". The calculation of risk for radioactive decay chain products assumed equal activity concentrations (i.e., secular equilibrium) with the principal or parent nuclide. Risk calculations for decay chain products were assessed by summing the ingestion, inhalation, and external slope factors for the parent radionuclide and decay members of continuous decay chains (Reference 15 and Appendix H).

Chemical intakes from oral and inhalation exposure are expressed as the amount of chemical at the exchange boundary (e.g., skin, lungs, intestine) that is available for absorption. These intakes are not equivalent to the absorbed dose (the amount of chemical actually absorbed into the blood stream). Dermal doses are expressed as

estimates of absorbed dose. The toxicological reference values used to calculate risk have been adjusted to account for this difference, which is a source of uncertainty when comparing or combining dermal doses with intakes from other exposure routes.

3.4.1 Soil Exposure Pathways

Exposure to soil through incidental ingestion was evaluated for Construction Workers and Site Employees under current and future land use scenarios. Intake estimates for the chemical contaminants in the soil ingestion pathway were estimated by means of the following equation:

$$\text{Intake (mg / kg – day)} = \frac{C_{so} \times IR \times EF \times ED \times CF}{BW \times AT}$$

Where:

C_{so}	=	Contaminant concentration in soil (mg/kg)
IR	=	Ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (10^{-6} kg/mg)
BW	=	Body weight (kg)
AT	=	Averaging time for cancer and non-cancer effects (days)

Radionuclide intake estimates for the soil via incidental ingestion were estimated by means of the following equation:

$$\text{Intake (picoCuries (pCi))} = C_{so} \times IR \times EF \times ED \times CF$$

Where:

C_{SO}	=	Radiological activity in soil (pCi/g)
IR	=	Ingestion rate (mg/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (10^{-3} g/mg)

Unlike inhalation and ingestion exposure to soil, the external radiation exposure term is defined as an equivalent radionuclide concentration in soil that an onsite receptor would be exposed to for a particular duration. This exposure term is adjusted for exposure time and shielding. For the Phase I area RRE a default-shielding factor of 20% for the Site Employee and 10% for the Construction Worker Scenarios was assumed. These assumptions provide for a conservative estimate of external radiation exposure.

The intake equation for radionuclide contaminants via the external exposure pathway

was estimated using the following equation:

$$IR_{ext} \text{ (pCi/g-year)} = C_{so} \times ED_{ex} \times (1\text{-}Se) \times Te$$

Where:

IR_{ext}	=	External exposure contact rate (pCi-year/g)
C_{so}	=	Radiological activity of soil (pCi/g)
ED_{ex}	=	Exposure Duration x 0.685 (days worked/days in a year= 250/365) (year)
Se	=	Gamma Shielding Factor (unitless)
Te	=	Gamma Exposure Time Factor (unitless)

Intake of soil (fugitive dust) via inhalation was evaluated for Construction Workers and Site Employees under current and future use scenarios. The intake equation for chemical contaminants by this means is provided below:

$$\text{Intake (mg / kg – day)} = \frac{C_{so} \times IR_{air} \times EF \times ED}{PEF \times BW \times AT}$$

Where:

C_{so}	=	Contaminant concentration in soil (mg/kg)
IR_{air}	=	Inhalation rate (m^3/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
PEF	=	Particulate emission factor (1.32×10^9 m^3/kg, USEPA default value)
BW	=	Body weight (kg)
AT	=	Averaging time for cancer and non-cancer effects (days)

The intake equation for radionuclide contaminants via inhalation of fugitive dust was estimated using the following equation:

$$\text{Intake (pCi)} = \frac{C_{so} \times IR_{air} \times EF \times ED \times CF}{PEF}$$

Where:

C_{so}	=	Radiological activity in soil (pCi/g)
IR_{air}	=	Inhalation rate (m^3/day)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
CF	=	Conversion factor (1,000 g/kg)

PEF = Particulate emission factor (1.32×10^9 m^3/kg, USEPA default value)

The PEF relates the concentration of the contaminant in soil to the concentration of respirable particles in the air from fugitive dust emissions. These emissions result from wind erosion. The default value of 1.32×10^9 m^3/kg was taken from Risk-Based Guideline Values (Reference 12).

The absorbed dose from dermal exposure to soil was estimated using the following equation:

$$\text{Dermally absorbed dose (mg/kg-day)} = \frac{DA_{event} \times EF \times SA \times ED}{BW \times AT}$$

$$DA_{event} = C_{soil} \times AF \times ABS \times CF$$

Where:

C_{soil}	=	contaminant concentration in soil (mg/kg)
AF	=	adherence factor of soil to skin (mg/m^2 – event)
SA	=	skin surface area available for contact (m^2)
ABS	=	chemical-specific absorption factor (dimensionless)
EF	=	exposure frequency (events/year)
ED	=	exposure duration (year)
BW	=	body weight (kg)
AT	=	averaging time (yrx365day/year)
CF	=	conversion factor (10^{-6} kg/mg)

This pathway applies only to the current and future Construction Worker. The dermally absorbed dose was calculated for those chemicals with an ABS available.

Volatilization of chemical contaminants from soil may result in exposures via inhalation for Construction Workers and Site Employees; however, no volatile COPCs were identified in the Phase I area. Therefore, this pathway was not evaluated for chemical constituents.

3.4.2 Groundwater Exposure Pathways

Intake from the ingestion of groundwater was evaluated for Construction Workers and Site Employees under current and future use scenarios. The current concentration of contaminants in groundwater was derived from concentrations detected in two of the Mound Plant production wells (Wells 0271 and 0076). The method for estimating the future concentration of contaminants in groundwater assumes that all contaminants

detected in the bedrock wells will migrate to the BVA and be withdrawn at the Mound Plant production wells. Historical and current bedrock well data were screened and modeled to predict future contribution to the BVA from bedrock using a Flow Tube Model. This future bedrock estimated concentration for each final COPC was then added to the respective EPC (lower of 95% UCL or maximum detected concentration) in the Mound Plant production wells to provide the estimated future contaminant concentrations in groundwater used to calculate future groundwater risk. The Flow Tube Model and future bedrock estimated concentrations and total future estimated groundwater concentrations are presented in Appendix B. Risk was then calculated for current and future intake of groundwater under the Construction Worker and Site Employee Scenarios. The following equation was used to estimate current and future intake of chemical COPCs from the ingestion of groundwater as a drinking water source for both the Construction Worker and the Site Employee:

$$\text{Constituent Intake (mg / kg – day)} = \frac{C_w \times IR_w \times EF \times ED}{BW \times AT}$$

Where:

C_w	=	constituent concentration in water (mg/L)
IR_w	=	ingestion rate (L/day)
EF	=	exposure frequency (days/year)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)

In addition to groundwater ingestion, the Construction Worker was assumed to shower at work. While showering, workers were assumed to have dermal exposure to contaminants in groundwater and to inhale volatile contaminants. The dermal absorbed dose from dermal contact with constituents in groundwater was calculated as follows:

$$\text{Constituent DAD (mg / kg – day)} = \frac{DA_{event} \times EV \times EF \times SA \times ED}{BW \times AT}$$

Where:

DAD	=	dermal absorbed dose (mg/kg-day)
DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
EV	=	events per day (day^{-1})
EF	=	exposure frequency (days/year)
SA	=	surface area of skin exposed (cm^2)
ED	=	exposure duration (years)
BW	=	body weight (kg)
AT	=	averaging time (days)

For inorganics, DA_{event} (mg/cm^2-event) was calculated as follows:

$$DA_{event} = K_p \times C_w \times t_{event} \times 10^{-3}\ L/cm^3$$

Where:

DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
K_p	=	chemical-specific permeability coefficient (cm/hr)
C_w	=	concentration of chemical in water (mg/L)
t_{event}	=	duration of event (hr/event)

For organics, DA_{event} (mg/cm^2-event) was calculated as follows:

$$DA_{event} = 2 \times K_p \times C_w\ 10^{-3}\ L/cm^3 \times (6 \times T \times t_{event}/\pi)^{1/2}$$

Where:

DA_{event}	=	absorbed dose per event in water (mg/cm^2-event)
K_p	=	chemical-specific permeability coefficient (cm/hr)
C_w	=	concentration of chemical in water ($mg/cm^3 = 10^{-3}$ mg/L)
t_{event}	=	duration of event (hr/event)
T	=	lag time (hour)
π	=	constant (3.14159)

Constituent-specific permeability coefficient values (K_p) and the formula for the calculation of K_p were taken from Chapter 5 of Dermal Exposure Assessment: Principles and Applications (Reference 16). If a K_p was not found, it was calculated using the following formula:

$$\log K_p = -2.72 + 0.71 \log (K_{o/w}) - 0.0061\ MW$$

Where:

$\log K_p$	=	log of the constituent-specific permeability coefficient
$K_{o/w}$	=	octanol/water coefficient (constituent-specific)

MW = molecular weight (g/mole)

The following equation was used to calculate the intake of radionuclides from ingestion of water:

$$\text{Intake (pCi)} = C_w \times IR \times ED \times EF$$

Where:

C_w = radionuclide concentration in water (pCi/L)
IR = ingestion rate (L/day)
ED = exposure duration (year)
EF = exposure frequency (day/year)

The following equation was used to calculate the intake of radionuclides from dermal contact with water:

$$\text{Intake (pCi)} = C_w \times SA \times K_p \times EF \times ED \times Et_s \times 1000 \times L/m^3$$

Where:

C_w = concentration of contaminant in water (pCi/L)
SA = surface area of skin exposed (cm^2)
K_p = chemical-specific permeability constant (cm/hour)
EF = exposure frequency (days/year)
ED = exposure duration (years)
ET_s = duration of event (hours/day)

The following equation was used to calculate chemical contaminant intake from inhalation during showering:

$$\text{Intake (mg/kg – day)} = \frac{C_w \times K \times IR_{air} \times EF \times ED \times ET \times CF}{BW \times AT}$$

Where:

C_w = contaminant concentration in water (mg/L)
K = volatilization factor (L/m^3)
IR_{air} = inhalation rate (m^3/day)
EF = exposure frequency (day/year)
ED = exposure duration (year)
ET = exposure time (hour/day)
CF = conversion factor (1day/24 hr)
BW = body weight (kg)
AT = averaging time (year x 365 day/year)

Tritium is the only radionuclide present at the Mound Plant that is volatile enough that its vapor needs to be considered for the inhalation pathway. The following equation was used to calculate tritium intake from inhalation during showering:

$$\text{Intake (pCi)} = C_w \times IR_{air} \times EF \times ED \times M_{total} \times ET_s \times L/1000g$$

Where:

C_w	=	Tritium concentration in water (pCi/L)
IR_{air}	=	inhalation rate (m^3/day)
EF	=	exposure frequency (day/year)
ED	=	exposure duration (year)
M_{total}	=	airborne mass concentration of water in shower (66.96 g/m^3, Reference 11)
ET_s	=	shower duration (hour/day)

4.0 TOXICITY ASSESSMENT

The objectives of the toxicity assessment are to identify and select toxicological values for use in estimating the significance of the exposure and to evaluate potential adverse effects associated with exposure to compounds detected in Phase I. The RRE for Phase I evaluated chronic exposures. The RRE utilized methods recommended by USEPA for evaluating human cancer and non-cancer effects resulting from exposure to the COPCs. Cancer and non-cancer toxicity assessments for COPCs in soil and groundwater were conducted as part of the Phase I RRE. Risks due to exposures to groundwater, soil, and air are summed in Tables 34 through 36.

The toxicity criteria used in the RRE were obtained from the most current update of the USEPA Integrated Risk Information System (IRIS) or, if the information was not available in IRIS, the USEPA HEAST. IRIS is an electronic database containing the most current descriptive and quantitative USEPA regulatory information on chemical and radiological constituents. Constituent files maintained in IRIS contain information related to non-cancer and cancer health effects of constituents. HEAST is a published reference, updated periodically by USEPA. HEAST contains slope factors needed to evaluate the cancer risk due to radionuclides. The National Center for Environmental Assessment (NCEA) was another possible source for toxicity values not available from IRIS or HEAST. Table 15 presents a summary of toxicological criteria used to calculate risk for soil and groundwater COPCs, along with the chemical-specific characteristics used to estimate dermal absorbed dose and the concentrations present in vapors or dust.

In assessing the potential for non-cancer health effects, USEPA assumes that there is a

threshold below which no adverse toxic effects are expected. For example, a toxic threshold would exist if a substance had no toxic effect at a certain level of exposure, but did have a toxic effect at a higher level. USEPA derives and publishes and reference concentrations (R_fCs) for use in evaluating adverse non-cancer effects. These are estimates (with uncertainty spanning an order of magnitude or greater) of daily human exposures, including sensitive sub-populations, which may go without appreciable deleterious effects during a lifetime (Reference 3). USEPA derives reference doses (R_fDs) and R_fCs for humans, based on estimates of the no-observable-adverse-effect-level (NOAEL) or lowest-observable-adverse-effect-level (LOAEL) observed in test organisms.

USEPA classifies all radionuclides as carcinogens and the process of carcinogenesis is generally thought to be a phenomenon without a threshold for effect (Reference 3). The basis for this presumption is that an extremely low level of exposure to some carcinogens may result in chromosomal or enzyme changes leading to uncontrolled cellular proliferation or cancer. USEPA does not, therefore, estimate an effective threshold for cancer chemicals. USEPA uses a two-part evaluation for carcinogens. First the constituent is assigned a weight-of-evidence classification based on both epidemiological evidence of cancer effects and laboratory tests conducted with animals. Then a CSF is calculated. HEAST lists ingestion, inhalation, and external exposure CSFs for radionuclides in the units of risk per picocuries (risk/pCi). Ingestion and inhalation slope factors are central estimates in a linear model of the age-averaged, lifetime-attributable radiation cancer incidence (fatal and nonfatal) risk per unit of activity inhaled or ingested. The slope factor is a plausible upper-bound estimate of the slope of the dose-response curve in the low dose range. In risk assessment, the CSF is used to estimate the excess lifetime probability of a cancer effect occurring in exposed receptors.

4.1 Toxicity Values for Evaluating the Dermal Pathway

Toxicological reference values are available only for the oral and inhalation pathways and the majority of these values are based on intake (i.e., administered dose) rather than an absorbed dose. Because the intake equation for the dermal contact pathway calculates absorbed dose (by incorporating a dermal absorption factor or a permeability coefficient), it is necessary to convert the administered dose toxicity value to an absorbed dose toxicity value in order to calculate risk or hazard index. For the Phase I RRE, oral administered-dose toxicity values were adjusted by using compound-specific gastrointestinal absorption factors. For non-carcinogens, the administered dose toxicity

value (i.e., the R_fD) was multiplied by the gastrointestinal absorption factor. For carcinogens, the slope factor was divided by the gastrointestinal absorption factor.

5.0 RISK CHARACTERIZATION

This section presents the risk characterization for Phase I. In risk characterization, information from the exposure assessment (Section 3) combined with information from the toxicity assessment (Section 4) is used to characterize human health risks.

5.1 Risk Characterization Methods

Risk characterization integrates the exposure and toxicity assessments by comparing estimates of intake or dose with appropriate toxicity values. This in turn provides an indication of the potential for adverse effects to exposed receptors. The objective of the risk characterization is to determine if exposure to contaminants associated with the site poses risks that exceed USEPA acceptable levels for human health effects. The results of a risk assessment may support the determination of site release or the need for site remediation.

The RRE reports the incremental risk, total risk, and risk from background for each contaminant evaluated. The incremental risk is the risk posed by site-related contamination above the risk posed by background levels. Background risk is the risk resulting from sources other than the Mound-related residual contamination. Total risk is the sum of the background and incremental risk. This risk characterization presents a separate evaluation of non-cancer and cancer effects. Quantification methods for cancer and non-cancer effects are discussed separately in the following sections.

5.1.1 Quantification of Cancer Risk

Cancer risks are probabilistic estimates of the excess lifetime cancer risk for an individual specifically attributable to long-term exposure to site-related chemicals. The procedure for calculating risk associated with exposure to cancer compounds has been established by USEPA (Reference 3). A non-threshold, dose-response model was used to calculate a cancer slope (potency) factor for each COPC. To derive an estimate of risk, the cancer slope factor was multiplied by the estimated chronic daily intake experienced by the exposed individual:

$$\text{Risk} = \text{CDI} \times \text{CSF}$$

Where:

Risk= High end estimate of the excess lifetime cancer risk to an individual (unitless probability)
CDI= Chronic daily intake averaged over a 70-year period (mg/kg body weight-day)
CSF= Cancer slope factor (95% upper-bound estimate of the slope of the dose-response curve) expressed as (mg/kg body weight-day)$^{-1}$

To evaluate the risk of exposure to more than one cancer COPC, the risk estimate for each COPC was summed to provide an overall estimate of total cancer risk (Reference 3).

$$Risk_t = \sum_{i=1}^{n} Risk_i$$

Where:

$Risk_t$= The combined excess lifetime cancer risk across chemical carcinogens
$Risk_i$= Risk estimate for the ith chemical of n chemicals under evaluation.

5.1.2 Quantification of Non-cancer Hazard

The traditionally accepted practice of evaluating exposure to non-cancer compounds has been to experimentally determine a NOAEL and to divide this by a safety factor to establish an acceptable human dose, for example, acceptable daily intake or R_fD. The R_fD is then compared to the average daily intake experienced by the exposed population to obtain a measure of concern for adverse non-cancer effects:

$$HQ = Intake/R_fD$$

Where:

HQ= Hazard Quotient: potential for adverse non-cancer effects

Intake= Average daily intake for subchronic or chronic exposure (mg/kg body weight-day)

R_fD= Acceptable intake for subchronic or chronic exposure (mg/kg body weight-day)

To evaluate exposure to multiple non-cancer COPCs the HQs for all COPCs were summed to obtain the HI.

$$HI = \sum_{i=1}^{n} HQ$$

Where:

HI= Hazard Index

HQ= Hazard quotient estimate for the ith chemical of n chemicals under evaluation

For non-cancer effects, USEPA has set the acceptable HQ at one. If the HQ is greater than 1, there is the potential for adverse health effects at the given exposure/dose level, but the HQ value is not an indication of the severity of the effects. For multiple non-carcinogens, the HQs for all of the chemicals under evaluation are summed resulting in the Hazard Index (HI). If the HI is greater than 1, the potential also exists for adverse health effects resulting from exposure to mixtures of chemicals. In cases where the HQ for individual substances is below 1 yet several HQs sum to greater than 1, USEPA recommends segregating the compounds into groups with like or common toxicological effects and re-evaluating the potential for the various adverse health effects. In cases where HQs for individual substances are greater than 1, this step is not necessary or useful.

5.2 Risk Characterization Results

The following sections present the risk characterization results for Phase I by potential receptor. Risk estimates for individual soil COPCs for all scenarios and pathways are presented in Tables 16 through 21. Tables 16 through 18 present soil risk estimates based on Construction Worker exposure parameters, and Tables 19 through 21 present soil risk estimates based on Site Employee exposure parameters. Total risk was calculated using the total concentration of the COPCs detected in Phase I. Background risk was based on background levels of the COPCs and incremental risk was calculated using the difference between total and background levels. Incremental risk can be used to assess the increase in risk above background levels due to Mound Plant operations. Tables 34 through 36 present summaries of the risk results for all scenarios and media for exposure pathways assessed in the RRE.

Current groundwater risk was assessed using the EPC for each COPC and the risk equations presented in Section 3.5.2. Appendix B presents the methodology for

calculation and EPC values of the future groundwater COPCs that were then applied to equations presented in Section 3.5.2. Risks due to exposure to current and future groundwater are presented in Tables 22 through 33.

In Tables 34 through 36, risk estimates that are at or above the non-cancer HI of one and the cancer acceptable risk level of 10^{-6} are bolded to identify them for evaluation. The NCP acceptable risk range is 10^{-4} to 10^{-6}.

5.2.1 Construction Worker Risk Results

Soil. Tables 16 through 18 present total, background, and incremental risk and hazard for the Construction Worker Scenario in Phase I, respectively. Total (0.17), background (0.027), and incremental (0.14) non-cancer hazards are below the acceptable HI of one. Total residual cancer risk from soil for the Construction Worker Scenario is 5.1×10^{-5}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. Background residual risk from soil for the Construction Worker Scenario in Phase I is 3.4×10^{-5} and is based on background concentrations of thorium-232 long-lived decay and uranium-238 long-lived decay chains. Incremental residual soil risk is 1.7×10^{-5}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. The external exposure pathway contributes 56% of the incremental residual cancer risk for the Construction Worker Scenario in Phase I. The oral exposure pathway contributes 44% of the incremental residual cancer risk for the Construction Worker in Phase I. The uranium-238 long-lived decay chain contributes 45% of the incremental residual cancer risk. Plutonium-238 contributes 25% of the incremental residual cancer risk.

Current Groundwater. Total, background, and incremental risks and hazards for a Construction Worker exposed to current groundwater are presented in Tables 22 through 24. Total (0.87), background (0.015), and incremental (0.86) non-cancer residual hazards from current groundwater for the current Construction Worker Scenario are below the acceptable HI of one. Total residual cancer risk from current groundwater for the Construction Worker Scenario is 6.4×10^{-6}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. Background residual risk from current groundwater for the Construction Worker Scenario is 1.6×10^{-6} and is based on the background concentration for the uranium-238 long-lived decay chain. Incremental residual risk from current groundwater is 4.8×10^{-6}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. The oral exposure pathway contributes 73% of the incremental residual cancer

risk. The uranium-238 long-lived decay chain contributes 67% of the incremental residual cancer risk. TCE contributes 33% of the incremental residual cancer risk.

Future Groundwater. Final COPCs for future groundwater for the Construction Worker Scenario are identified in Table 11. Total, background, and incremental risks for the Construction Worker Scenario are presented in Tables 28, 29, and 30, respectively. Total residual non-cancer hazard from future groundwater for the Construction Worker Scenario was 6.1. Background residual non-cancer hazard from future groundwater for the Construction Worker Scenario was 0.62 and incremental residual non-cancer hazard from future groundwater was 5.5. Total and incremental non-cancer hazard for the Construction Worker Scenario exceed the acceptable HI of one. Chromium contributes 64% of the incremental HI. Future total and incremental cancer residual risk from groundwater for the Construction Worker Scenario were 2.6×10^{-5} and 2.2×10^{-5}, respectively. Both are within the acceptable risk range of 10^{-4} to 10^{-6}. Several contaminants contribute to the future incremental cancer risk. The uranium-238 long-lived decay chain is the largest contributor (33%). Background residual cancer risk from future groundwater for the Construction Worker Scenario was 2.6×10^{-6}.

Air. Potential cumulative total and incremental cancer risks due to exposure to contaminants in air are 2.1×10^{-7} and 2.0×10^{-7} respectively, which is less than the acceptable risk range. None of the COPCs identified in air have non-cancer hazard criteria so a HI was not calculated for exposure to contaminants in air.

5.2.2 Site Employee Risk Results

Soil. Total, background, and incremental residual soil risks for the Site Employee Scenario in Phase I are presented in Tables 19, 20, and 21, respectively. Total (0.0145), background (0.014), and incremental (0.0005) residual non-cancer hazard are below the acceptable HI of one. Total residual cancer risk from soil for the Site Employee Scenario in Phase I is 5.3×10^{-5}, which falls within the acceptable risk range of 10^{-4} to 10^{-6}. Background residual risk from soil for the Site Employee Scenario in Phase I is 3.7×10^{-5} and is based on background concentrations of the thorium-232 and uranium-238 long-lived decay chains. Incremental residual soil risk is 1.6×10^{-5}. The external exposure pathway contributes 75% of the incremental residual cancer risk for the Site Employee Scenario from Phase I soil. The uranium-238 long-lived decay chain contributes 52% of the incremental residual risk. The thorium-232 long-lived decay chain contributes 28% of the incremental residual risk.

Current Groundwater. Total, background, and incremental residual current groundwater risks and hazards for the Site Employee Scenario in Phase I are presented in Tables 25, 26, and 27, respectively. The total and incremental non-cancer hazard from current groundwater for the Site Employee Scenario are 0.57 and 0.55, respectively, which do not exceed the acceptable HI of one. The current groundwater background non-cancer hazard for the Site Employee Scenario is 0.014. Total and incremental cancer risks for the Site Employee exposed to current groundwater are $3.1x10^{-5}$ and $2.6x10^{-5}$, respectively. These values fall within the acceptable risk range of 10^{-4} to 10^{-6}. The thorium-232 long-lived decay chain contributes 65% of the incremental risk via the ingestion (oral) pathway. The uranium-238 long-lived decay chain contributes 19% of the incremental cancer risk via the oral pathway. Current background cancer risk to the Site Employee presents a risk of $1.1x10^{-5}$.

Future Groundwater. Final COPCs for future groundwater for the Site Employee Scenario are identified in Table 13. Total, background, and incremental risks for the Site Employee Scenario are presented in Tables 31, 32, and 33, respectively. Future total and incremental non-cancer residual hazard from groundwater for the Site Employee Scenario were 5.2 and 4.6, respectively. Both of these values exceed the acceptable HI of one. Chromium contributes 67% of the incremental HI. Future background non-cancer residual hazard in groundwater for the Site Employee Scenario is 0.61. Future total and incremental cancer residual risks from groundwater for the Site Employee Scenario were $1.2x10^{-4}$ and $9.3x10^{-5}$, respectively. The incremental cancer risk associated with exposure to groundwater falls within the acceptable risk range of 10^{-4} to 10^{-6} for the Site Employee Scenario. Background cancer residual risk from future groundwater for the Site Employee Scenario was $2.1x10^{-5}$.

Air. Potential cumulative total and incremental cancer risks due to Site Employee exposure to contaminants in air are $1.0x10^{-6}$ and $9.8x10^{-7}$, respectively, which are less than or within the acceptable risk range. None of the COPCs identified in air have non-cancer risk criteria so a HI was not calculated for exposure to contaminants in air.

5.2.3 Overall Summary of Risk Results

Overall total, background, and incremental cancer and non-cancer risks are presented in Tables 34 through 36. The values in the tables are the sum of all of the media and associated pathways for the Construction Worker and Site Employee Scenarios.

The cumulative incremental current hazard (1) for the Construction Worker Scenario is at the acceptable limit (1). The cumulative incremental current risk ($2.2x10^{-5}$) is

acceptable (10^{-4} to 10^{-6}). The cumulative incremental future hazard for the Construction Worker Scenario (5.7) exceeds the acceptable level (1). The cumulative incremental future risk ($4x10^{-5}$) is acceptable (10^{-4} to 10^{-6}). The exceedance is due to the modeled future groundwater.

The cumulative incremental current risk ($4.3x10^{-5}$) and hazard (0.55) for the Site Employee are acceptable. The cumulative incremental future risk for the Site Employee ($1.1x10^{-4}$) is at the limit of the acceptable risk range (10^{-4} to 10^{-6}). The cumulative incremental future hazard (4.6) exceeds the acceptable level (1). This exceedance is due to the modeled future groundwater.

6.0 UNCERTAINTY IN THE RISK ASSESSMENT

In the following section, an evaluation is presented of the sources of uncertainty in the Phase I RRE and the relative influence of these sources on the results of the evaluation. Uncertainty is inherent in the selection of input parameters and in every step of the risk assessment process. Risk assessment of contaminated sites must not be viewed as yielding single value, invariant results. Rather, the results of risk assessment are estimates that span a range of possible values, and which must be understood only in light of the assumptions and methods used in the evaluation.

The results of the RRE are presented in terms of the potential for adverse effects based upon a number of conservative assumptions. The tendency to be conservative is an effort to err toward protecting health. Uncertainty can be found at all phases in the risk assessment: in the analytical data, the exposure assessment, the toxicity assessment, and the risk characterization. Where uncertainty does exist, the RRE uses conservative assumptions to ensure that the outcome will be protective.

6.1 Uncertainty in Analytical Data

Uncertainty is introduced to the RRE when sample locations are selected and when samples are collected and analyzed. In the RRE, the long-term exposure concentrations were upper estimates of site concentrations (e.g., maximum detect or 95% UCL); therefore, a conservative bias to overestimate potential exposure has been incorporated into the risk estimates. The uncertainty associated with the statistical analysis of environmental data is low, with little introduction of bias. However, it is possible that contaminated areas of Phase I were not sampled.

Data for the RRE were collected over a 20-year period, during which analytical detection limits and methods have changed. This has resulted in current lower detection limits and presents uncertainty in the data by adding potential bias to the EPC for a constituent. The earlier data with higher detection limits resulted in non-detected concentrations that were higher, in some cases, than current maximum detected concentrations. Substitution of one-half the detection limit for non-detected concentration limits tends to bias the EPC high. For groundwater, the historical and current groundwater data were collected and used to develop the EPC by a conservative approach and model presented in Mound 2000 RREM. Uncertainty is introduced because the analytical results for constituents in the groundwater, collected over a 20-year time period, may not meet the DQOs currently in place for data collection at Mound. The long time frame also means that contaminants detected in the production wells and bedrock wells may have degraded. For example, 20 years is greater than one half-life for tritium. The concentration of tritium in groundwater is reduced by half every 12 years.

To estimate future maximum constituent concentrations in the BVA, the EPC (lower of maximum detected concentration or 95% UCL) in the production wells was added to the Flow Tube modeled maximum detected concentration found in the bedrock wells. The Flow Tube Model includes an assumption that the maximum concentration of a constituent detected in each of the twenty bedrock Flow Tubes impacts the BVA in the future. The model does not take into account chemical and physical processes such as dilution, dispersion, and adsorption, which may reduce contaminant levels by the time they reach the BVA. As a result of this methodology, the future groundwater EPCs are biased high and conservative. This added conservatism helps to compensate for the uncertainties in the characterization of the bedrock aquifer (data gaps over time, changing analytical techniques, limited sample locations, and limited flow). It was agreed through the implementation of the Mound 2000 Process and the RREM, that extensive characterization of the bedrock groundwater was not needed due to the following: 1. A restriction on the use of the aquifer would be implemented; 2. The groundwater yield from the bedrock is low (i.e. one gallon per minute); and 3. Characterization and remediation of fractured bedrock is technically difficult and costly. It is important to recognize the uncertainties of the assumptions, but it is also important to maintain the conservative nature of the assumptions.

6.2 Uncertainty in Exposure Assessment

Exposure assessment may introduce considerable uncertainty in the risk assessment process. The RREM presents exposure and intake calculations based on USEPA procedures that were used in the Phase I RRE. Exposure assumptions were also used to develop site-specific risk-based guideline values for the Mound Plant which were approved by OEPA and USEPA after public review. Exposure assumptions are based on speculation regarding potential land use, assumptions concerning contaminant fate and transport, and receptor behavior. The uncertainty associated with the exposure assumptions used in the risk assessment is moderate, and most likely overestimates the actual risks.

One of the exposure assumptions used in the Phase I RRE is that future site users would utilize the production wells for potable water supplies. The Miamisburg Mound Community Improvement Corporation (MMCIC) intends to tap future site users into the municipal water supply system in the near future, therefore exposure to bedrock or BVA groundwater is unlikely. Using the production well and bedrock well data to estimate future risk is a conservative estimate of future risk, but appropriate because the production wells are located in a productive portion of the BVA and could be used in the future as a water resource.

The chromium data introduce another uncertainty in the analytical data. Chromium can exist in two different states: chromium III or chromium VI. Chromium VI is highly reactive and, as a result, has a very short holding time. Of the 180 measurements of chromium in groundwater that contribute to this risk evaluation, four are measurements of chromium VI. All four results are at the detection limit of 0.02 mg/l. The EPC for chromium is 0.964 mg/l. All chromium was assumed to be chromium VI. (R_fD_o = 0.003 mg/kg-day). The resulting future total groundwater hazard index for the Construction Worker was 3.6. If the chromium is assumed to be chromium III (R_fD_o = 1.5 mg/kg-day), the resultant HI for the same scenario is 0.007.

Another source of uncertainty in the Phase I RRE involves external exposure to gamma-emitting radionuclides. External exposure refers to the irradiation of tissues by radiation emitted by radionuclides located outside the body either dispersed in air, on skin surfaces, or deposited on ground surfaces. Gamma and x-rays are the most penetrating of the emitted radiation and comprise the primary contribution to radiation dose from external exposures. The calculation of risk from external radiation exposure assumes that any gamma-emitting radionuclide in soil is uniformly distributed in soil.

The calculation of external radiation exposure risk includes a gamma-shielding factor (S_e) to account for attenuation of radiation by structures, terrain or engineered barriers. S_e is expressed as a fractional value between 0 and 1, representing the possible risk reduction range from 0% to 100% due to shielding. For the Phase I RRE a default value of 0.2 or 20% shielding for the Site Employee and 0.1 or 10% shielding for the Construction Worker Scenarios was used in the risk calculations. The shielding default values are consistent with values previously used in the calculation of the GVs by DOE.

6.3 Uncertainties Related to Toxicity Information

Although USEPA approved toxicity values were used for the RRE; a significant amount of uncertainty may surround these values. Identification of the sources of this uncertainty enables the risk assessor to establish the degree of confidence associated with the toxicity measures.

Uncertainty is inherent within the toxicity assessment and is primarily due to differences in study design, species, sex, routes of exposure, or dose-response relationships. A major source of uncertainty involves using toxicity values based on experimental studies that substantially differ from typical human exposure scenarios. The derivation of the toxicity values must take into account such differences as 1) using dose-response information from animal studies to predict effects in humans, 2) extrapolating dose-response information from high-dose studies to predict adverse health effects from low doses, 3) using data from short-term studies to predict chronic effects, and 4) extrapolating from uniform animal populations to variable human populations.

The cancer slope factors in particular are based on studies that may differ greatly from realistic situations. Experimental cancer bioassays typically expose animals to very high levels of chemicals (i.e., the maximum tolerated dose) for their entire lifetime. After appropriate studies have been identified, the slope factor is calculated as the upper 95th percent confidence limit of the slope of the dose-response curve. This introduces conservatism into the risk assessment. In addition, carcinogens are assumed to be human carcinogens regardless of USEPA's weight-of-evidence classification.

The derivation of reference doses involves the use of animal studies. Uncertainty factors ranging from 1 to 1,000 are incorporated into the reference dose to provide an extra level of health protection. The factors used depend on the type of study from which the value has been derived (e.g., animal or human, chronic or acute, study design). The scientific basis for this practice is somewhat subjective. In general, high

uncertainty factors are meant to bias the results conservatively so that exposures at the reference dose level will not result in adverse health effects.

Toxicity values derived from oral administered dose studies have been converted to absorbed dose toxicity values for use in evaluating the dermal contact pathway. This is considered a more accurate approach than using unadjusted oral toxicity values for the dermal pathway. Uncertainty is introduced in the use of the gastrointestinal absorption factors. Limited information is available on the gastrointestinal absorption of some analytes and many have no information at all. In addition, no adjustments have been made for the medium of exposure (e.g., when the medium of exposure in the site differs from the medium of exposure assumed by the toxicity value). The uncertainty associated with using the absorbed dose toxicity values for the dermal pathway is moderate and the bias unknown.

There are some chemicals for which no toxicity value exists and for which little information is available. Therefore, a quantitative risk estimate cannot be calculated for these chemicals. For example, many chemicals are not evaluated for the inhalation pathway because of limited inhalation-based toxicological information. The lack of toxicity information for some chemicals contributes to the underestimation of risks. The following constituents in Phase I do not have toxicity criteria accepted by HEAST or IRIS: VOCs (bromochloromethane, fluorobenzene, O-chloroflurobenzene), pesticides (chlordane), SVOCs (benzo(g,h,i)perylene, phenanthrene), and inorganics (bismuth, lead, and lithium).

Although the USEPA has developed toxicity values for the oral and inhalation routes of exposure for many chemicals, they have not developed toxicity criterion for all chemicals and all exposure routes that were evaluated for Phase I. For this reason, acceptable literature databases (ATSDR, Sax's Dangerous Properties of Industrial Materials, Chemfinder.com, Risk Assessment Information System Website) were reviewed to determine if toxicological information on other COPCs is available. Information obtained in this fashion is discussed qualitatively.

Bromochloromethane is a poison—it is mildly toxic by ingestion and inhalation (Reference 17). Fluorobenzene is also mildly toxic by ingestion and inhalation (Reference 17).

Benzo(g,h,i)perylene is a polycyclic aromatic hydrocarbon (PAH). PAHs generally occur as complex mixtures (for example, as part of combustion products such as soot). The USEPA and International Agency for Research on Cancer have determined that

benzo(g,h,i)perylene is not classifiable as to human carcinogenicity (Reference 18). Bismuth has been reported as poisonous to humans (Reference 17).

Unlike most other chemicals, the hazard posed by inorganic lead is based on levels of lead in blood rather than on toxicity values. The USEPA has developed mathematical models for predicting concentrations of lead in the blood of children and adults resulting from exposure to soil, air, drinking water, food, and other sources. The USEPA compares the predicted blood-lead concentrations with a concentration of 10 micrograms of lead per deciliter of blood to decide whether lead presents a health risk. The USEPA has estimated that the concentration of lead in blood could exceed 10 ug/dL if the concentration of lead in soil at residences exceeds 400 mg of lead per kg of soil. In work areas, USEPA has estimated that the concentration of lead in soil should not exceed 750 to 1,750 mg/kg. In Phase I, the concentration of lead in soil was 16.7 mg/kg for the Construction Worker and 0.013 mg/kg for the Site Employee. Although certain lead compounds have been shown to cause cancer in animals, the risk of cancer is not typically evaluated for lead because people are more sensitive to lead's non-cancer effects than to its cancer effects. For radioactive isotopes of lead, the cancer risks were included in the risks from the appropriate long-lived decay chains in Phase I (Reference 19).

To estimate potential impact associated with simultaneous exposure to multiple chemicals, cancer risks were summed for all COPCs and hazard indexes were summed for all COPCs. USEPA classifies carcinogens according to the weight of evidence from epidemiological and animal studies as follows:

Class A – Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Class B – Probable Human Carcinogen (limited evidence of carcinogenicity in humans or sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)

Class C – Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

In the case of carcinogens, this gives carcinogens with a class B or class C weight-of-evidence the same weight as carcinogens with a class A weight-of-evidence. It also equally weights slope factors derived from animal data with those derived from human data. Uncertainties in the combined risks are also compounded because R_fDs and cancer slope factors do not have equal accuracy or levels of confidence and are not

based on the same severity of effect.

6.4 Uncertainties in Risk Characterization

Uncertainties in any phase of the risk analysis are reflected in the risk estimates. Some uncertainty is associated with the summation of risks and HQs for multiple chemical contaminants. As stated in RAGS (Reference 3), "The assumption of dose additivity ignores possible synergistic or antagonistic effects among chemicals, and assumes similarity in mechanisms of action and metabolism." However, summing risks and HQs for multiple substances in this risk assessment provides a conservative estimate.

6.5 Conclusions

The current incremental risk in Phase I is within the acceptable risk range. The future incremental risk for the Construction Worker Scenario is within the acceptable risk range. The future incremental risk for the Site Employee is at the limit of the acceptable risk range and is primarily driven by the conservative groundwater analysis (see section 6.1). Incremental risk due to soil and air contaminants is within acceptable risk range for industrial/commercial reuse.

The current incremental HI for the Site Employee is within the acceptable range (less than 1). The current incremental HI for the Construction Worker Scenario is at the limit of the acceptable range (1). The future incremental HI for the Construction Worker and Site Employee Scenarios exceeds the acceptable level (1) and is driven by the conservative groundwater analysis (see Section 6.1). Incremental HI due to soil and air contaminants is within the acceptable range for industrial/commercial use.

7.0 REFERENCES

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Reference 3 "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part A, Interim Final," USEPA, Office of Emergency and Remedial Response, Washington, DC. 1989

Reference 4 Operable Unit 9, Remedial Investigation/Feasibility Study, Quality Assurance Project Plan, June 1993

Reference 5 Operable Unit 6, Verification Work Plan, Quality Assurance Project Plan, July 1992

Reference 6 Operable Unit 5, Remedial Investigation/Feasibility Study, Sampling and Analysis Plan – Quality Assurance Project Plan, December 1993

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Reference 8 Mound Methods Compendium, MD-80045, Issue 2, January 2002

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Reference 11 Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. Prepared by Hazardous Waste Remedial Actions Program managed by Lockheed Martin Energy Systems, Inc. March 1997

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Reference 16 "Dermal Exposure Assessment: Principles and Applications," EPA/600/8-91/011b, Office of Health and Environmental Assessment, Washington, DC. 1992

Reference 17 Sax's Dangerous Properties of Industrial Materials, tenth Edition, John Wiley & Sons, 1999

Reference 18 ATSDR ToxProfiles Website: www.atsdr.cdc.gov

Reference 19 Lead Human Health Sheet, ANL website: www-unix.mcs.anl.gov/mpi/index.html

APPENDIX A

Evaluation of Potential Cumulative Risk due to Exposure to Contaminants in Air

A1.1 EVALUATION OF POTENTIAL CUMULATIVE EXPOSURE – AIR

Potential exposure to contaminants originating from outside Phase I that may reach a receptor in the phase are termed potential cumulative exposures. This appendix presents potential cumulative exposures that may come from air.

Airborne contaminant concentrations were measured at the Mound Facility in 1994 during various site restoration activities (DOE, 1994). Both radiological and non-radiological data were collected. These data are shown in Table A1-1. It is assumed that the measured concentrations would represent an upper-bound air concentration. Trends in air COPCs have not increased since this evaluation was conducted; therefore, the measured concentrations are representative of current exposure and are assumed to be representative of future exposures.

Risks due to inhalation of the radionuclides by construction workers and site employees were calculated and are also presented in Table A1-1. The calculated risks attributable to the potential upper-bound exposure of airborne contaminants would total 2.0E-07 for the construction worker and 9.8E-07 for the site employee. Note that the potential exposures and associated risks are based on the assumption of long-term consumption of this upper-bound concentration that was measured during site restoration activities.

Table A1-1 Concentration of Radionuclides in Air in 1994 (EG&G Mound Applied Technologies- Mound Site Environmental Report for Calendar Year 1994, pg. 4-15 to 4-17) MLM-3814

Radionuclide	Maximum Concentration* (μCi/mL)	Risks to Construction Worker*	Risks to Site Employees**
Tritium oxide (H-3)	7.54 ± 4.61E-12	1.8E-08	9.0E-08
Plutonium-238	259.65 ± 289.58E-18	1.75E-07	8.8E-07
Plutonium-239/240	3.50 ±2.75E-18	2.5E-09	1.2E-08
Total		2.0E-07	9.8E-07

* Error limits are estimates of the standard error of the estimated means at the 95% confidence level. Values given are from the location on the site with the highest concentration (based on the average of two or more samples).

** Calculated risks assumed that the maximum concentration shown here was the C_{air} value needed for the calculation of risk by inhalation for construction workers and site employees.

APPENDIX B

Methodology and Evaluation of Groundwater Exposure for Mound RRE

Potential Future Maximum Concentrations of COPCs in Groundwater

This Appendix describes the steps completed to estimate the potential future concentration of contaminants in the Mound Plant Production Wells. In summary, very conservative estimates of future contaminant concentrations were developed by assuming all contaminants currently detected in the Bedrock Aquifer of the Mound Property would migrate to the Buried Valley Aquifer (BVA), from which the Mound Plant Production Wells withdraw potable water for Mound facility use. The calculated potential bedrock contaminant concentrations were then added to the current contaminant concentrations in the Mound Plant Production Wells to obtain the estimated future contaminant concentrations.

The techniques used to forecast future contaminant concentrations were purposely designed to represent the most conservative (worst-case) future scenario possible. This overly conservative approach assures no significant chemical of concern would be prematurely removed from the risk evaluation process. The steps completed to develop this initial "model" of the future contaminant concentrations in the Mound Plant Production Wells are summarized as follows.

1. Using established groundwater flow net analysis techniques, a topographic map of the bedrock surface underlying the Mound facility was used to create 20 evaluation areas of similar size termed "flow tubes." Groundwater flow within the Bedrock Aquifer was assumed to generally follow the topography of the bedrock surface. The flow tubes were delineated based on drainage patterns suggested by the bedrock topographic map (see Figure B-1). Within each flow tube it is assumed groundwater flows in the same general direction, on a slope of the same general gradient. Based on topography and gradient, groundwater from the majority of these flow tubes will eventually flow into the BVA. Although several of the flow tubes do not appear to contribute to the BVA directly, they were considered to contribute to the BVA to make the future scenario as conservative as possible.

2. All contaminant concentration data from bedrock wells currently maintained or archived in the MEIMS database were examined for each

flow tube. The maximum concentration of each analyte for any of the bedrock wells or selected bedrock seeps was assumed to be representative of the contamination within the flow tube. This maximum concentration was multiplied by the volume of water per unit time that flows within each flow tube in order to determine the mass of each contaminant that could be contributed to the BVA production wells.

3. The total flow of each tube was determined by measuring the width and gradient of the flow tube from the bedrock topographic map. These were multiplied by the assumed thickness of the bedrock aquifer (40 feet), and by the assumed hydraulic conductivity (0.1 feet/day). The product of these values is the volume of groundwater flow per tube per unit time.

4. The maximum concentration of each analyte from each flow tube was applied to the total flow of each tube to determine a potential mass of contaminant entering the BVA per year per flow tube.

5. The contaminant mass from each flow tube was summed to provide the total potential mass of each contaminant contributed by the bedrock aquifer to the BVA per year.

6. The total mass of each contaminant was divided by an assumed Mound Plant water use of 260,000 gallons per day (94,900,000 gallons per year) to obtain the theoretical concentration of the bedrock contribution for all bedrock contaminants. Therefore, the very conservative assumption is made that the masses of all contaminants that enter the BVA from the bedrock contribute to the production wells without any dilution or degradation.

7. This theoretical concentration was added to the current concentration of contaminants observed in the Mound Plant Production wells to obtain the theoretical worst-case future groundwater concentration.

This approach represents the most conservative scenario possible using currently available groundwater data. A more realistic estimate of the future groundwater concentrations would require consideration of dilution and

degradation of contaminants within the bedrock and the BVA aquifers, quantification of the actual amounts of bedrock water intercepted by the Mound production wells, and replacement of the maximum contaminant concentrations with more representative values.

Table B-1 lists all contaminants of potential concern detected in either a bedrock well, see, or a Mound Plant production well, their respective concentrations, and the calculated combined estimated future maximum concentration.

Antimony – An Example

The wells and seeps selected to best represent the water quality of the consolidated lithologic units beneath the Mound are summarized in Table B-2. Upon review of the data in the MEIMS database for these monitoring locations, antimony was detected in the bedrock monitoring wells and seeps in 47 out of 158 analyses for this parameter. All designated wells and seeps were assigned to specific flow tubes. The highest concentration measured in each monitoring well or seep within a flow tube was used to calculate a potential annual contribution of antimony to the groundwater. Table B-3 summarizes the water volume and concentrations used to project antimony to the Mound production wells.

As shown in Table B-1, the calculated COPC concentration obtained from the flow tube model is added to the existing concentration measured in the production wells. It is this potential future maximum constituent concentration that is the RRE modeling process.

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
630-20-6	1,1,1,2-Tetrachloroethane	0.000112017	0	0.000112017
71-55-6	1,1,1-Trichloroethane	0.00048027	0.000898	0.00137827
79-34-5	1,1,2,2-Tetrachloroethane	0.00048027	0	0.00048027
79-00-5	1,1,2-Trichloroethane	0.000459043	0	0.000459043
75-34-3	1,1-Dichloroethane	0.000468441	0.000341	0.000809441
75-35-4	1,1-Dichloroethene	0.000481229	0.00039	0.000871229
96-18-4	1,2,3-Trichloropropane	0.000112017	0	0.000112017
120-82-1	1,2,4-Trichlorobenzene	0.001231584	0	0.001231584
156-59-2	1,2-cis-Dichloroethene	0.000618206	0.00108	0.001698206
95-50-1	1,2-Dichlorobenzene	0.000864843	0	0.000864843
107-06-2	1,2-Dichloroethane	0.000459916	0	0.000459916
540-59-0	1,2-Dichloroethene		0.0072	0.0072
78-87-5	1,2-Dichloropropane	0.000462048	0	0.000462048
135-01-3	1,2-Diethylbenzene	0.000303543	0	0.000303543
156-60-5	1,2-trans-Dichloroethene	0.000492922	0.000388	0.000880922
99-35-4	1,3,5-Trinitrobenzene	0.000265123	0	0.000265123
10061-01-5	1,3-cis-Dichloropropene	0.000525984	0.000553	0.001078984
541-73-1	1,3-Dichlorobenzene	0.00091014	0	0.00091014
141-93-5	1,3-Diethylbenzene	0.000112017	0	0.000112017
99-65-0	1,3-Dinitrobenzene	0.000155904	0	0.000155904
10061-02-6	1,3-trans-Dichloropropane	0.000525984	0	0.000525984
106-46-7	1,4-Dichlorobenzene	0.000885431	0	0.000885431
105-05-5	1,4-Diethylbenzene	0.000112017	0	0.000112017
544-10-5	1-Chlorohexane	0.000112017	0	0.000112017
108-60-1	2,2'-oxybis(1-chloropropane)	0.001862313	0	0.001862313
95-95-4	2,4,5-Trichlorophenol	0.004912268	0	0.004912268
88-06-2	2,4,6-Trichlorophenol	0.001231584	0	0.001231584
118-96-7	2,4,6-Trinitrotoluene	0.000145622	0	0.000145622
120-83-2	2,4-Dichlorophenol	0.001231584	0	0.001231584
105-67-9	2,4-Dimethylphenol	0.001231584	0	0.001231584
51-28-5	2,4-Dinitrophenol	0.004912268	0	0.004912268
121-14-2	2,4-Dinitrotoluene	0.00120126	0	0.00120126
606-20-2	2,6-Dinitrotoluene	0.001108858	0	0.001108858
35572-78-2	2-Amino-4,6-Dinitrotoluene	8.90831E-05	0	8.90831E-05
120-32-1	2-Benzyl-4-Chlorophenol	0.001231584	0	0.001231584
78-93-3	2-Butanone	0.002895276	0.041	0.043895276
110-75-8	2-Chloroethylvinylether	0.000652447	0	0.000652447
91-58-7	2-Chloronaphthalene	0.001231584	0	0.001231584
95-57-8	2-Chlorophenol	0.001231584	0	0.001231584
95-49-8	2-Chlorotoluene	0.000112017	0	0.000112017
591-78-6	2-Hexanone	0.001120167	0	0.001120167

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
91-57-6	2-Methylnaphthalene	0.001241754	0	0.001241754
95-48-7	2-Methylphenol	0.001231584	0	0.001231584
88-74-4	2-Nitroaniline	0.004912268	0	0.004912268
88-75-5	2-Nitrophenol	0.001231584	0	0.001231584
91-94-1	3,3'-Dichlorobenzidine	0.001962855	0	0.001962855
99-09-2	3-Nitroaniline	0.004912268	0	0.004912268
72-54-8	4,4'-DDD	1.15404E-05	0	1.15404E-05
72-55-9	4,4'-DDE	1.15404E-05	0	1.15404E-05
50-29-3	4,4'-DDT	1.15404E-05	0	1.15404E-05
534-52-1	4,6-Dinitro-o-Cresol	0.004912268	0	0.004912268
101-55-3	4-Bromophenyl-phenyl Ether	0.001231584	0	0.001231584
59-50-7	4-Chloro-3-Methylphenol	0.001231584	0	0.001231584
106-47-8	4-Chloroaniline	0.001231584	0	0.001231584
7005-72-3	4-Chlorophenyl-Phenylether	0.001231584	0	0.001231584
106-43-4	4-Chlorotoluene	0.000112017	0	0.000112017
108-10-1	4-Methyl-2-pentanone	0.001013606	0	0.001013606
106-44-5	4-Methylphenol	0.002044743	0	0.002044743
100-01-6	4-Nitroaniline	0.004912268	0	0.004912268
100-02-7	4-Nitrophenol	0.004912268	0	0.004912268
83-32-9	Acenaphthene	0.001344013	0	0.001344013
208-96-8	Acenaphthylene	0.001422283	0	0.001422283
67-64-1	Acetone	0.002547214	0.012	0.014547214
75-05-8	Acetonitrile	0.005429501	0	0.005429501
107-13-1	Acrylonitrile	0.005429501	0	0.005429501
7440-34-8	Actinium-227	3.561494238		3.561494238
309-00-2	Aldrin	5.79147E-06	0	5.79147E-06
5103-71-9	Alpha Chlordane	3.3283E-05	0	3.3283E-05
319-84-6	Alpha-BHC	5.79147E-06	0	5.79147E-06
7429-90-5	Aluminum	1.875810437	0.148	2.023810437
14596-10-2	Americium-241	0.808115673	0	0.808115673
7664-41-7	Ammonia	1.038369547	0.58	1.618369547
120-12-7	Anthracene	0.001231584	0	0.001231584
7440-36-0	Antimony	0.003983868	0.0144	0.018383868
12674-11-2	Aroclor-1016	5.91352E-05	0	5.91352E-05
11104-28-2	Aroclor-1221	6.1576E-05	0	6.1576E-05
11141-16-5	Aroclor-1232	5.91352E-05	0	5.91352E-05
53469-21-9	Aroclor-1242	5.91352E-05	0	5.91352E-05
12672-29-6	Aroclor-1248	5.91352E-05	0	5.91352E-05
11097-69-1	Aroclor-1254	8.62573E-05	0	8.62573E-05
11096-82-5	Aroclor-1260	8.62573E-05	0	8.62573E-05
7440-38-2	Arsenic	0.018391503	0	0.018391503
7440-39-3	Barium	0.08931148	0.0936	0.18291148
71-43-2	Benzene	0.000518324	0	0.000518324

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
56-55-3	Benzo(a)anthracene	0.001231584	0	0.001231584
50-32-8	Benzo(a)pyrene	0.001231584	0	0.001231584
205-99-2	Benzo(b)fluoranthene	0.001231584	0	0.001231584
191-24-2	Benzo(g,h,i)perylene	0.001231584	0	0.001231584
207-08-9	Benzo(k)fluoranthene	0.001231584	0	0.001231584
65-85-0	Benzoic Acid	0.018876741	0	0.018876741
100-51-6	Benzyl Alcohol	0.001231584	0	0.001231584
100-44-7	Benzyl Chloride	0.000112017	0	0.000112017
7440-41-7	Beryllium	0.000290252	0	0.000290252
319-85-7	Beta-BHC	5.79147E-06	0	5.79147E-06
111-91-1	Bis(2-chloroethoxy)methane	0.001231584	0	0.001231584
111-44-4	Bis(2-chloroethyl)ether	0.001231584	0	0.001231584
117-81-7	Bis(2-ethylhexyl)phthalate	0.017553582	0	0.017553582
7440-69-9	Bismuth	0.024087072	0	0.024087072
14331-79-4	Bismuth-210	1.552696539	0.39	1.942696539
7440-42-8	Boron	0.020762697		0.020762697
74-97-5	Bromochloromethane	0.005824867	0	0.005824867
75-27-4	Bromodichloromethane	0.000474835	0.000379	0.000853835
75-25-2	Bromoform	0.000496147	0	0.000496147
74-83-9	Bromomethane	0.001120167	0	0.001120167
85-68-7	Butyl Benzyl Phthalate	0.001231584	0	0.001231584
7440-43-9w	Cadmium	0.001469976	0.00656	0.008029976
7440-70-2	Calcium	77.49407787	110	187.4940779
86-74-8	Carbazole	0.001231584	0	0.001231584
75-15-0	Carbon Disulfide	0.000560083	0	0.000560083
56-23-5	Carbon Tetrachloride	0.000479097	0	0.000479097
10045-97-3	Cesium-137	1.628165373	0	1.628165373
108-90-7	Chlorobenzene	0.000496147	0	0.000496147
75-00-3	Chloroethane	0.001120167	0	0.001120167
67-66-3	Chloroform	0.000464179	0.000416	0.000880179
74-87-3	Chloromethane	0.001120167	0	0.001120167
25168-05-2	Chlorotoluene	0.000112017	0	0.000112017
218-01-9	Chrysene	0.001231584	0	0.001231584
7440-47-3	Chromium	0.944047832	0.0202	0.964247832
7440-48-4	Cobalt	0.009465879	0	0.009465879
10198-40-0	Cobalt-60	1.770258695	0	1.770258695
7440-50-8	Copper	0.01409079	0.0416	0.05569079
57-12-5	Cyanide	0.001290095	0	0.001290095
319-86-8	Delta-BHC	5.79147E-06	0	5.79147E-06
53-70-3	Dibenz(a,h)anthracene	0.001231584	0	0.001231584
132-64-9	Dibenzofuran	0.001231584	0	0.001231584
124-48-1	Dibromochloromethane	0.000472704	0	0.000472704
74-95-3	Dibromomethane	0.000314634	0	0.000314634

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
75-71-8	Dichlorodifluoromethane	0.000191343	0	0.000191343
60-57-1	Dieldrin	1.15404E-05	0	1.15404E-05
84-66-2	Diethyl Phthalate	0.001231584	0	0.001231584
131-11-3	Dimethyl Phthalate	0.001231584	0	0.001231584
84-74-2	Di-n-butyl Phthalate	0.001231584	0	0.001231584
117-84-0	Di-n-octyl Phthalate	0.001231584	0	0.001231584
959-98-8	Endosulfan I	5.79147E-06	0	5.79147E-06
33213-65-9	Endosulfan II	1.15404E-05	0	1.15404E-05
1031-07-8	Endosulfan Sulfate	1.15404E-05	0	1.15404E-05
72-20-8	Endrin	1.15404E-05	0	1.15404E-05
7421-93-4	Endrin Aldehyde	1.15404E-05	0	1.15404E-05
53494-70-5	Endrin Ketone	1.15404E-05	0	1.15404E-05
100-41-4	Ethylbenzene	0.000529606	0.000482	0.001011606
206-44-0	Fluoranthene	0.001231584	0	0.001231584
86-73-7	Fluorene	0.001231584	0	0.001231584
462-06-6	Fluorobenzene	0.008737301		0.008737301
76-13-1	FREON-113	0.000385419	0.034	0.034385419
5103-74-2	Gamma Chlordane	3.3283E-05	0	3.3283E-05
58-89-9	Gamma-BHC (Lindane)	5.79147E-06	0	5.79147E-06
76-44-8	Heptachlor	5.79147E-06	0	5.79147E-06
1024-57-3	Heptachlor Epoxide	5.79147E-06	0	5.79147E-06
118-74-1	Hexachlorobenzene	0.001231584	0	0.001231584
87-68-3	Hexachlorobutadiene	0.001231584	0	0.001231584
77-47-4	Hexachlorocyclopentadiene	0.001231584	0	0.001231584
67-72-1	Hexachloroethane	0.001231584	0	0.001231584
110-54-3	Hexane	0.001120167		0.001120167
2691-41-0	HMX	0.000235872	0	0.000235872
193-39-5	Indeno(1,2,3-cd)pyrene	0.001231584	0	0.001231584
74-88-4	Iodomethane	0.000784134		0.000784134
7439-89-6	Iron	9.438456297	0.437	9.875456297
78-59-1	Isophorone	0.001231584	0	0.001231584
7439-92-1	Lead	0.006409627	0.013	0.019409627
7439-93-2	Lithium	0.148116009	0.0029	0.151016009
7439-95-4	Magnesium	33.49199549	34.5	67.99199549
7439-96-5w	Manganese	0.188464291	0.0269	0.215364291
7439-97-6	Mercury	4.40536E-05	0	4.40536E-05
72-43-5	Methoxychlor	5.79147E-05	0	5.79147E-05
75-09-2	Methylene Chloride	0.014699676	0.000697	0.015396676
7439-98-7	Molybdenum	0.01215327	0.0027	0.01485327
91-20-3	Naphthalene	0.001344013	0	0.001344013
13994-20-2	Neptunium-237	26.47635152	0	26.47635152
7440-02-0	Nickel	0.261572678	0.0163	0.277872678
14797-55-8	Nitrate	0.63263791	2.55	3.18263791

Table B-1
Exposure Point Concentrations for Modeled Future Groundwater
Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
14797-65-0	Nitrite	0.003928125		0.003928125
14797-55-8nn	Nitrate/Nitrite	1.609755573	4.9	6.509755573
98-95-3	Nitrobenzene	0.000854054	0	0.000854054
7727-37-9	Nitrogen	0.911888948	0.62	1.531888948
621-64-7	N-Nitroso-di-n-propylamine	0.001231584	0	0.001231584
86-30-6	N-Nitrosodiphenylamine	0.001231584	0	0.001231584
348-51-6	O-Chloroflurobenzene	0.007169067		0.007169067
87-86-5	Pentachlorophenol	0.004912268	0	0.004912268
78-11-5	PETN	0.000112017	0	0.000112017
85-01-8	Phenanthrene	0.001231584	0	0.001231584
108-95-2	Phenol	0.001231584	0	0.001231584
108-86-1	Phenyl bromide, Monobromob	0.000224033	0	0.000224033
14265-44-2	Phosphate	0.187355687	0.22	0.407355687
13981-16-3	Plutonium-238	0.077661245	0.181	0.258661245
15117-48-3	Plutonium-239	0.001604465	0	0.001604465
PU-239/240	Plutonium-239/240	0.042182144	2	2.042182144
13982-10-0	Plutonium-242	0.022723533	#N/A	#N/A
7440-09-7	Potassium	9.811226641	3.65	13.46122664
13966-00-2	Potassium-40	48.3051639	0	48.3051639
13981-14-1	Protactinium-233	6.197215267	0	6.197215267
129-00-0	Pyrene	0.001231584	0	0.001231584
13982-63-3	Radium-226	1.16493353	0.52	1.68493353
15262-20-1	Radium-228	0.417873369		0.417873369
121-82-4	RDX	0.000120628	0	0.000120628
7782-49-2	Selenium	0.001281403	0.0015	0.002781403
7440-22-4	Silver	0.005213044	0.018	0.023213044
7440-23-5	Sodium	279.6337996	66.4	346.0337996
10098-97-2	Stronium-90	0.91727463	0.5	1.41727463
100-42-5	Styrene	0.000560083	0	0.000560083
127-18-4	Tetrachloroethene	0.000561683	0.000963	0.001524683
479-45-8	Tetryl	0.00033605	0	0.00033605
7440-28-0	Thallium	0.001649558	0.002	0.003649558
15623-47-9	Thorium-227	20.67086777	0.23	20.90086777
14274-82-9	Thorium-228	75.33339736	2.17	77.50339736
15594-54-4	Thorium-229		#N/A	#N/A
14269-63-7	Thorium-230	0.144156019	0.476	0.620156019
7440-29-1	Thorium-232	0.080276175	0.1	0.180276175
7440-31-5	Tin	0.011059047	0.0087	0.019759047
108-88-3	Toluene	0.000592599	0.000503	0.001095599
8001-35-2	Toxaphene	0.000579147	0	0.000579147
79-01-6	Trichloroethene	0.001578957	0.00231	0.003888957
75-69-4	Trichlorofluoromethane	0.000239418	0.000432	0.000671418
10028-17-8w	Tritium	65998.95738	799	66797.95738

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Using Bedrock Flow Tube Model Results

CAS Number	Constituents in Production or Bedrock Wells	Bedrk. Contribution to BVA (mg/L or pCi/L)	Current Production Well EPC (mg/L or pCi/L)	Est. Future EPC Conc. (mg/L or pCi/L)
13968-55-3	Uranium-233	1.361946326		1.361946326
U-233/234	Uranium-233/234	0.108421116	0.246	0.354421116
13966-29-5	Uranium-234	0.581258098	2.02	2.601258098
15117-96-1	Uranium-235	1.682512969	0.466	2.148512969
U-235/236	Uranium-235/236	0.018390817	0	0.018390817
7440-61-1	Uranium-238	0.14342314	0.409	0.55242314
7440-62-2	Vanadium	0.011081055	0.0146	0.025681055
108-05-4	Vinyl Acetate	0.000970982	0	0.000970982
75-01-4	Vinyl Chloride	0.000928358	0	0.000928358
1330-20-7	Xylenes, Total	0.000559569	0.000556	0.001115569
7440-66-6	Zinc	0.020243241	0.0577	0.077943241

Table B-2
Locations and Details of Water Quality Monitoring Sites
Used in Bedrock Flow Tube Calculations

Well / Seep I.D.	Parcel	Flow Tube	Well Depth (feet)	Screen Length (feet)	Depth into Bedrock (feet)	Comments
Bedrock Monitoring Wells						
0034 (a)	8	11	20.61	3	7.5	Abandoned – Historical Data Only. Use in flow Tube 11
0035 (a)	8	12	20+	2	6.0	Abandoned – Historical Data Only. Use in flow Tube 12
0012	7	11	36.70	10	13.0	Use in Flow Tube 11
0013	6	Recharge Area	55.72	3 (upper) 3 (lower)	56.5	Use in Flow Tube 15. At top of recharge area
0014	8	Recharge Area	51.31	3 (upper) 3 (lower)	39.5	Use in Flow Tube 15. At top of recharge area
0015	8	15	40.25	10	27.5	Use in Flow Tube 15. At top of recharge area
0116	8	Recharge Area	81.95	10	69.5	Use in Flow Tube 15. At top of recharge area
0117	8	12	18.10	10	15.0	Use in Flow Tube 12
0120	8	12	32.86	10	28.5	Use in Flow Tube 12
0227 (a)	8	13	35.29	2	3.0	Abandoned – Historical Data Only. Use In Flow Tube 13
0242 (a)	8	12	15.36	2	11.5	Abandoned – Historical Data Only. Use in flow Tube 12
0312	8	13	34.50	10	6.5	Use in Flow Tube 13
0318	7	9	31.07	10	17.0	Use in Flow Tube 9
0322	7	20	56.27	10	12.5	Use in Flow Tube 20
0323	8	13	17.53	5	8.0	Use in Flow Tube 13
0324	8	13	19.82	5	19.0	Use in Flow Tube 13
0325	7	7	31.93	10	26.0	Use in Flow Tube 7
0326	7	8	35.06	10	19.0	Use in Flow Tube 8
0332	MMCIC	20	31.56	10	19.0	Use in Flow Tube 20
0335	Off Site	15	54.51	5	33.0	Use in Flow Tube 15. In discharge area
0351	MMCIC	4	21.39	10	16.7	Use in Flow Tube 4. At top of recharge area
0354	4	4	26.06	10	11.5	Use in Flow Tube 4
0372	8	6	64.16	10	12.0	Use in Flow Tube 6
0380	8	6	63.08	10	28.0	Use in Flow Tube 6. At base of Flow Tube in discharge area
0381	8	6	39.59	10	12.0	Use in Flow Tube 6
0382	8	6	37.25	10	17.8	Use in Flow Tube 6
0399	4	3	34.93	10	29.0	Use in Flow Tube 3
0411	5	5	39.70	10	24.0	Use in Flow Tube 5
0442	Phase I	3	33.45	10	28.5	Use in Flow Tube 3
0443	Phase I	6	37.86	10	36.5	Use in Flow Tube 6
0444	Phase I	5	30.68	10	29.5	Use in Flow Tube 5
0445	Phase I	5	40.53	10	38.5	Use in Flow Tube 5
P004	8	6	64.51	10	12.4	Use in Flow Tube 6
P021	7	12	33.08	5	8.0	Use in Flow Tube 12
P024	9	6	42.58	5	5.0	Use in Flow Tube 6

Table B-2
Locations and Details of Water Quality Monitoring Sites
Used in Bedrock Flow Tube Calculations

Well / Seep I.D.	Parcel	Flow Tube	Well Depth (feet)	Screen Length (feet	Depth into Bedrock (feet)	Comments
Interface Monitoring Wells – Partially Screened into Bedrock						
0314	8	6	45.47	10	65.5	Use in Flow Tube 6. At base of Flow Tube in discharge area
0353	8	5	22.12	5	2.0	Use in Flow Tube 5, although very Shallow
Bedrock Seeps with Annual Flow						
601	8	14	NA	NA	NA	Use in Flow Tube 14
607	3	18	NA	NA	NA	Use in Flow Tube 18
Production Wells						
0076	All	All	64	15.5	NA	Use as Receptor Well
0271	All	All	59	15.5	NA	Use as Receptor Well

a - abandoned

Table B-3
Contribution of Antimony to Bedrock-derived Groundwater for the Future Maximum Concentration Evaluation

Flow Tube (#)	Flow Tube Discharge (liters/yr)	Parameter Max. Conc. (mg/L)	Annual Bdrk Contribution (mg)
1	3158986	0.0067	21165
2	2622525	0.0067	17571
3	2986588	0.0067	20010
4	3497913	0.0063	22037
5	5926541	0.0117	69341
6	5179894	0.0111	57497
7	4577574	0.0102	46691
8	5311033	0.0128	67981
9	3438297	0.0085	29226
10	4286151	0.009	36432
11	3020572	0.0055	16613
12	4278420	0.03	128353
13	3684327	0.0176	64844
14	1624763	0.0302	49068
15	3136537	0.0031	9723
16	3742041	0.003	11600
17	8624724	0.0416	358788
18	5031433	0.0416	209308
19	4424896	0.0416	184076
20	1925159	0.0056	10781
Averages	4098873	0.015455	71555
Totals	81977457		***1431105***

Mound Water Use:

260000 gallons/day
94900000 gallons/year
359224970 liters/year

Projected to the BVA: Antimony contribution from bedrock 0.003984 mg/L

Figure B-1. Flow tube designations for calculating future constituents concentrations at the Mound Facility.

APPENDIX C

Tables

Table 1: Data Source Summary

Project Code	Description	Status	Matrix
BURNAREA	Burn Area Sampling	Used	Soil
WASTEBURI	Characterization of Waste Burial Areas	Used	Soil
BLDG21	D & D Building 21 and Surrounding Soils	Used	Soil
BLDG21-97	D & D Building 21 and Surrounding Soils Jul 97	Used	Soil
HWSF	Hazardous Waste Storage Facility	Used	Soil
MND20	Mound - Operable Unit 9	Used	Soil
DOEES	Mound Plant Environmental Survey	Filtered Out	Soil
SCRDATA	Mound Plant Screening Data	Used	Soil
34896	New Property	Used	Soil
34897	New Property Extended Phase	Used	Soil
MND33	Operable Unit 3 LFI	Used	Soil
2680	Operational Area Investigation (OU5)	Used	Soil
MND17	Other Soils Areas	Filtered Out	Soil
RSS	Radiological Site Survey - OU9 Site Scoping Report	Used	Soil
OU6RECON	Reconnaissance Sampling OU6 D&D Areas	Used	Soil
04-2768	Regional Soils Investigation	Used	Soil
SGCSP	Soil Gas Confirmation Sampling	Used	Soil
SGS	Soil Gas Survey Area K	Filtered Out	Soil
PRS280	PRS 280	Used	Soil
PRS407VERF	PRS 407 Verfication Sampling	Used	Soil
P4P5BOUND	Parcel 4, Parcel 5 Boundary	Used	Soil
PRS421	PRS 421 Sample Data	Used	Soil
TF2001	Test Fire Valley (PRS 72, 73 & 87)	Used	Soil
PRS274	PRS 274/275 Characterization (one borehole B103 at edge of PRS)	Used	Soil
PRS276V	PRS 276 Verification	Used	Soil
WELL0411	Well 0411 Additional Work	Used	Soil
PRS421V	PRS 421 Verification 2002	Used	Soil
PRS276C	PRS 276 Characterization	Used	Soil
BDB2002	Bio degredation Barn Petrol Sampling	Used	Soil
GWMDR	Cum. GW Monitoring Data Report 4th Qtr FY'92	Used	Water
GWSW	GW and Seep Water Reports 91	Used	Water
GWMDR2	GW Monitoring and Mapping Results Dec 92	Used	Water
GWMDR6	GW Monitoring and Mapping Results Dec 95	Used	Water

Table 1: Data Source Summary

Project Code	Description	Status	Matrix
GWMDR5	GW Monitoring and Mapping Results Jun 95	Used	Water
GWMDR3	GW Monitoring and Mapping Results Mar 93	Used	Water
GWQDR	GW Quality Data Sampling Hits 2/84 thru 9/91	Used	Water
GWPMPP398	GWPMPP & OU1 Qtr Mon Mar 98	Used	Water
GWPMPP1297	GWPMPP Annual & OU1 Qtr Mon DEC. 97	Used	Water
GWPMPP	GWPMPP Dec 96 Annual Sampling	Used	Water
GWPMPP697	GWPMPP Semi-Annual & OU1 Qtr Mon Jun 97	Used	Water
GWPMPP997	GWPMPP Semi-Annual & OU1 Qtr Mon Sep 97	Used	Water
GWPMPP0698	GWPMPP Semi-Annual Jun 98	Used	Water
MHSEEP	Main Hill Seep Sampling	Used	Water
MAR97GWP	Mar 1997 Quarterly Groundwater Monitoring	Used	Water
DOEES	Mound Plant Environmental Survey	Filtered Out	Water
34897	New Property Extended Phase	Used	Water
OU1PTBASE	OU-1 Pump & Treat Baseline, Spring Qtr 97	Used	Water
SWEEPS	OU9 Groundwater Sweeps	Used	Water
MND01	Operable Unit 1	Used	Water
MND23	PAW Soils - Operable Unit 1(RIR)	Used	Water
PRS111	PRS 111 Sampling	Used	Water
04-2768	Regional Soils Investigation	Used	Water
SPRFLG	Spring Fling Tritium Water Sampling (Pre Weston)	Used	Water
SWSD	Surface Water and Sediment	Used	Water
GWPMPP1098	GWPMPP QTR MON.OCT. 98	Used	Water
GWPMPP0199	GWPMPP ANNUAL MON. JAN. 99	Used	Water
GWPMPP4_99	GWPMPP QUARTERLY MONITORING APRIL 1999	Used	Water
GWPMPP6_99	GWPMPP SEMI-ANNUAL MONITORING JUNE 1999	Used	Water
GWPMPP9_99	GWPMPP Fall 1999 Quarterly Groundwater Monitoring	Used	Water
GWPMPP1_00	GWPMPP Annual Monitoring January 2000	Used	Water
DWRAPC91	Drinking Water Risk Assessment Project Chemical 91	Used	Water
DWRAPC92	Drinking Water Risk Assessment Project Chemical 92	Used	Water
DWRAPC93	Drinking Water Risk Assessment Project Chemical 93	Used	Water
DWRAPC94	Drinking Water Risk Assessment Project Chemical 94	Used	Water
DWRAPC95	Drinking Water Risk Assessment Project Chemical 95	Used	Water
DWRAPC96	Drinking Water Risk Assessment Project Chemical 96	Used	Water

Table 1: Data Source Summary

Project Code	Description	Status	Matrix
DWRAPC97	Drinking Water Risk Assessment Project Chemical 97	Used	Water
DWRAPC98	Drinking Water Risk Assessment Project Chemical 98	Used	Water
DWRAPC99	Drinking Water Risk Assessment Project Chemical 99	Used	Water
DWRAPC00	Drinking Water Risk Assessment Project Chemical 00	Used	Water
DWRAPR99	Drinking Water Risk Assessment Project Rad 99	Used	Water
GWPMPP4_00	GWPMPP Quarterly GW Monitoring - April 2000	Used	Water
GWPMPP6_00	GWPMPP Semiannual GW Monitoring June 2000	Used	Water
GWPMPP9_00	GWPMPP Quarterly Monitoring - September 2000	Used	Water
GWPMPP1_01	GWPMPP Quarterly GW Monitoring - Jan 2001	Used	Water
GWPMPP4_01	GWPMPP Quarterly Monitoring April 2001	Used	Water
GWPMPP7_01	GWPMPP Semiannual GW Monitoring - July 2001	Used	Water
GWPMPP1001	GWPMPP Quarterly Monitoring - October 2001	Used	Water
GWPMPP4_02	GWPMPP Quarterly Monitoring April 2002	Used	Water
DWRAPC01	Drinking Water Risk Assessment Project Chemical 01	Used	Water
DWRAPC02	Drinking Water Risk Assessment Project Chemical 02	Used	Water

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Inorganics (mg/kg)									
Aluminum	7429-90-5	589.000	23000.000	N	145/ 146	23000.000	19000.000	21291.667	YES
Antimony	7440-36-0	0.210	44.500	D	64/ 209	44.500		8.517	YES
Arsenic	7440-38-2	0.490	19.500	X	137/ 143	19.500	8.600	1.987	YES
Barium	7440-39-3	4.400	604.000	X	226/ 227	604.000	180.000	1490.417	NO:2
Beryllium	7440-41-7	0.050	3.600	X	220/ 226	3.600	1.300	42.118	NO:2
Bismuth	7440-69-9	0.820	72.700	X	33/ 59	72.700			YES
Cadmium	7440-43-9s	0.250	11.700	D	69/ 227	11.700	2.100	21.292	NO:2
Calcium	7440-70-2	1420.000	342000.000	X	145/ 146	342000.000	310000.000		NO:4
Chromium	7440-47-3	1.100	37.000	X	226/ 227	37.000	20.000	31937.500	NO:2
Chromium VI	18540-29-9	1.100	37.000	X	226/ 227	37.000	20.000	63.664	NO:2
Cobalt	7440-48-4	0.790	25.000	X	145/ 146	25.000	19.000	1277.500	NO:2
Copper	7440-50-8	1.800	1100.000	X	143/ 146	1100.000	26.000	851.667	YES
Cyanide	57-12-5	0.100	8.900	D	35/ 162	8.900		425.833	NO:2
Iron	7439-89-6	23.000	43000.000	N	145/ 146	43000.000	35000.000		NO:4
Lead	7439-92-1	1.600	220.000	X	242/ 256	220.000	48.000		YES
Lithium	7439-93-2	2.300	34.100	N	53/ 55	34.100	26.000		YES
Magnesium	7439-95-4	12.000	120000.000	X	145/ 146	120000.000	40000.000		NO:4
Manganese	7439-96-5s	65.200	8190.000	X	137/ 138	8190.000	1400.000	2276.586	YES
Mercury	7439-97-6	0.030	1.400	D	61/ 139	1.400		6.387	NO:2
Molybdenum	7439-98-7	0.220	9.700	L	49/ 54	9.700	27.000	106.458	NO:2,3
Nickel	7440-02-0	2.300	247.000	X	224/ 227	247.000	32.000	425.833	NO:2
Potassium	7440-09-7	305.000	326000.000	X	142/ 147	326000.000	1900.000		NO:4
Selenium	7782-49-2	0.460	2.300	D	19/ 131	2.300		106.458	NO:2
Silver	7440-22-4	0.110	20.800	D	65/ 227	20.800	1.700	106.458	NO:2
Sodium	7440-23-5	41.700	3450.000	X	136/ 146	3450.000	240.000		NO:4
Thallium	7440-28-0	0.200	3.500	D	29/ 142	3.500	0.460	1.703	YES
Tin	7440-31-5	0.670	3.300	D	22/ 54	3.300	20.000	12775.000	NO:2,3
Vanadium	7440-62-2	1.700	42.700	X	145/ 146	42.700	25.000	149.042	NO:2
Zinc	7440-66-6	5.500	463.000	X	145/ 146	463.000	140.000	6387.500	NO:2

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Pesticides (mg/kg)									
4,4'-DDE	72-55-9	0.000	0.002	D	7/ 121	0.002	0.004	8.767	NO:2,3
Chlordane	57-74-9	0.019	0.098	D	2/ 23	0.098			YES
SVOCs (mg/kg)									
Anthracene	120-12-7	0.022	2.800	D	13/ 174	2.800		6387.500	NO:2
Benzo(a)anthracene	56-55-3	0.023	4.200	D	31/ 174	4.200		4.083	YES
Benzo(a)pyrene	50-32-8	0.023	3.600	D	29/ 174	3.600		0.408	YES
Benzo(b)fluoranthene	205-99-2	0.025	2.800	D	35/ 174	2.800		4.083	NO:2
Benzo(g,h,i)perylene	191-24-2	0.027	2.100	D	16/ 174	2.100			YES
Benzo(k)fluoranthene	207-08-9	0.021	3.400	D	27/ 174	3.400		40.833	NO:2
Bis(2-ethylhexyl)phthalate	117-81-7	0.019	6.500	D	59/ 159	6.500		212.917	NO:2
Chrysene	218-01-9	0.020	1.700	D	30/ 159	1.700		408.328	NO:2
Di-n-butyl Phthalate	84-74-2	0.021	2.000	D	61/ 240	2.000		2129.167	NO:2
Fluoranthene	206-44-0	0.023	11.000	D	48/ 174	11.000		851.667	NO:2
Indeno(1,2,3-cd)pyrene	193-39-5	0.025	1.900	D	18/ 174	1.900		4.083	NO:2
N-Nitrosodiphenylamine	86-30-6	0.057	0.210	D	8/ 159	0.210		608.333	NO:2
Phenanthrene	85-01-8	0.027	11.000	D	32/ 174	11.000			YES
Pyrene	129-00-0	0.026	9.700	D	45/ 174	9.700		638.750	NO:2
VOCs (mg/kg)									
2-Butanone	78-93-3	0.001	0.031	D	18/ 177	0.031		2279.081	NO:2
4-Methyl-2-pentanone	108-10-1	0.001	0.007	D	9/ 177	0.007		1703.333	NO:2
Acetone	67-64-1	0.004	0.170	D	48/ 177	0.170		2129.167	NO:2
Dichloromethane (Methylene Chloride)	75-09-2	0.003	0.068	D	96/ 200	0.068		82.665	NO:2
Naphthalene	91-20-3	0.001	0.006	D	3/ 6	0.006		425.520	NO:2
Tetrachloroethene	127-18-4	0.002	0.041	D	13/ 200	0.041		38.005	NO:2
Toluene	108-88-3	0.001	0.051	D	35/ 200	0.051		200.348	NO:2
Xylenes, Total	1330-20-7	0.001	0.039	D	16/ 177	0.039		42583.333	NO:2
mp-Xylene	mp-Xylene	0.005	0.006	X	23/ 23	0.006		276.987	NO:2

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Radionuclides (pCi/g)									
Actinium-227	14952-40-0	0.050	2.110	D	37/ 282	2.110		4.368	NO:2
Actinium-227 +D	14952-40-0(+D)	0.050	2.110	D	37/ 282	2.110		0.453	YES
Actinium-227 long lived decay	14952-40-0L	0.050	2.110	D	37/ 282	2.110		0.453	YES
Actinium-228	14331-83-0	0.762	1.380	D	7/ 7	1.380		0.215	YES
Bismuth-214	14733-03-0	0.699	0.926	N	10/ 10	0.926		0.130	YES
Cesium-137	10045-97-3	0.021	1.600	D	276/ 564	1.600	0.420	37.698	NO:2
Cesium-137 +D	10045-97-3(+D)	0.021	1.600	D	276/ 564	1.600	0.420	0.378	YES
Cesium-137 long lived decay	10045-97-3L	0.021	1.600	D	276/ 564	1.600	0.420	0.378	YES
Lead-210	14255-04-0	0.487	3.730	X	180/ 344	3.730		0.905	YES
Lead-210+D	14255-04-0(+D)	0.487	3.730	X	180/ 344	3.730		0.625	YES
Lead-210 long lived decay	14255-04-0L	0.487	3.730	X	180/ 344	3.730		0.625	YES
Lead-212	15092-94-1	0.843	1.220	L	10/ 10	1.220		1.776	NO:2
Lead-214	15067-28-4	0.570	1.120	N	20/ 20	1.120		0.991	YES
Plutonium-238	13981-16-3	0.012	396.400	D	665/1545	396.400	0.130	6.125	YES
Plutonium-239	15117-48-3	0.004	1.270	X	83/ 90	1.270	0.180	6.031	NO:2
Plutonium-239/240	PU-239/240	0.004	1.010	D	79/ 254	1.010	0.180		YES
Potassium-40	13966-00-2	7.180	36.600	X	122/ 126	36.600	37.000	1.168	NO:3
Radium-224	13233-32-4	0.073	6.270	X	190/ 190	6.270		3.238	YES
Radium-226	13982-63-3	0.179	3.700	X	494/ 567	3.700	2.000	2.170	YES
Radium-226+D	13982-63-3(+D)	0.179	3.700	X	494/ 567	3.700	2.000	0.109	YES
Radium-226 long lived decay	13982-63-3L	0.179	3.700	X	494/ 567	3.700	2.000	0.093	YES
Radium-228	15262-20-1	0.309	1.990	N	80/ 81	1.990		0.731	YES
Radium-228+D	15262-20-1(+D)	0.309	1.990	N	80/ 81	1.990		0.166	YES
Radium-228 long lived decay	15262-20-1L	0.309	1.990	N	80/ 81	1.990		0.069	YES
Thallium-208	14913-50-9	0.156	0.401	N	10/ 10	0.401		0.055	YES
Thorium-227	15623-47-9	0.060	0.440	L	17/ 33	0.440		2.125	NO:2
Thorium-228	14274-82-9	0.037	4.520	X	342/ 384	4.520	1.500	5.582	NO:2
Thorium-228+D	14274-82-9(+D)	0.037	4.520	X	342/ 384	4.520	1.500	0.118	YES
Thorium-228 long lived decay	14274-82-9L	0.037	4.520	X	342/ 384	4.520	1.500	0.118	YES
Thorium-230	14269-63-7	0.100	7.510	X	340/ 595	7.510	1.900	8.194	NO:2

Table 2: Initial Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Thorium-230 long lived decay	14269-63-7L	0.100	7.510	X	340/ 595	7.510	1.900	0.092	YES
Thorium-232	7440-29-1	0.045	80.100	D	789/1805	80.100	1.400	7.197	YES
Thorium-232 long lived decay	7440-29-1L	0.045	80.100	D	789/1805	80.100	1.400	0.068	YES
Uranium-234	13966-29-5	0.375	1.560	N	46/ 54	1.560	1.100	10.520	NO:2
Uranium-235	15117-96-1	0.027	0.210	D	28/ 77	0.210	0.110	1.596	NO:2
Uranium-235+D	15117-96-1(+D)	0.027	0.210	D	28/ 77	0.210	0.110	1.525	NO:2
Uranium-235 long lived decay	15117-96-1L	0.027	0.210	D	28/ 77	0.210	0.110	0.310	NO:2
Uranium-238	7440-61-1	0.408	1.950	X	72/ 119	1.950	1.200	11.648	NO:2
Uranium-238+D	7440-61-1(+D)	0.408	1.950	X	72/ 119	1.950	1.200	4.113	NO:2
Uranium-238 long lived decay	7440-61-1L	0.408	1.950	X	72/ 119	1.950	1.200	0.089	YES

"+D" : incorporates daughter products within the risk calculations

CAS: Chemical Abstract Service

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index

VOC: volatile organic compound

SVOC: semivolatile organic compound

Dist.: distribution where:

N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and

X = significantly different from lognormal or normal distribution

COPC: Constituent of Potential Concern, evaluation based on maximum detect vs. background or RBGV

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

Ta[illegible] 3: Final Identification of Current and Futu[illegible] Soil COPCs for the Construction Worker Sc[illegible]rio

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Inorganics (mg/kg)									
Aluminum	7429-90-5	589.000	23000.000	N	145/ 146	15400.000	15400.000	19000.000	NO
Antimony	7440-36-0	0.210	44.500	D	64/ 209	8.460	8.460		YES
Arsenic	7440-38-2	0.490	19.500	X	137/ 143	8.220	8.220	8.600	NO
Bismuth	7440-69-9	0.820	72.700	X	33/ 59	133.000	72.700		YES
Copper	7440-50-8	1.800	1100.000	X	143/ 146	22.100	22.100	26.000	NO
Lead	7439-92-1	1.600	220.000	X	242/ 256	15.400	15.400	48.000	NO
Lithium	7439-93-2	2.300	34.100	N	53/ 55	18.300	18.300	26.000	NO
Manganese	7439-96-5s	65.200	8190.000	X	137/ 138	679.000	679.000	1400.000	NO
Thallium	7440-28-0	0.200	3.500	D	29/ 142	1.140	1.140	0.460	YES
Pesticides (mg/kg)									
Chlordane	57-74-9	0.019	0.098	D	2/ 23	0.016	0.016		YES
SVOCs (mg/kg)									
Benzo(a)anthracene	56-55-3	0.023	4.200	D	31/ 174	0.321	0.321		YES
Benzo(a)pyrene	50-32-8	0.023	3.600	D	29/ 174	0.316	0.316		YES
Benzo(g,h,i)perylene	191-24-2	0.027	2.100	D	16/ 174	0.304	0.304		YES
Phenanthrene	85-01-8	0.027	11.000	D	32/ 174	0.348	0.348		YES
Radionuclides (pCi/g)									
Actinium-227 +D	14952-40-0(+D)	0.050	2.110	D	37/ 282	0.304	0.304		YES:1
Actinium-227 long lived decay	14952-40-0L	0.050	2.110	D	37/ 282	0.304	0.304		YES
Actinium-228	14331-83-0	0.762	1.380	D	7/ 7	1.230	1.380		YES:3
Bismuth-214	14733-03-0	0.699	0.926	N	10/ 10	0.858	0.926		YES:2
Cesium-137 +D	10045-97-3(+D)	0.021	1.600	D	276/ 564	0.159	0.159	0.420	NO
Cesium-137 long lived decay	10045-97-3L	0.021	1.600	D	276/ 564	0.159	0.159	0.420	NO
Lead-210	14255-04-0	0.487	3.730	X	180/ 344	1.150	1.150		YES:2
Lead-210+D	14255-04-0(+D)	0.487	3.730	X	180/ 344	1.150	1.150		YES:2
Lead-210 long lived decay	14255-04-0L	0.487	3.730	X	180/ 344	1.150	1.150		YES:2
Lead-214	15067-28-4	0.570	1.120	N	20/ 20	0.921	0.921		YES:2
Plutonium-238	13981-16-3	0.012	396.400	D	665/1545	25.900	25.900	0.130	YES
Plutonium-239/240	PU-239/240	0.004	1.010	D	79/ 254	0.044	0.044	0.180	NO
Radium-224	13233-32-4	0.073	6.270	X	190/ 190	1.250	1.250		YES:3

Table 3: Final Identification of Current and Future Soil COPCs for the Construction Worker Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Radium-226	13982-63-3	0.179	3.700	X	494/ 567	1.240	1.240	2.000	NO
Radium-226+D	13982-63-3(+D)	0.179	3.700	X	494/ 567	1.240	1.240	2.000	NO
Radium-226 long lived decay	13982-63-3L	0.179	3.700	X	494/ 567	1.240	1.240	2.000	NO
Radium-228	15262-20-1	0.309	1.990	N	80/ 81	1.220	1.220		YES:3
Radium-228+D	15262-20-1(+D)	0.309	1.990	N	80/ 81	1.220	1.220		YES:3
Radium-228 long lived decay	15262-20-1L	0.309	1.990	N	80/ 81	1.220	1.220		YES:3
Thallium-208	14913-50-9	0.156	0.401	N	10/ 10	0.377	0.401		YES:3
Thorium-228+D	14274-82-9(+D)	0.037	4.520	X	342/ 384	1.640	1.640	1.500	YES:3
Thorium-228 long lived decay	14274-82-9L	0.037	4.520	X	342/ 384	1.640	1.640	1.500	YES:3
Thorium-230 long lived decay	14269-63-7L	0.100	7.510	X	340/ 595	2.830	2.830	1.900	YES:2
Thorium-232	7440-29-1	0.045	80.100	D	789/1805	0.832	0.832	1.400	NO
Thorium-232 long lived decay	7440-29-1L	0.045	80.100	D	789/1805	0.832	0.832	1.400	YES:4
Uranium-238 long lived decay	7440-61-1L	0.408	1.950	X	72/ 119	1.880	1.880	1.200	YES

"+D" : incorporates daughter products within the risk calculations
CAS: Chemical Abstract Service
UCL: upper confidence limit
EPC: Exposure Point Concentration
SVOCs: semivolatile organic compounds
Dist.: distribution where:
N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and
X = significantly different from lognormal or normal distribution
COPC: Constituent of Potential Concern, evaluation based on EPC vs. background
COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). See Appendix H for details. For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation.
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

ble 4: Initial Identification of Current and F re Soil COPCs for the Site Employee Scena

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Explosives (mg/kg)									
Nitrobenzene	98-95-3	0.3800	0.380	D	1/ 12	0.380		102.200	NO:2
Inorganics (mg/kg)									
Aluminum	7429-90-5	589.0000	23000.000	N	105/ 105	23000.000	19000.000	204400.000	NO:2
Antimony	7440-36-0	0.2100	44.500	D	42/ 146	44.500		81.760	NO:2
Arsenic	7440-38-2	0.4900	19.500	X	104/ 105	19.500	8.600	3.804	YES
Barium	7440-39-3	4.4000	453.000	X	158/ 158	453.000	180.000	14308.000	NO:2
Beryllium	7440-41-7	0.1200	3.600	X	155/ 158	3.600	1.300	369.600	NO:2
Bismuth	7440-69-9	12.6000	72.700	X	26/ 36	72.700			YES
Cadmium	7440-43-9s	0.2500	11.700	D	43/ 158	11.700	2.100	204.400	NO:2
Calcium	7440-70-2	1420.0000	312000.000	X	105/ 105	312000.000	310000.000		NO:4
Chromium	7440-47-3	1.1000	37.000	X	158/ 158	37.000	20.000	306600.000	NO:2
Chromium VI	18540-29-9	1.1000	37.000	X	158/ 158	37.000	20.000	449.680	NO:2
Cobalt	7440-48-4	0.7900	25.000	X	105/ 105	25.000	19.000	12264.000	NO:2
Copper	7440-50-8	2.6000	1100.000	X	103/ 105	1100.000	26.000	8176.000	NO:2
Cyanide	57-12-5	0.1000	8.900	D	31/ 126	8.900		4088.000	NO:2
Iron	7439-89-6	23.0000	43000.000	N	105/ 105	43000.000	35000.000		NO:4
Lead	7439-92-1	1.6000	220.000	X	179/ 186	220.000	48.000		YES
Lithium	7439-93-2	2.3000	26.900	N	31/ 31	26.900	26.000		YES
Magnesium	7439-95-4	12.0000	116000.000	X	105/ 105	116000.000	40000.000		NO:4
Manganese	7439-96-5s	65.2000	1280.000	X	104/ 104	1280.000	1400.000	7208.611	NO:2,3
Mercury	7439-97-6	0.0300	0.650	D	43/ 97	0.650		61.255	NO:2
Molybdenum	7439-98-7	0.4700	9.700	L	29/ 31	9.700	27.000	1022.000	NO:2,3
Nickel	7440-02-0	2.3000	247.000	X	157/ 158	247.000	32.000	4088.000	NO:2
Potassium	7440-09-7	305.0000	5230.000	X	103/ 105	5230.000	1900.000		NO:4
Selenium	7782-49-2	0.4900	2.300	D	18/ 96	2.300		1022.000	NO:2
Silver	7440-22-4	0.1100	20.800	D	47/ 158	20.800	1.700	1022.000	NO:2
Sodium	7440-23-5	41.7000	3450.000	X	100/ 105	3450.000	240.000		NO:4
Thallium	7440-28-0	0.2200	3.500	D	27/ 100	3.500	0.460	16.352	NO:2
Tin	7440-31-5	1.1000	2.200	D	7/ 31	2.200	20.000	122640.000	NO:2,3
Vanadium	7440-62-2	1.7000	40.000	X	105/ 105	40.000	25.000	1430.800	NO:2

Table 4: Initial Identification of Current and Future Soil COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Zinc	7440-66-6	5.5000	463.000	X	105/ 105	463.000	140.000	61320.000	NO:2
Pesticides (mg/kg)									
4,4'-DDE	72-55-9	0.0003	0.002	D	7/ 85	0.002		16.833	NO:2
Chlordane	57-74-9	0.0190	0.098	D	2/ 23	0.098			YES
SVOCs (mg/kg)									
Anthracene	120-12-7	0.0220	2.800	D	11/ 134	2.800		61320.000	NO:2
Benzo(a)anthracene	56-55-3	0.0280	4.200	D	24/ 134	4.200		7.839	NO:2
Benzo(a)pyrene	50-32-8	0.0240	3.600	D	22/ 134	3.600		0.784	YES
Benzo(b)fluoranthene	205-99-2	0.0250	2.800	D	28/ 134	2.800		7.839	NO:2
Benzo(g,h,i)perylene	191-24-2	0.0270	2.100	D	12/ 134	2.100			YES
Benzo(k)fluoranthene	207-08-9	0.0250	3.400	D	24/ 134	3.400		78.390	NO:2
Bis(2-ethylhexyl)phthalate	117-81-7	0.0200	6.500	D	44/ 119	6.500		408.800	NO:2
Chrysene	218-01-9	0.0200	1.700	D	23/ 119	1.700		783.900	NO:2
Di-n-butyl Phthalate	84-74-2	0.0210	2.000	D	48/ 172	2.000		20440.000	NO:2
Dibenzofuran	132-64-9	0.0320	0.580	D	6/ 119	0.580		817.600	NO:2
Diethyl Phthalate	84-66-2	0.0390	0.110	D	6/ 119	0.110		163520.000	NO:2
Fluoranthene	206-44-0	0.0230	11.000	D	40/ 134	11.000		8176.000	NO:2
Fluorene	86-73-7	0.0380	1.100	D	7/ 134	1.100		8176.000	NO:2
Indeno(1,2,3-cd)pyrene	193-39-5	0.0250	1.900	D	14/ 134	1.900		7.839	NO:2
Phenanthrene	85-01-8	0.0270	11.000	D	25/ 134	11.000			YES
Pyrene	129-00-0	0.0280	9.700	D	37/ 134	9.700		6132.000	NO:2
VOCs (mg/kg)									
2-Butanone	78-93-3	0.0010	0.017	D	7/ 86	0.017		2712.604	NO:2
4-Methyl-2-pentanone	108-10-1	0.0010	0.006	D	5/ 86	0.006		16352.000	NO:2
Acetone	67-64-1	0.0040	0.150	D	14/ 86	0.150		20440.000	NO:2
Dichloromethane (Methylene Chloride)	75-09-2	0.0030	0.068	D	49/ 109	0.068		20.319	NO:2
Naphthalene	91-20-3	0.0010	0.006	D	3/ 6	0.006		18.747	NO:2
Tetrachloroethene	127-18-4	0.0020	0.028	D	7/ 109	0.028		18.719	NO:2
Toluene	108-88-3	0.0010	0.051	D	18/ 109	0.051		209.164	NO:2
Xylenes, Total	1330-20-7	0.0010	0.039	D	7/ 86	0.039		408800.000	NO:2
mp-Xylene	mp-Xylene	0.0050	0.006	X	23/ 23	0.006		278.611	NO:2

ble 4: Initial Identification of Current and F re Soil COPCs for the Site Employee Scena

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Radionuclides (pCi/g)									
Actinium-227	14952-40-0	0.0500	2.110	D	36/ 219	2.110		7.487	NO:2
Actinium-227 +D	14952-40-0(+D)	0.0500	2.110	D	36/ 219	2.110		0.485	YES
Actinium-227 long lived decay	14952-40-0L	0.0500	2.110	D	36/ 219	2.110		0.485	YES
Actinium-228	14331-83-0	0.7620	1.380	D	7/ 7	1.380		0.193	YES
Bismuth-214	14733-03-0	0.6990	0.926	N	10/ 10	0.926		0.117	YES
Cesium-137	10045-97-3	0.0211	1.600	X	258/ 461	1.600	0.420	70.723	NO:2
Cesium-137 +D	10045-97-3(+D)	0.0211	1.600	X	258/ 461	1.600	0.420	0.342	YES
Cesium-137 long lived decay	10045-97-3L	0.0211	1.600	X	258/ 461	1.600	0.420	0.342	YES
Lead-210	14255-04-0	0.6300	3.730	X	146/ 262	3.730		1.733	YES
Lead-210+D	14255-04-0(+D)	0.6300	3.730	X	146/ 262	3.730		1.194	YES
Lead-210 long lived decay	14255-04-0L	0.6300	3.730	X	146/ 262	3.730		1.194	YES
Lead-212	15092-94-1	0.8430	1.220	L	10/ 10	1.220		1.661	NO:2
Lead-214	15067-28-4	0.8270	1.120	N	10/ 10	1.120		0.892	YES
Plutonium-238	13981-16-3	0.0122	396.400	D	592/1308	396.400	0.130	11.330	YES
Plutonium-239	15117-48-3	0.0035	1.270	X	83/ 90	1.270	0.180	11.157	NO:2
Plutonium-239/240	PU-239/240	0.0039	1.010	D	64/ 230	1.010	0.180		YES
Potassium-40	13966-00-2	7.4500	36.000	X	96/ 96	36.000	37.000	1.076	NO:3
Radium-224	13233-32-4	0.0730	6.270	X	186/ 186	6.270		5.424	YES
Radium-226	13982-63-3	0.1790	3.700	X	411/ 466	3.700	2.000	3.921	NO:2
Radium-226+D	13982-63-3(+D)	0.1790	3.700	X	411/ 466	3.700	2.000	0.101	YES
Radium-226 long lived decay	13982-63-3L	0.1790	3.700	X	411/ 466	3.700	2.000	0.093	YES
Radium-228	15262-20-1	0.5450	1.990	N	74/ 75	1.990		1.403	YES
Radium-228+D	15262-20-1(+D)	0.5450	1.990	N	74/ 75	1.990		0.170	YES
Radium-228 long lived decay	15262-20-1L	0.5450	1.990	N	74/ 75	1.990		0.067	YES
Thallium-208	14913-50-9	0.1560	0.401	N	10/ 10	0.401		0.050	YES
Thorium-227	15623-47-9	0.0600	0.440	L	17/ 33	0.440		2.093	NO:2
Thorium-228	14274-82-9	0.0370	4.520	X	319/ 356	4.520	1.500	9.158	NO:2
Thorium-228+D	14274-82-9(+D)	0.0370	4.520	X	319/ 356	4.520	1.500	0.110	YES
Thorium-228 long lived decay	14274-82-9L	0.0370	4.520	X	319/ 356	4.520	1.500	0.110	YES
Thorium-230	14269-63-7	0.1000	7.510	X	317/ 499	7.510	1.900	14.979	NO:2
Thorium-230 long lived decay	14269-63-7L	0.1000	7.510	X	317/ 499	7.510	1.900	0.092	YES

Table 4: Initial Identification of Current and Future Soil COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	Screening Concentration	Background Conc.	RBGV	COPC
Thorium-232	7440-29-1	0.0450	80.100	D	675/1518	80.100	1.400	13.041	YES
Thorium-232 long lived decay	7440-29-1L	0.0450	80.100	D	675/1518	80.100	1.400	0.066	YES
Tritium	10028-17-8p	1.3500	1.350	D	1/ 16	1.350		14541.469	NO:2
Uranium-234	13966-29-5	0.3890	1.560	N	25/ 29	1.560	1.100	19.707	NO:2
Uranium-235	15117-96-1	0.0326	0.210	D	13/ 55	0.210	0.110	1.559	NO:2
Uranium-235+D	15117-96-1(+D)	0.0326	0.210	D	13/ 55	0.210	0.110	1.488	NO:2
Uranium-235 long lived decay	15117-96-1L	0.0326	0.210	D	13/ 55	0.210	0.110	0.332	NO:2
Uranium-238	7440-61-1	0.4760	1.950	X	50/ 91	1.950	1.200	21.917	NO:2
Uranium-238+D	7440-61-1(+D)	0.4760	1.950	X	50/ 91	1.950	1.200	5.085	NO:2
Uranium-238 long lived decay	7440-61-1L	0.4760	1.950	X	50/ 91	1.950	1.200	0.090	YES

"+D" : incorporates daughter products within the risk calculations
CAS: Chemical Abstract Service
RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
VOC: volatile organic compound
SVOC: semivolatile organic compound
Dist.: distribution where:
N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and
X = significantly different from lognormal or normal distribution
COPC: Constituent of Potential Concern, evaluation based on maximum detect vs. background or RBGV
COPC = YES indicates the analyte is retained as a COPC
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

ble 5: Final Identification of Current and F e Soil COPCs for the Site Employee Scena

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Inorganics (mg/kg)									
Arsenic	7440-38-2	0.4900	19.500	X	9.9E-01	8.880	8.880	8.600	YES
Bismuth	7440-69-9	12.6000	72.700	X	26/ 36	104.000	72.700		YES
Lead	7439-92-1	1.6000	220.000	X	179/ 186	16.700	16.700	48.000	NO
Lithium	7439-93-2	2.3000	26.900	N	31/ 31	16.600	16.600	26.000	NO
Pesticides (mg/kg)									
Chlordane	57-74-9	0.0190	0.098	D	2/ 23	0.016	0.016		YES
SVOCs (mg/kg)									
Benzo(a)pyrene	50-32-8	0.0240	3.600	D	22/ 134	0.350	0.350		YES
Benzo(g,h,i)perylene	191-24-2	0.0270	2.100	D	12/ 134	0.333	0.333		YES
Phenanthrene	85-01-8	0.0270	11.000	D	25/ 134	0.398	0.398		YES
Radionuclides (pCi/g)									
Actinium-227 +D	14952-40-0(+D)	0.0500	2.110	D	36/ 219	0.354	0.354		YES
Actinium-227 long lived decay	14952-40-0L	0.0500	2.110	D	36/ 219	0.354	0.354		YES
Actinium-228	14331-83-0	0.7620	1.380	D	7/ 7	1.230	1.380		YES:3
Bismuth-214	14733-03-0	0.6990	0.926	N	10/ 10	0.858	0.926		YES:2
Cesium-137 +D	10045-97-3(+D)	0.0211	1.600	X	258/ 461	0.179	0.179	0.420	NO
Cesium-137 long lived decay	10045-97-3L	0.0211	1.600	X	258/ 461	0.179	0.179	0.420	NO
Lead-210	14255-04-0	0.6300	3.730	X	146/ 262	1.290	1.290		YES:2
Lead-210+D	14255-04-0(+D)	0.6300	3.730	X	146/ 262	1.290	1.290		YES:2
Lead-210 long lived decay	14255-04-0L	0.6300	3.730	X	146/ 262	1.290	1.290		YES:2
Lead-214	15067-28-4	0.8270	1.120	N	10/ 10	1.030	1.120		YES:2
Plutonium-238	13981-16-3	0.0122	396.400	D	592/1308	24.900	24.900	0.130	YES
Plutonium-239/240	PU-239/240	0.0039	1.010	D	64/ 230	0.044	0.044	0.180	NO
Radium-224	13233-32-4	0.0730	6.270	X	186/ 186	1.260	1.260		YES:3
Radium-226+D	13982-63-3(+D)	0.1790	3.700	X	411/ 466	1.250	1.250	2.000	NO
Radium-226 long lived decay	13982-63-3L	0.1790	3.700	X	411/ 466	1.250	1.250	2.000	NO
Radium-228	15262-20-1	0.5450	1.990	N	74/ 75	1.260	1.260		YES:3
Radium-228+D	15262-20-1(+D)	0.5450	1.990	N	74/ 75	1.260	1.260		YES:3
Radium-228 long lived decay	15262-20-1L	0.5450	1.990	N	74/ 75	1.260	1.260		YES:3
Thallium-208	14913-50-9	0.1560	0.401	N	10/ 10	0.377	0.401		YES:3
Thorium-228+D	14274-82-9(+D)	0.0370	4.520	X	319/ 356	1.700	1.700	1.500	YES:3

Table 5: Final Identification of Current and Future Soil COPCs for the Site Employee Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Detection Frequency	95% UCL of Mean	EPC	Background Concentration	COPC
Thorium-228 long lived decay	14274-82-9L	0.0370	4.520	X	319/ 356	1.700	1.700	1.500	YES:3
Thorium-230 long lived decay	14269-63-7L	0.1000	7.510	X	317/ 499	2.700	2.700	1.900	YES:2
Thorium-232	7440-29-1	0.0450	80.100	D	675/1518	0.873	0.873	1.400	NO
Thorium-232 long lived decay	7440-29-1L	0.0450	80.100	D	675/1518	0.868	0.868	1.400	YES:4
Uranium-238 long lived decay	7440-61-1L	0.4760	1.950	X	50/ 91	2.030	1.950	1.200	YES

"+D" : incorporates daughter products within the risk calculations
CAS: Chemical Abstract Service
UCL: upper confidence limit
EPC: Exposure Point Concentration
SVOCs: semivolatile organic compounds
Dist.: distribution where:
N = normal, L = lognormal, D = distribution not determined due to less than 20 or less than 50% detects, and
X = significantly different from lognormal or normal distribution
COPC: Constituent of Potential Concern, evaluation based on EPC vs. background
COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). See Appendix H for details. For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation.

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or
4 = analyte is an essential human nutrient

Table 6: Initial Identification of Current Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Nitrate (Mound CAS 7697-37-2)	14797-55-8	0.7380	2.550	2/ 2	2.550	5.349	10.000	c	NO:2,3
Nitrate/Nitrite (Mound CAS 1497-55-8)	14797-65-0	0.6800	4.900	11/ 11	4.900	5.349	1.000	c	NO:2
Aluminum	7429-90-5	0.0688	0.148	6/ 22	0.148	0.038	10.187	b	NO:3
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.014	0.001	0.004	b	YES
Barium	7440-39-3	0.0750	0.115	20/ 22	0.115	0.310	0.713	b	NO:2,3
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.008		0.005	c	YES
Calcium	7440-70-2	94.3000	126.000	24/ 24	126.000	111.111			NO:4
Chromium	7440-47-3	0.0183	0.024	5/ 25	0.024	0.006	0.100	c	NO:3
Chromium VI	18540-29-9	0.0183	0.024	5/ 25	0.024	0.006	0.031	b	NO:3
Copper	7440-50-8	0.0016	0.593	15/ 25	0.593	0.001	0.407	b	YES
Iron	7439-89-6	0.0190	1.890	13/ 24	1.890	4.065			NO:4
Lead	7439-92-1	0.0034	0.040	5/ 25	0.040				YES
Lithium	7439-93-2	0.0029	0.003	2/ 4	0.003	0.056			NO:2
Magnesium	7439-95-4	29.1000	39.600	24/ 24	39.600	40.428			NO:4
Manganese	7439-96-5w	0.0028	0.224	22/ 24	0.224	0.230	0.479	b	NO:2,3
Molybdenum	7439-98-7	0.0020	0.003	2/ 4	0.003	0.006	0.051	b	NO:2,3
Nickel	7440-02-0	0.0021	0.027	5/ 25	0.027	0.035	0.204	b	NO:2,3
Potassium	7440-09-7	2.3900	3.650	20/ 26	3.650	4.461			NO:4
Silver	7440-22-4	0.0169	0.024	5/ 22	0.024		0.051	b	NO:3
Sodium	7440-23-5	46.6000	84.200	24/ 24	84.200	62.426			NO:4
Tin	7440-31-5	0.0087	0.009	1/ 4	0.009	0.034	6.112	b	NO:2,3
Vanadium	7440-62-2	0.0078	0.015	7/ 22	0.015	0.017	0.071	b	NO:2,3
Zinc	7440-66-6	0.0045	0.058	9/ 25	0.058	0.120	3.056	b	NO:2,3
Volatile Organic Compounds (mg/L)									
1,1,1-Trichloroethane	71-55-6	0.0003	0.003	91/ 215	0.003		0.200	c	NO:3
1,2-Dichloroethene *	540-59-0	0.0013	0.007	10/ 13	0.007		0.070	c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0005	0.004	102/ 182	0.004		0.070	c	NO:3
2-Butanone	78-93-3	0.0070	0.041	3/ 13	0.041		5.111	b	NO:3
Acetone	67-64-1	0.0020	0.012	6/ 11	0.012		1.022	b	NO:3
Chloroform (Trichloromethane)	67-66-3	0.0005	0.007	13/ 219	0.007		0.035	b	NO:3
FREON-113	76-13-1	0.0020	0.034	12/ 19	0.034		246.554	b	NO:3
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.002				YES
Tetrachloroethene	127-18-4	0.0003	0.002	114/ 218	0.002		0.003	a	NO:3

Table 6: Initial Identification of Current Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.006		0.001 b	YES
Radionuclides (pCi/L)								
Bismuth-210	14331-79-4	0.1100	0.390	2/ 18	0.390		89.686	NO:3
Plutonium-238	13981-16-3	0.0060	0.250	8/ 57	0.250	0.087	6.107	NO:3
Plutonium-238/239	PU-238/239	0.0100	0.010	1/ 6	0.010		5.926	NO:3
Plutonium-239/240	PU-239/240	0.0018	2.000	5/ 19	2.000	0.125	5.926	NO:3
Radium-226	13982-63-3	0.1000	0.520	6/ 18	0.520	0.996	2.078	NO:2,3
Radium-226+D	13982-63-3(+D)	0.1000	0.520	6/ 18	0.520	0.996	2.073	NO:2,3
Radium-226 long lived decay	13982-63-3L	0.1000	0.520	6/ 18	0.520	0.996	0.483	NO:2
Strontium-85	13967-73-2	25.0000	25.000	1/ 2	25.000		353.982	NO:3
Strontium-90	10098-97-2	0.5000	0.500	3/ 18	0.500		14.311	NO:3
Thorium-227	15623-47-9	0.0110	0.230	16/ 22	0.230		16.878	NO:3
Thorium-228	14274-82-9	0.0085	2.170	17/ 46	2.170	0.779	7.477	NO:3
Thorium-228+D	14274-82-9(+D)	0.0085	2.170	17/ 46	2.170	0.779	2.667	NO:3
Thorium-228 long lived decay	14274-82-9L	0.0085	2.170	17/ 46	2.170	0.779	2.667	NO:3
Thorium-230	14269-63-7	0.0075	1.990	19/ 43	1.990		8.791	NO:3
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	1.990		0.458	YES
Thorium-232	7440-29-1	0.0025	0.100	8/ 44	0.100	0.314	7.921	NO:2,3
Thorium-232 long lived decay	7440-29-1L	0.0025	0.100	8/ 44	0.100	0.314	0.555	NO:2,3
Tritium	10028-17-8w	30.0000	7200.000	123/ 139	7200.000	1485.470	15544.541	NO:3
Uranium-233/234	U-233/234	0.1670	0.361	36/ 36	0.361		1.334	NO:3
Uranium-234	13966-29-5	0.2000	8.140	19/ 24	8.140	0.792	11.315	NO:3
Uranium-235	15117-96-1	0.0063	2.300	30/ 53	2.300	0.814	11.494	NO:3
Uranium-235+D	15117-96-1(+D)	0.0063	2.300	30/ 53	2.300	0.814	11.142	NO:3
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	2.300	0.814	1.095	YES
Uranium-238	7440-61-1	0.1300	8.250	52/ 59	8.250	0.688	12.500	NO:3
Uranium-238+D	7440-61-1(+D)	0.1300	8.250	52/ 59	8.250	0.688	9.185	NO:3
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	8.250	0.688	0.420	YES

footnotes on next page

Table 6: Initial Identification of Current Groundwater COPCs for the Construction Worker Scenario

footnotes

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
"+D": incorporates daughter products within the risk calculations
* 1,2-cis-dichloroethene isomer RBGV used for screening due to lack of criteria for 1,2-dichloroethene

COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 7: Final Identification of Current Groundwater COPCs for the Construction Worker Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	95% UCL	EPC	Background Concentration	COPC
Inorganics (mg/L)								
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.044	0.014	0.001	YES
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.007	0.007		YES
Copper	7440-50-8	0.0016	0.593	15/ 25	0.042	0.042	0.001	YES
Lead	7439-92-1	0.0034	0.040	5/ 25	0.013	0.013		YES
Volatile Organic Compounds (mg/L)								
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.001	0.001		YES
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.002	0.002		YES
Radionuclides (pCi/L)								
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	0.476	0.476		YES:2
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	0.466	0.466	0.814	NO
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	0.409	0.409	0.688	YES:5

EPC: exposure point concentration
UCL: upper confidence limit
CAS: Chemical Abstract Service

COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation.

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 8: Initial Identification of Current Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Nitrate (Mound CAS 7697-37-2)	14797-55-8	0.7380	2.550	2/ 2	2.550	5.349	10.000	c	NO:2,3
Nitrate/Nitrite (Mound CAS 1497-55-8)	14797-65-0	0.6800	4.900	11/ 11	4.900	5.349	1.000	c	NO:2
Aluminum	7429-90-5	0.0688	0.148	6/ 22	0.148	0.038	10.220	b	NO:3
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.014	0.001	0.004	b	YES
Barium	7440-39-3	0.0750	0.115	20/ 22	0.115	0.310	0.715	b	NO:2,3
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.008		0.005	c	YES
Calcium	7440-70-2	94.3000	126.000	24/ 24	126.000	111.111			NO:4
Chromium	7440-47-3	0.0183	0.024	5/ 25	0.024	0.006	0.100	c	NO:3
Chromium VI	18540-29-9	0.0183	0.024	5/ 25	0.024	0.006	0.031	b	NO:3
Copper	7440-50-8	0.0016	0.593	15/ 25	0.593	0.001	0.409	b	YES
Iron	7439-89-6	0.0190	1.890	13/ 24	1.890	4.065			NO:4
Lead	7439-92-1	0.0034	0.040	5/ 25	0.040				YES
Lithium	7439-93-2	0.0029	0.003	2/ 4	0.003	0.056			NO:2
Magnesium	7439-95-4	29.1000	39.600	24/ 24	39.600	40.428			NO:4
Manganese	7439-96-5w	0.0028	0.224	22/ 24	0.224	0.230	0.480	b	NO:2,3
Molybdenum	7439-98-7	0.0020	0.003	2/ 4	0.003	0.006	0.051	b	NO:2,3
Nickel	7440-02-0	0.0021	0.027	5/ 25	0.027	0.035	0.204	b	NO:2,3
Potassium	7440-09-7	2.3900	3.650	20/ 26	3.650	4.461			NO:4
Silver	7440-22-4	0.0169	0.024	5/ 22	0.024		0.051	b	NO:3
Sodium	7440-23-5	46.6000	84.200	24/ 24	84.200	62.426			NO:4
Tin	7440-31-5	0.0087	0.009	1/ 4	0.009	0.034	6.132	b	NO:2,3
Vanadium	7440-62-2	0.0078	0.015	7/ 22	0.015	0.017	0.072	b	NO:2,3
Zinc	7440-66-6	0.0045	0.058	9/ 25	0.058	0.120	3.066	b	NO:2,3
Volatile Organic Compounds (mg/L)									
1,1,1-Trichloroethane	71-55-6	0.0003	0.003	91/ 215	0.003		0.200	c	NO:3
1,2-Dichloroethene *	540-59-0	0.0013	0.007	10/ 13	0.007		0.070	c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0005	0.004	102/ 182	0.004		0.070	c	NO:3
2-Butanone	78-93-3	0.0070	0.041	3/ 13	0.041		6.132	b	NO:3
Acetone	67-64-1	0.0020	0.012	6/ 11	0.012		1.022	b	NO:3
Chloroform (Trichloromethane)	67-66-3	0.0005	0.007	13/ 219	0.007		0.102	b	NO:3
FREON-113	76-13-1	0.0020	0.034	12/ 19	0.034		306.600	b	NO:3
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.002				YES
Tetrachloroethene	127-18-4	0.0003	0.002	114/ 218	0.002		0.005	c	NO:3
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.006		0.001	a	YES

Table 8: Initial Identification of Current Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Radionuclides (pCi/L)								
Bismuth-210	14331-79-4	0.1100	0.390	2/ 18	0.390		17.937	NO:3
Plutonium-238	13981-16-3	0.0060	0.250	8/ 57	0.250	0.087	1.221	NO:3
Plutonium-238/239	PU-238/239	0.0100	0.010	1/ 6	0.010		1.185	NO:3
Plutonium-239/240	PU-239/240	0.0018	2.000	5/ 19	2.000	0.125	1.185	YES
Radium-226	13982-63-3	0.1000	0.520	6/ 18	0.520	0.996	0.416	NO:2
Radium-226+D	13982-63-3(+D)	0.1000	0.520	6/ 18	0.520	0.996	0.415	NO:2
Radium-226 long lived decay	13982-63-3L	0.1000	0.520	6/ 18	0.520	0.996	0.097	NO:2
Strontium-85	13967-73-2	25.0000	25.000	1/ 2	25.000		70.796	NO:3
Strontium-90	10098-97-2	0.5000	0.500	3/ 18	0.500		2.862	NO:3
Thorium-227	15623-47-9	0.0110	0.230	16/ 22	0.230		3.376	NO:3
Thorium-228	14274-82-9	0.0085	2.170	17/ 46	2.170	0.779	1.495	YES
Thorium-228+D	14274-82-9(+D)	0.0085	2.170	17/ 46	2.170	0.779	0.533	YES
Thorium-228 long lived decay	14274-82-9L	0.0085	2.170	17/ 46	2.170	0.779	0.533	YES
Thorium-230	14269-63-7	0.0075	1.990	19/ 43	1.990		1.758	YES
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	1.990		0.092	YES
Thorium-232	7440-29-1	0.0025	0.100	8/ 44	0.100	0.314	1.584	NO:2,3
Thorium-232 long lived decay	7440-29-1L	0.0025	0.100	8/ 44	0.100	0.314	0.111	NO:2,3
Tritium	10028-17-8w	30.0000	7200.000	123/ 139	7200.000	1485.470	3155.819	YES
Uranium-233/234	U-233/234	0.1670	0.361	36/ 36	0.361		0.267	YES
Uranium-234	13966-29-5	0.2000	8.140	19/ 24	8.140	0.792	2.263	YES
Uranium-235	15117-96-1	0.0063	2.300	30/ 53	2.300	0.814	2.299	YES
Uranium-235+D	15117-96-1(+D)	0.0063	2.300	30/ 53	2.300	0.814	2.228	YES
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	2.300	0.814	0.219	YES
Uranium-238	7440-61-1	0.1300	8.250	52/ 59	8.250	0.688	1.100	YES
Uranium-238+D	7440-61-1(+D)	0.1300	8.250	52/ 59	8.250	0.688	1.837	YES
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	8.250	0.688	0.084	YES

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index

a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)

CAS: Chemical Abstract Service

"+D": incorporates daughter products within the risk calculations

* 1,2-cis-dichloroethene isomer RBGV used for screening due to lack of criteria for 1,2-dichloroethene

COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 9: Final Identification of Current Groundwater COPCs for the Site Employee Scenario

(EPC vs. Background)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	95% UCL	EPC	Background Concentration	COPC
Inorganics (mg/L)								
Antimony	7440-36-0	0.0028	0.014	3/ 20	0.0436	0.0144	0.0006	YES
Cadmium	7440-43-9w	0.0046	0.008	5/ 25	0.0066	0.0066		YES
Copper	7440-50-8	0.0016	0.593	15/ 25	0.0416	0.0416	0.0012	YES
Lead	7439-92-1	0.0034	0.040	5/ 25	0.0130	0.0130		YES
Volatile Organic Compounds (mg/L)								
Tert-butyl methyl ether	1634-04-4	0.0012	0.002	4/ 24	0.0006	0.0006		YES
Trichloroethylene (TCE)	79-01-6	0.0005	0.006	189/ 219	0.0023	0.0023		YES
Radionuclides (pCi/L)								
Plutonium-239/240	PU-239/240	0.0018	2.000	5/ 19	9.6400	2.0000	0.1250	YES
Thorium-228	14274-82-9	0.0085	2.170	17/ 46	25.6000	2.1700	0.7790	YES:3
Thorium-228+D	14274-82-9(+D)	0.0085	2.170	17/ 46	25.6000	2.1700	0.7790	YES:3
Thorium-228 long lived decay	14274-82-9L	0.0085	2.170	17/ 46	25.6000	2.1700	0.7790	YES:3
Thorium-230	14269-63-7	0.0075	1.990	19/ 43	0.4760	0.4760		YES:2
Thorium-230 long lived decay	14269-63-7L	0.0075	1.990	19/ 43	0.4760	0.4760		YES:2
Thorium-232 long lived decay	7440-29-1L	0.0025	0.100	8/ 44	0.3380	0.1000	0.3140	YES:4
Tritium	10028-17-8w	30.0000	7200.000	123/ 139	799.0000	799.0000	1485.4700	NO
Uranium-233/234	U-233/234	0.1670	0.361	36/ 36	0.2460	0.2460		YES
Uranium-234	13966-29-5	0.2000	8.140	19/ 24	2.0200	2.0200	0.7920	YES:2
Uranium-235	15117-96-1	0.0063	2.300	30/ 53	0.4660	0.4660	0.8140	NO
Uranium-235+D	15117-96-1(+D)	0.0063	2.300	30/ 53	0.4660	0.4660	0.8140	NO
Uranium-235 long lived decay	15117-96-1L	0.0063	2.300	30/ 53	0.4660	0.4660	0.8140	NO
Uranium-238	7440-61-1	0.1300	8.250	52/ 59	0.4090	0.4090	0.6880	NO
Uranium-238+D	7440-61-1(+D)	0.1300	8.250	52/ 59	0.4090	0.4090	0.6880	NO
Uranium-238 long lived decay	7440-61-1L	0.1300	8.250	52/ 59	0.4090	0.4090	0.6880	YES:5

footnotes on second page

Table 9: Final Identification of Current Groundwater COPCs for the Site Employee Scenario

footnotes

"+D" - incorporates daughter products within the risk calculations
EPC: exposure point concentration
UCL: upper confidence limit
CAS: Chemical Abstract Service
COPC: Constituent of Potential Concern
COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). See Appendix H for details. For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation.
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 10: Initial Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGV)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Aluminum	7429-90-5	0.0121	31.5000	141/ 151	31.500	0.038	10.187	b	YES
Antimony	7440-36-0	0.0004	0.0416	47/ 158	0.042	0.001	0.004	b	YES
Arsenic	7440-38-2	0.0003	0.9330	35/ 150	0.933	0.033	0.001	a	YES
Barium	7440-39-3	0.0176	3.1200	148/ 150	3.120	0.310	0.713	b	YES
Beryllium	7440-41-7	0.0000	0.0023	56/ 151	0.002		0.004	c	NO:3
Bismuth	7440-69-9	0.0008	0.2640	29/ 139	0.264				YES
Boron	7440-42-8	0.0570	0.1290	7/ 8	0.129		0.917	b	NO:3
Cadmium	7440-43-9w	0.0001	0.0131	17/ 161	0.013		0.005	c	YES
Calcium	7440-70-2	0.1160	1510.0000	198/ 198	1510.000	111.111			NO:4
Chromium	7440-47-3	0.0002	44.8000	106/ 155	44.800	0.006	0.100	c	YES
Cobalt	7440-48-4	0.0003	0.2950	63/ 151	0.295		0.611	b	NO:3
Copper	7440-50-8	0.0004	0.5140	118/ 153	0.514	0.001	0.407	b	YES
Cyanide	57-12-5	0.0055	0.0142	3/ 46	0.014		0.200	b	NO:3
Iron	7439-89-6	0.0002	192.0000	186/ 199	192.000	4.065			NO:4
Lead	7439-92-1	0.0004	0.0404	62/ 162	0.040				YES
Lithium	7439-93-2	0.0117	4.5900	123/ 138	4.590	0.056			YES
Magnesium	7439-95-4	0.0269	719.0000	199/ 199	719.000	40.428			NO:4
Manganese	7439-96-5w	0.0000	3.0300	190/ 199	3.030	0.230	0.479	b	YES
Molybdenum	7439-98-7	0.0004	0.4740	82/ 134	0.474	0.006	0.051	b	YES
Nickel	7440-02-0	0.0004	11.6000	114/ 154	11.600	0.035	0.204	b	YES
Nitrate	14797-55-8	0.1700	9.4000	5/ 10	9.400	5.349	10.000	c	NO:3
Nitrate/Nitrite	14797-65-0nn	0.0063	20.0000	76/ 113	20.000	5.349	1.000	c	YES
Nitrite	14797-65-0	0.0100	0.0700	2/ 21	0.070		1.000	c	NO:3
Potassium	7440-09-7	0.0021	214.0000	186/ 200	214.000	4.461			NO:4
Selenium	7782-49-2	0.0013	0.0091	11/ 149	0.009		0.050	c	NO:3
Silver	7440-22-4	0.0002	0.0294	13/ 153	0.029		0.051	b	NO:3
Sodium	7440-23-5	0.0682	7270.0000	197/ 197	7270.000	62.426			NO:4
Thallium	7440-28-0	0.0011	0.0069	10/ 147	0.007		0.001	b	YES
Tin	7440-31-5	0.0014	0.3572	29/ 136	0.357	0.034	6.112	b	NO:3
Vanadium	7440-62-2	0.0002	0.2770	72/ 151	0.277	0.017	0.071	b	YES
Zinc	7440-66-6	0.0006	0.3990	114/ 153	0.399	0.120	3.056	b	NO:3
SVOCs (mg/L)									

Table 10: Initial Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGV)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Bis(2-ethylhexyl)phthalate	117-81-7	0.0010	0.9500	12/ 66	0.950		0.006	c	YES
Di-n-butyl Phthalate	84-74-2	0.0006	0.0030	5/ 65	0.003		0.409	b	NO:3
VOCs (mg/L)									
1,1,1-Trichloroethane	71-55-6	0.0004	0.0070	20/ 264	0.007		0.200	c	NO:3
1,2-Dichloroethene *	540-59-0	0.0018	0.0350	10/ 33	0.035		0.070	c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0009	0.0170	46/ 166	0.017		0.070	c	NO:3
2-Butanone	78-93-3	0.0060	0.0650	12/ 130	0.065		5.111	b	NO:3
Acetone	67-64-1	0.0010	0.0170	23/ 75	0.017		1.022	b	NO:3
Bromochloromethane	74-97-5	0.0260	0.0260	1/ 1	0.026				YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0010	0.6100	46/ 264	0.610		0.005	c	YES
Fluorobenzene	462-06-6	0.0390	0.0390	1/ 1	0.039				YES
O-Chloroflurobenzene	348-51-6	0.0320	0.0320	1/ 1	0.032				YES
Tetrachloroethene	127-18-4	0.0003	0.0250	50/ 264	0.025		0.003	a	YES
Trichloroethylene (TCE)	79-01-6	0.0006	0.0460	139/ 273	0.046		0.005	c	YES
Radionuclides (pCi/L)									
Americium-241	14596-10-2	0.0675	0.1650	6/ 43	0.165	0.139	7.692		NO:3
Plutonium-238	13981-16-3	0.0090	1.8700	8/ 62	1.870	0.087	6.107		NO:3
Plutonium-239/240	PU-239/240	0.0030	0.1820	12/ 52	0.182	0.125	5.926		NO:3
Plutonium-242	13982-10-0	0.1110	0.1110	1/ 2	0.111		6.250		NO:3
Potassium-40	13966-00-2	129.0000	258.0000	5/ 54	258.000		32.389		YES
Radium-226	13982-63-3	0.1260	39.4700	50/ 66	39.470	0.996	2.078		YES
Radium-226 +D	13982-63-3(+D)	0.1260	39.4700	50/ 66	39.470	0.996	2.073		YES
Radium-226 long lived decay	13982-63-3L	0.1260	39.4700	50/ 66	39.470	0.996	0.483		YES
Radium-228	15262-20-1	0.5710	16.8000	8/ 8	16.800		0.769		YES
Radium-228 +D	15262-20-1(+D)	0.5710	16.8000	8/ 8	16.800		0.769		YES
Radium-228 long lived decay	15262-20-1L	0.5710	16.8000	8/ 8	16.800		0.597		YES
Strontium-90	10098-97-2	0.7480	42.4000	8/ 57	42.400	0.975	14.311		YES
Thorium-227	15623-47-9	0.0580	0.0580	1/ 5	0.058		16.878		NO:3
Thorium-228	14274-82-9	0.0200	8.5000	42/ 57	8.500	0.779	7.477		YES
Thorium-228+D	14274-82-9(+D)	0.0200	8.5000	42/ 57	8.500	0.779	2.667		YES
Thorium-228 long lived decay	14274-82-9L	0.0200	8.5000	42/ 57	8.500	0.779	2.667		YES
Thorium-230	14269-63-7	0.0044	4.0700	45/ 59	4.070		8.791		NO:3
Thorium-230 long lived decay	14269-63-7L	0.0044	4.0700	45/ 59	4.070		0.458		YES
Thorium-232	7440-29-1	0.0005	2.1100	33/ 66	2.110	0.314	7.921		NO:3
Thorium-232 long lived decay	7440-29-1L	0.0011	2.1100	32/ 66	2.110	0.314	0.555		YES

Table 10: Initial Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGV)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Tritium	10028-17-8w	2.9500	2816310.0000	4473/4488	2816310.000	1485.470	15544.541	YES
Uranium-233	13968-55-3	0.0272	16.1200	3/ 3	16.120		11.142	YES
Uranium-233 long lived decay	13968-55-3L	0.0272	16.1200	3/ 3	16.120		1.334	YES
Uranium-233/234	U-233/234	0.1540	0.9280	5/ 5	0.928		1.334	NO:3
Uranium-234	13966-29-5	0.0330	66.9000	61/ 70	66.900	0.792	11.315	YES
Uranium-235	15117-96-1	0.0078	8.2500	20/ 43	8.250	0.814	11.494	NO:3
Uranium-235+D	15117-96-1(+D)	0.0078	8.2500	20/ 43	8.250	0.814	11.142	NO:3
Uranium-235 long lived decay	15117-96-1L	0.0078	8.2500	20/ 43	8.250	0.814	1.095	YES
Uranium-235/236	U-235/236	0.0373	0.0471	2/ 26	0.047		1.095	NO:3
Uranium-238	7440-61-1	0.0290	6.5800	59/ 77	6.580	0.688	12.500	NO:3
Uranium-238+D	7440-61-1(+D)	0.0290	6.5800	59/ 77	6.580	0.688	9.185	NO:3
Uranium-238 long lived decay	7440-61-1L	0.0290	6.5800	59/ 77	6.580	0.688	0.420	YES

* used cis-1,2-dichloroethene values for screening due to lack of toxicity criteria
'+D' incorporates daughter products
CAS: Chemical Abstract Service
SVOCs: semivolatile organic compounds
VOCs: volatile organic compounds

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
a - carcinogen value
b - noncarcinogen value
c - maximum contaminant level (MCL)

COPC: Constituent of Potential Concern, evaluation based on maximum detect vs. background or RBGV
COPC = YES indicates the analyte is retained as a COPC
COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to RBGV, and/or 4 = analyte is an essential human nutrient

Table 11: Final Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Metals (mg/L)				
Aluminum	7429-90-5	2.0238	0.038	YES
Antimony	7440-36-0	0.0184	0.001	YES
Arsenic	7440-38-2	0.0184	0.033	NO
Barium	7440-39-3	0.1829	0.310	NO
Bismuth	7440-69-9	0.0241		YES
Cadmium	7440-43-9w	0.0080		YES
Chromium	7440-47-3	0.9642	0.006	YES
Copper	7440-50-8	0.0557	0.001	YES
Lead	7439-92-1	0.0194		YES
Lithium	7439-93-2	0.1510	0.056	YES
Manganese	7439-96-5w	0.2154	0.230	NO
Molybdenum	7439-98-7	0.0149	0.006	YES
Nickel	7440-02-0	0.2779	0.035	YES
Nitrate/Nitrite	14797-65-0nn	6.5098	5.3490	YES
Thallium	7440-28-0	0.0036		YES
Vanadium	7440-62-2	0.0257	0.017	YES
SVOCs (mg/L)				
Bis(2-ethylhexyl)phthalate	117-81-7	0.0176		YES
VOCs (mg/L)				
Bromochloromethane	74-97-5	0.0058		YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0154		YES
Fluorobenzene	462-06-6	0.0087		YES
O-Chloroflurobenzene	348-51-6	0.0072		YES
Tetrachloroethene	127-18-4	0.0015		YES
Tert-butyl methyl ether	1634-04-4	0.0006		YES
Trichloroethylene (TCE)	79-01-6	0.0039		YES
Radionuclides (pCi/L)				
Plutonium-238	13981-16-3	0.2587	0.087	YES
Potassium-40	13966-00-2	48.3052		YES
Radium-226	13982-63-3	1.6849	0.996	YES:2
Radium-226 +D	13982-63-3(+D)	1.6849	0.996	YES:2
Radium-226 long lived decay	13982-63-3L	1.6849	0.996	YES:2
Radium-228	15262-20-1	0.4179		YES:3
Radium-228 +D	15262-20-1(+D)	0.4179		YES:3
Radium-228 long lived decay	15262-20-1L	0.4179		YES:3
Strontium-90	10098-97-2	1.4173	0.975	YES
Thorium-228	14274-82-9	77.5034	0.779	YES:3
Thorium-228+D	14274-82-9(+D)	77.5034	0.779	YES:3
Thorium-228 long lived decay	14274-82-9L	77.5034	0.779	YES:3
Thorium-230	14269-63-7	0.6202		YES:2

Table 11: Final Identification of Future Groundwater COPCs for the Construction Worker Scenario

(Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Thorium-230 long lived decay	14269-63-7L	0.6202		YES:2
Thorium-232	7440-29-1	0.1803	0.314	NO
Thorium-232 long lived decay	7440-29-1L	0.1803	0.314	YES:4
Tritium	10028-17-8w	66797.9574	1485.470	YES
Uranium-233	13968-55-3	1.3619		YES:6
Uranium-233 long lived decay	13968-55-3L	1.3619		YES
Uranium-234	13966-29-5	2.6013	0.792	YES:2
Uranium-235	15117-96-1	2.1485	0.814	YES:7
Uranium-235+D	15117-96-1(+D)	2.1485	0.814	YES:7
Uranium-235 long lived decay	15117-96-1L	2.1485	0.814	YES
Uranium-235/236	U-235/236	0.0184		YES:7
Uranium-238	7440-61-1	0.5524	0.688	NO
Uranium-238+D	7440-61-1(+D)	0.5524	0.688	NO
Uranium-238 long lived decay	7440-61-1L	0.5524	0.688	YES:5

'+D' incorporates daughter products
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds

COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation. Analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of U-233 (reference 6) and U-235 (reference 7).

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 12: Initial Identification of Future Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Inorganics (mg/L)									
Aluminum	7429-90-5	0.0121	31.500	141/ 151	31.500	0.0375	10.2200	b	YES
Antimony	7440-36-0	0.0004	0.042	47/ 158	0.042	0.0006	0.0041	b	YES
Arsenic	7440-38-2	0.0003	0.933	35/ 150	0.933	0.0330	0.0002	a	YES
Barium	7440-39-3	0.0176	3.120	148/ 150	3.120	0.3102	0.7154	b	YES
Beryllium	7440-41-7	0.0000	0.002	56/ 151	0.002		0.0040	c	NO:3
Bismuth	7440-69-9	0.0008	0.264	29/ 139	0.264				YES
Boron	7440-42-8	0.0570	0.129	7/ 8	0.129		0.9198	b	NO:3
Cadmium	7440-43-9w	0.0001	0.013	17/ 161	0.013		0.0050	c	YES
Calcium	7440-70-2	0.1160	1510.000	198/ 198	1510.000	111.1107			NO:4
Chromium	7440-47-3	0.0002	44.800	106/ 155	44.800	0.0061	0.1000	c	YES
Cobalt	7440-48-4	0.0003	0.295	63/ 151	0.295		0.6132	b	NO:3
Copper	7440-50-8	0.0004	0.514	118/ 153	0.514	0.0012	0.4088	b	YES
Cyanide	57-12-5	0.0055	0.014	3/ 46	0.014		0.2044	b	NO:3
Iron	7439-89-6	0.0002	192.000	186/ 199	192.000	4.0649			NO:4
Lead	7439-92-1	0.0004	0.040	62/ 162	0.040				YES
Lithium	7439-93-2	0.0117	4.590	123/ 138	4.590	0.0557			YES
Magnesium	7439-95-4	0.0269	719.000	199/ 199	719.000	40.4281			NO:4
Manganese	7439-96-5w	0.0000	3.030	190/ 199	3.030	0.2296	0.4803	b	YES
Molybdenum	7439-98-7	0.0004	0.474	82/ 134	0.474	0.0056	0.0511	b	YES
Nickel	7440-02-0	0.0004	11.600	114/ 154	11.600	0.0350	0.2044	b	YES
Nitrate	14797-55-8	0.1700	9.400	5/ 10	9.400	5.3490	10.0000	c	NO:3
Nitrate/Nitrite	14797-65-0nn	0.0063	20.000	76/ 113	20.000	5.3490	1.0000	c	YES
Nitrite	14797-65-0	0.0100	0.070	2/ 21	0.070		1.0000	c	NO:3
Potassium	7440-09-7	0.0021	214.000	186/ 200	214.000	4.4611			NO:4
Selenium	7782-49-2	0.0013	0.009	11/ 149	0.009		0.0500	c	NO:3
Silver	7440-22-4	0.0002	0.029	13/ 153	0.029		0.0511	b	NO:3
Sodium	7440-23-5	0.0682	7270.000	197/ 197	7270.000	62.4256			NO:4
Thallium	7440-28-0	0.0011	0.007	10/ 147	0.007		0.0008	b	YES
Tin	7440-31-5	0.0014	0.357	29/ 136	0.357	0.0344	6.1320	b	NO:3
Vanadium	7440-62-2	0.0002	0.277	72/ 151	0.277	0.0171	0.0715	b	YES
Zinc	7440-66-6	0.0006	0.399	114/ 153	0.399	0.1196	3.0660	b	NO:3
SVOCs (mg/L)									

Table 12: Initial Identification of Future Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV		COPC
Bis(2-ethylhexyl)phthalate	117-81-7	0.0010	0.950	12/ 66	0.950		0.0060	c	YES
Di-n-butyl Phthalate	84-74-2	0.0006	0.003	5/ 65	0.003		1.0220	b	NO:3
VOCs (mg/L)									
1,1,1-Trichloroethane	71-55-6	0.0004	0.007	20/ 264	0.007		0.2000	c	NO:3
1,2-Dichloroethene *	540-59-0	0.0018	0.035	10/ 33	0.035		0.0700	c	NO:3
1,2-cis-Dichloroethene	156-59-2	0.0009	0.017	46/ 166	0.017		0.0700	c	NO:3
2-Butanone	78-93-3	0.0060	0.065	12/ 130	0.065		6.1320	b	NO:3
Acetone	67-64-1	0.0010	0.017	23/ 75	0.017		1.0220	b	NO:3
Bromochloromethane	74-97-5	0.0260	0.026	1/ 1	0.026				YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0010	0.610	46/ 264	0.610		0.0050	c	YES
Fluorobenzene	462-06-6	0.0390	0.039	1/ 1	0.039				YES
O-Chloroflurobenzene	348-51-6	0.0320	0.032	1/ 1	0.032				YES
Tetrachloroethene	127-18-4	0.0003	0.025	50/ 264	0.025		0.0050	c	YES
Trichloroethylene (TCE)	79-01-6	0.0006	0.046	139/ 273	0.046		0.0050	c	YES
Radionuclides (pCi/L)									
Americium-241	14596-10-2	0.0675	0.165	6/ 43	0.165	0.1390	1.5385		NO:3
Plutonium-238	13981-16-3	0.0090	1.870	8/ 62	1.870	0.0870	1.2214		YES
Plutonium-239/240	PU-239/240	0.0030	0.182	12/ 52	0.182	0.1250	1.1852		NO:3
Potassium-40	13966-00-2	129.0000	258.000	5/ 54	258.000		6.4777		YES
Radium-226	13982-63-3	0.1260	39.470	50/ 66	39.470	0.9960	0.4156		YES
Radium-226 +D	13982-63-3(+D)	0.1260	39.470	50/ 66	39.470	0.9960	0.4145		YES
Radium-226 long lived decay	13982-63-3L	0.1260	39.470	50/ 66	39.470	0.9960	0.0966		YES
Radium-228	15262-20-1	0.5710	16.800	8/ 8	16.800		0.1538		YES
Radium-228 +D	15262-20-1(+D)	0.5710	16.800	8/ 8	16.800		0.1538		YES
Radium-228 long lived decay	15262-20-1L	0.5710	16.800	8/ 8	16.800		0.1194		YES
Strontium-90	10098-97-2	0.7480	42.400	8/ 57	42.400	0.9750	2.8623		YES
Thorium-227	15623-47-9	0.0580	0.058	1/ 5	0.058		3.3755		NO:3
Thorium-228	14274-82-9	0.0200	8.500	42/ 57	8.500	0.7790	1.4953		YES
Thorium-228+D	14274-82-9(+D)	0.0200	8.500	42/ 57	8.500	0.7790	0.5333		YES
Thorium-228 long lived decay	14274-82-9L	0.0200	8.500	42/ 57	8.500	0.7790	0.5333		YES
Thorium-230	14269-63-7	0.0044	4.070	45/ 59	4.070		1.7582		YES
Thorium-230 long lived decay	14269-63-7L	0.0044	4.070	45/ 59	4.070		0.0916		YES
Thorium-232	7440-29-1	0.0005	2.110	33/ 66	2.110	0.3140	1.5842		YES

Table 12: Initial Identification of Future Groundwater COPCs for the Site Employee Scenario

(Maximum Detected Values in Bedrock vs. Background and RBGVs)

Analyte (unit)	CAS Number	Minimum Detect	Maximum Detect	Detection Frequency	Screening Concentration	Background Concentration	RBGV	COPC
Thorium-232 long lived decay	7440-29-1L	0.0011	2.110	32/ 66	2.110	0.3140	0.1110	YES
Tritium	10028-17-8w	2.9500	2816310.000	4473/4488	2816310.000	1485.4700	3155.8185	YES
Uranium-233	13968-55-3	0.0272	16.120	3/ 3	16.120		2.2284	YES
Uranium-233 long lived decay	13968-55-3L	0.0272	16.120	3/ 3	16.120		0.2668	YES
Uranium-233/234	U-233/234	0.1540	0.928	5/ 5	0.928		0.2668	YES
Uranium-234	13966-29-5	0.0330	66.900	61/ 70	66.900	0.7920	2.2631	YES
Uranium-235	15117-96-1	0.0078	8.250	20/ 43	8.250	0.8140	2.2989	YES
Uranium-235+D	15117-96-1(+D)	0.0078	8.250	20/ 43	8.250	0.8140	2.2284	YES
Uranium-235 long lived decay	15117-96-1L	0.0078	8.250	20/ 43	8.250	0.8140	0.2189	YES
Uranium-235/236	U-235/236	0.0373	0.047	2/ 26	0.047		0.2189	NO:3
Uranium-238	7440-61-1	0.0290	6.580	59/ 77	6.580	0.6880	2.5000	YES
Uranium-238+D	7440-61-1(+D)	0.0290	6.580	59/ 77	6.580	0.6880	1.8370	YES
Uranium-238 long lived decay	7440-61-1L	0.0290	6.580	59/ 77	6.580	0.6880	0.0840	YES

* used cis-1,2-dichloroethene values for screening due to lack of toxicity criteria

'+D' incorporates daughter products

CAS: Chemical Abstract Service

VOCs: volatile organic compounds

SVOCs: semivolatile organic compounds

RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index

a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)

COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 13: Final Identification of Future Groundwater COPCs for the Site Employee Scenario

(Future Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Inorganics (mg/L)				
Aluminum	7429-90-5	2.0238	0.0375	YES
Antimony	7440-36-0	0.0184	0.0006	YES
Arsenic	7440-38-2	0.0184	0.0330	NO
Barium	7440-39-3	0.1829	0.3102	NO
Bismuth	7440-69-9	0.0241		YES
Cadmium	7440-43-9w	0.0080		YES
Chromium	7440-47-3	0.9642	0.0061	YES
Copper	7440-50-8	0.0557	0.0012	YES
Lead	7439-92-1	0.0194		YES
Lithium	7439-93-2	0.1510	0.0557	YES
Manganese	7439-96-5w	0.2154	0.2296	NO
Molybdenum	7439-98-7	0.0149	0.0056	YES
Nickel	7440-02-0	0.2779	0.0350	YES
Nitrate/Nitrite	14797-65-0nn	6.510	5.3490	YES
Thallium	7440-28-0	0.0036		YES
Vanadium	7440-62-2	0.0257	0.0171	YES
SVOCs (mg/L)				
Bis(2-ethylhexyl)phthalate	117-81-7	0.0176		YES
VOCs (mg/L)				
Bromochloromethane	74-97-5	0.0058		YES
Dichloromethane (Methylene Chloride)	75-09-2	0.0154		YES
Fluorobenzene	462-06-6	0.0087		YES
O-Chloroflurobenzene	348-51-6	0.0072		YES
Tert-butyl methyl ether	1634-04-4	0.0006		YES
Tetrachloroethene	127-18-4	0.0015		YES
Trichloroethylene (TCE)	79-01-6	0.0039		YES
Radionuclides (pCi/L)				
Plutonium-238	13981-16-3	0.2587	0.0870	YES
Potassium-40	13966-00-2	48.3052		YES
Radium-226	13982-63-3	1.6849	0.9960	YES:2
Radium-226 +D	13982-63-3(+D)	1.6849	0.9960	YES:2
Radium-226 long lived decay	13982-63-3L	1.6849	0.9960	YES:2
Radium-228	15262-20-1	0.4179		YES:3
Radium-228 +D	15262-20-1(+D)	0.4179		YES:3
Radium-228 long lived decay	15262-20-1L	0.4179		YES:3
Strontium-90	10098-97-2	1.4173	0.9750	YES
Thorium-228	14274-82-9	77.5034	0.7790	YES:3
Thorium-228+D	14274-82-9(+D)	77.5034	0.7790	YES:3
Thorium-228 long lived decay	14274-82-9L	77.5034	0.7790	YES:3
Thorium-230	14269-63-7	0.6202		YES:2
Thorium-230 long lived decay	14269-63-7L	0.6202		YES:2

Table 13: Final Identification of Future Groundwater COPCs for the Site Employee Scenario

(Future Modeled Concentration vs. Background)

Analyte (unit)	CAS Number	Future Modeled Screening Concentration	Background Concentration	COPC
Thorium-232	7440-29-1	0.1803	0.3140	NO
Thorium-232 long lived decay	7440-29-1L	0.1803	0.3140	YES:4
Tritium	10028-17-8w	66797.9574	1485.4700	YES
Uranium-233	13968-55-3	1.3619		YES:6
Uranium-233 long lived decay	13968-55-3L	1.3619		YES
Uranium-234	13966-29-5	2.6013	0.7920	YES:2
Uranium-235	15117-96-1	2.1485	0.8140	YES:7
Uranium-235+D	15117-96-1(+D)	2.1485	0.8140	YES:7
Uranium-235 long lived decay	15117-96-1L	2.1485	0.8140	YES
Uranium-238	7440-61-1	0.5524	0.6880	NO
Uranium-238+D	7440-61-1(+D)	0.5524	0.6880	NO
Uranium-238 long lived decay	7440-61-1L	0.5524	0.6880	YES:5

'+D' incorporates daughter products
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
RBGV: Risk-Based Guideline Value, value is the lower of 10^{-6} cancer risk or 0.1 hazard index
a - carcinogen value, b - noncarcinogen value, c - maximum contaminant level (MCL)
COPC: Constituent of Potential Concern

COPC = YES indicates the analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of Ac-227 (reference 1), U-238 (reference 2), or Th-232 (reference 3). For reference 4, Th-232 screens out but the Th-232 long lived decay chain was retained for risk evaluation. For reference 5, U-238 screens out but the U-238 long lived decay chain was retained for risk evaluation. Analyte is retained as a COPC; however, will not be evaluated individually because it is included in the risk assessment as part of the long lived decay chain of U-233 (reference 6) and U-235 (reference 7).

COPC = NO indicates analyte was screened out based on: 2 = comparison to background, 3 = comparison to the lower of RBGV or MCL, and/or 4 = analyte is an essential human nutrient

Table 14: Exposure Assumptions for the Construction Worker and Site Employee Scenarios

Parameter/Medium/Pathway	Units	Construction Worker Adult	Site-Employee Adult	Reference
Soil		**(All depths)**	**(0 - 2 ft.)**	
Incidental ingestion				
Soil ingestion rate	mg/day	480	50	a
Exposure frequency	days/year	250	250	b
Exposure duration	years	5	25	c
Body weight	kg	70	70	d
Carcinogen averaging time	days	25550	25550	e
Noncarcinogen averaging time	days	1825	9125	e
Conversion Factor	kg/mg	1.00E-06	1.00E-06	
Inhalation of VOCs and dust				
Inhalation rate	m^3/day	20	20	f
Exposure frequency	days/year	250	250	b
Exposure duration	years	5	25	c
Body weight	kg	70	70	d
Carcinogen averaging time	days	25550	25550	e
Noncarcinogen averaging time	days	1825	9125	e
Particle Emissions Factor	m^3/kg	1.32×10^9	1.32×10^9	k
Conversion Factor	days/hour	0.042	0.042	
Air Exchange Rate	air changes/hour	N/A	0.45	h
Dermal Exposure				
Adherence factor of soil to skin	mg/m^2-event	0.3	NA	l
Skin surface area available for contact	m^2	50	NA	m
External Exposure				
Gamma Shielding Factor		0.1	0.2	
Gamma Exposure Time Factor		1/3	1/12	
Exposure Duration 2	years	5 X 0.685	25 X 0.685	c
Exposure Frequency	day/year	250	250	b

Table 14: Exposure Assumptions for the Construction Worker and Site Employee Scenarios

Parameter/Medium/Pathway	Units	Construction Worker Adult	Site-Employee Adult	Reference
Groundwater				
Drinking water ingestion				
Drinking water ingestion rate	L/day	1	1	i
Exposure frequency	days/year	250	250	b
Exposure time	years	5	25	g
Body weight	kg	70	70	d
Carcinogen averaging time	days	25550	25550	e
Noncarcinogen averaging time	days	1825	9125	e
Dermal contact while showering				
Skin surface area available for contact	cm^2	19400	NA	j
Exposure time	hr/day	0.167	NA	g
Exposure frequency	days/year	250	NA	b
Exposure duration	years	5	NA	c
Body weight	kg	70	NA	d
Carcinogen averaging time	days	25550	NA	e
Noncarcinogen averaging time	days	1825	NA	e
Conversion factor	L/cm^3	0.001	NA	
Inhalation of VOCs while showering				
Inhalation rate	m^3/day	20	NA	f
Exposure time	hr/day	0.167	NA	g
Exposure frequency	days/year	250	NA	b
Exposure duration	years	5	NA	c
Body weight	kg	70	NA	d
Carcinogen averaging time	days	25550	NA	e
Noncarcinogen averaging time	days	1825	NA	e

bgs: below ground surface

VOCs: volatile organic compounds

NA: not applicable

numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 14 (continued)
Exposure Assumptions for the Construction Worker and Site Employee Scenario References

a	Soil ingestion rate	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and Risk Assessment Guidance for Superfund (RAGS) Part A
b	Exposure frequency	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
c	Exposure duration	Exposure duration for the construction worker and site employee is based on Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
d	Body weight	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
e	Averaging time	Carcinogenic averaging time = 70 yrs • 365 days/year. Non-carcinogenic averaging time = exposure duration (yrs) • 365 days/year.
f	Inhalation rate	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and Exposure Factors Handbook Volume I, Table 1-2.
g	Exposure time	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
h	Air exchange rate	Volume of residential homes, EFH, Volume III, Table 17-3. 50th percentile air exchange rate of 0.45 air changes per hour, Exposure Factors Handbook, Volume III, Table 17-10
i	Drinking water ingestion	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
j	Skin surface available for contact	Risk-Based Guideline Values, Mound Plant, Miamisburg, Ohio. and RAGS Part A
k	Particulate emission factor	Soil Screening Guidance: User's Guide, Second Edition, Publication 9355.4-23, July 1996.
l	Adherence factor of soil to skin	EPA Dermal Risk Assessment Supplemental Guidance, August 1992.
m	Skin surface area available for contact	EPA Dermal Risk Assessment Supplemental Guidance, August 1992.

Table 15: Toxicity Criteria and Other Physical Chemical Values

	RfD (mg/kg-day)					CSF (Risk/mg/kg-day)									
	Oral			Inhalation		Oral			Inhalation						
			Adjusted					Adjusted							
Analyte	RfD_o	REF.	RfD_a	RfD_i	REF.	CSF_o	REF.	CSF_a	CSF_i	REF.	CSF_{ex}	GI Factor	Dermal Absorption Factor	Kp (cm/hr)	Lag Time (hr)
VOCs															
Bromochloromethane	---	---	---	---	---	---	---	---	---	---	NA	8.0E-01		3.1E-03	
Dichloromethane (Methylene Chloride)	6.0E-02	I	6.0E-02	8.6E-01	H	7.5E-03	I	7.5E-03	1.6E-03	I	NA	9.5E-01		4.5E-03	2.9E-01
Fluorobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
O-Chloroflurobenzene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Tert-butyl methyl ether	---	---	---	8.6E-01	I	---	---	---	---	---	NA	8.0E-01		2.6E-03	
Tetrachloroethene	1.0E-02	I	1.0E-02	---	---	5.2E-02	N	5.2E-02	2.0E-03	N	NA	1.0E+00		3.7E-01	9.0E-01
Trichloroethylene (TCE)	3.0E-04	N, 2002	3.0E-04	---	---	2.1E-01	N, 2002	2.1E-01	6.0E-03	N	NA	1.0E+00		2.3E-01	5.5E-01
Pesticides															
Chlordane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	#N/A			
SVOCs															
Benzo(a)anthracene	---	---	---	---	---	7.3E-01	EPA-93	7.3E-01	3.1E-01	EPA-93	NA	8.9E-01	1.3E-01		
Benzo(a)pyrene	---	---	---	---	---	7.3E+00	I	7.3E+00	3.1E+00	N	NA	8.9E-01	1.3E-01		
Benzo(g,h,i)perylene	---	---	---	---	---	---	---	---	---	---	NA	8.9E-01	1.3E-01		
Bis(2-ethylhexyl)phthalate	2.0E-02	I	3.8E-03	---	---	1.4E-02	I	7.4E-02	---	---	NA	1.9E-01		3.3E-02	
Phenanthrene	---	---	---	---	---	---	---	---	---	---	NA	8.9E-01	1.3E-01		
Inorganics															
Aluminum	1.0E+00	N	1.0E-01	---	---	---	---	---	---	---	NA	1.0E-01		1.0E-03	
Antimony	4.0E-04	I	6.0E-05	---	---	---	---	---	---	---	NA	1.5E-01		1.0E-03	
Arsenic	3.0E-04	I	3.0E-04	---	---	1.5E+00	I	---	1.5E+01	I	NA	9.5E-01	3.0E-02		
Bismuth	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
Cadmium	5.0E-04	I	1.3E-05	---	---	---	---	---	6.3E+00	I	NA	2.5E-02		1.0E-03	
Chromium (used VI CAS #)	3.0E-03	I	7.5E-05	2.9E-05	I	---	---	---	4.2E+01	I	NA	2.5E-02		1.0E-03	
Copper	4.0E-02	N	4.0E-02	---	---	---	---	---	---	---	NA	5.7E-01		1.0E-03	
Lead	---	---	---	---	---	---	---	---	---	---	NA	1.5E-01		1.0E-03	
Lithium	---	---	---	---	---	---	---	---	---	---	NA	8.0E-01		1.0E-03	
Molybdenum	5.0E-03	I	1.9E-03	---	---	---	---	---	---	---	NA	3.8E-01		1.0E-03	
Nickel	2.0E-02	I	8.0E-04	---	---	---	---	---	1.7E+00	I	NA	4.0E-02		1.0E-03	
Thallium	8.0E-05	I	8.0E-05	---	---	---	---	---	---	---	NA	1.0E+00		1.0E-03	
Vanadium	7.0E-03	H	1.8E-04	---	---	---	---	---	---	---	NA	2.6E-02		1.0E-03	
Nitrate/Nitrite	1.0E-01	I	1.0E-01	---	---	---	---	---	---	---	NA	NA		1.0E-03	

Table 15: Toxicity Criteria and other Physical Chemical Values

	RfD (mg/kg-day)					CSF (Risk/pCi)									
	Oral			Inhalation		Oral			Inhalation						
			Adjusted					Adjusted				GI Factor	Dermal Absorption Factor	Kp (cm/hr)	Lag Time (hr)
Analyte	RfD_o	REF.	RfD_a	RfD_i	REF.	CSF_o	REF.	CSF_a	CSF_i	REF.	CSF_{ex}				
Radionuclides (Groundwater)															
Plutonium-238	---		---	---		1.3E-10	H	---	3.4E-08	H	7.2E-11	5.0E-04		NA	
Plutonium-239/240	---		---	---		1.4E-10	H	---	3.3E-08	H	2.0E-10	5.0E-04		NA	
Potassium-40	---		---	---		2.5E-11	H	---	1.0E-11	H	8.0E-07	1.0E+00		NA	
Strontium-90	---		---	---		5.6E-11	H	---	1.1E-10	H	4.8E-10	3.0E-01		NA	
Thorium-232 long lived decay	---		---	---		1.4E-09	H	---	1.9E-07	H	1.2E-05	5.0E-04		NA	
Tritium	---		---	---		5.1E-14	H	5.1E-14	5.6E-14	H	NA	1.0E+00		1.5E-05	
Uranium-233 long lived decay	---		---	---		6.0E-10	H	---	2.4E-07	H	1.2E-06	2.0E-02		NA	
Uranium-235 long lived decay	---		---	---		7.3E-10	H	---	2.6E-07	H	2.2E-06	2.0E-02		NA	
Uranium-238 long lived decay	---		---	---		1.9E-09	H	---	7.5E-08	H	8.6E-06	2.0E-02		NA	
Radionuclides (Soil)															
Actinium-227 long lived decay	---		---	---		1.2E-09	H	---	2.1E-07	H	1.5E-06	5.0E-04		NA	
Plutonium-238	---		---	---		2.7E-10	H	---	3.4E-08	H	7.2E-11	5.0E-04		NA	
Thorium-232 long lived decay	---		---	---		3.3E-09	H	---	1.9E-07	H	1.2E-05	5.0E-04		NA	
Uranium-238 long lived decay	---		---	---		4.0E-09	H	---	7.5E-08	H	8.6E-06	5.0E-04		NA	

numbers written as 1.0E-3 equal 1x10-3 and 0.001

a - Reference (Ref): H = HEAST, July, 1997 chemicals and April, 2002 for radionuclides; I = IRIS, as of March 28, 2002; N = NCEA; EPA-93 guidance for PAHs.

b - Dermal default values are from Dermal Guidance, EPA 1992

CAS: Chemical Abstract Services

CAS Numbers presented on previous tables

VOCs: volatile organic compounds

SVOCs: semivolatile organic compounds

NA: not applicable

Kp: permeability coefficient

GI: Gastorintestinal Absorption Factor

RfD: reference dose

CSF: cancer slope factor

Table 16: Total Residual Soil Risk for the Construction Worker Scenario

			CANCER EFFECTS						NON-CANCER EFFECTS					
			Route-Specific Risk					Total	Route-Specific HI					Total
Analyte	CAS No.	EPC	Oral	Dermal	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Dermal	Inhal. Dust	Inhal. VOCs	External	Non-Cancer Hazard
Metals (mg/kg)														
Antimony	7440-36-0	8.46	---	---	---	NAP	NAP	---	9.9E-02	1.5E-03	---	NAP	NAP	1.0E-01
Bismuth	7440-69-9	72.70	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Thallium	7440-28-0	1.14	---	---	---	NAP	NAP	---	6.7E-02	1.5E-04	---	NAP	NAP	6.7E-02
Pesticides (mg/kg)														
Chlordane	57-74-9	0.02	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
SVOCs (mg/kg)														
Benzo(a)anthracene	56-55-3	0.32	7.9E-08	3.2E-08	1.0E-12	NAP	NAP	1.1E-07	---	---	---	NAP	NAP	---
Benzo(a)pyrene	50-32-8	0.32	7.7E-07	3.1E-07	1.0E-11	NAP	NAP	**1.1E-06**	---	---	---	NAP	NAP	---
Benzo(g,h,i)perylene	191-24-2	0.30	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Phenanthrene	85-01-8	0.35	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Radionuclides (pCi/g)														
Actinium-227 L	14952-40-0L	0.30	2.1E-07	NAP	1.2E-09	NAP	4.6E-07	6.7E-07	---	---	---	NAP	---	---
Plutonium-238	13981-16-3	26.10	4.3E-06	NAP	1.7E-08	NAP	1.9E-09	**4.3E-06**	---	---	---	NAP	---	---
Thorium-232 L	7440-29-1L	1.64	3.3E-06	NAP	5.9E-09	NAP	2.1E-05	**2.4E-05**	---	---	---	NAP	---	---
Uranium-238 L	7440-61-1L	1.88	4.5E-06	NAP	2.7E-09	NAP	1.7E-05	**2.1E-05**	---	---	---	NAP	---	---
TOTAL			**1.3E-05**	3.5E-07	2.6E-08	---	**3.8E-05**	**5.1E-05**	1.7E-01	1.6E-03	0.0E+00	---	---	1.7E-01

bold values represent estimates that exceed acceptable thresholds
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters
Ext.: External
Inhal.: Inhalation
L: long lived decay
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds

Table 17: Background Residual Soil Risk for the Construction Worker Scenario

			CANCER EFFECTS						NON-CANCER EFFECTS					
			Route-Specific Risk					Total	Route-Specific HI					Total
Analyte	CAS No.	EPC	Oral	Dermal	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Dermal	Inhal. Dust	Inhal. VOCs	External	Non-Cancer Hazard
Metals (mg/kg)														
Antimony	7440-36-0		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Bismuth	7440-69-9		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Thallium	7440-28-0	0.46	---	---	---	NAP	NAP	---	2.7E-02	6.0E-05	---	NAP	NAP	2.7E-02
Pesticides (mg/kg)														
Chlordane	57-74-9		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
SVOCs (mg/kg)														
Benzo(a)anthracene	56-55-3		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Benzo(a)pyrene	50-32-8		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Benzo(g,h,i)perylene	191-24-2		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Phenanthrene	85-01-8		---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Radionuclides (pCi/g)														
Actinium-227 L	14952-40-0L		---	NAP	---	NAP	---	---	---	---	---	NAP	---	---
Plutonium-238	13981-16-3	0.13	2.1E-08	NAP	8.3E-11	NAP	9.6E-12	**2.1E-08**	---	---	---	NAP	---	---
Thorium-232 L	7440-29-1L	1.40	2.8E-06	NAP	5.1E-09	NAP	1.8E-05	**2.0E-05**	---	---	---	NAP	---	---
Uranium-238 L	7440-61-1L	1.20	2.9E-06	NAP	1.7E-09	NAP	1.1E-05	**1.3E-05**	---	---	---	NAP	---	---
TOTAL			**5.7E-06**	---	6.9E-09	---	**2.8E-05**	**3.4E-05**	2.7E-02	6.0E-05	---	---	---	2.7E-02

bold values represent estimates that exceed acceptable thresholds
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters
Ext.: External
Inhal.: Inhalation
L: long lived decay
EPC: Exposure Point Concentration
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semi-volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 18: Incremental Residual Soil Risk for the Construction Worker Scenario

			CANCER EFFECTS						NON-CANCER EFFECTS					
			Route-Specific Risk					Total	Route-Specific HI					Total
Analyte	CAS No.	EPC	Oral	Dermal	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Dermal	Inhal. Dust	Inhal. VOCs	Ext.	Non-Cancer Hazard
Metals (mg/kg)														
Antimony	7440-36-0	8.46	---	---	---	NAP	NAP	---	9.9E-02	1.5E-03	---	NAP	NAP	1.0E-01
Bismuth	7440-69-9	72.70	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Thallium	7440-28-0	0.68	---	---	---	NAP	NAP	---	4.0E-02	8.9E-05	---	NAP	NAP	4.0E-02
Pesticides (mg/kg)														
Chlordane	57-74-9	0.02	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
SVOCs (mg/kg)														
Benzo(a)anthracene	56-55-3	0.32	7.9E-08	3.2E-08	1.0E-12	NAP	NAP	1.1E-07	---	---	---	NAP	NAP	---
Benzo(a)pyrene	50-32-8	0.32	7.7E-07	3.1E-07	1.0E-11	NAP	NAP	**1.1E-06**	---	---	---	NAP	NAP	---
Benzo(g,h,i)perylene	191-24-2	0.30	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Phenanthrene	85-01-8	0.35	---	---	---	NAP	NAP	---	---	---	---	NAP	NAP	---
Radionuclides (pCi/g)														
Actinium-227 L	14952-40-0L	0.30	2.1E-07	NAP	1.2E-09	NAP	4.6E-07	6.7E-07	---	---	---	NAP	---	---
Plutonium-238	13981-16-3	25.97	4.2E-06	NAP	1.7E-08	NAP	1.9E-09	**4.3E-06**	---	---	---	NAP	---	---
Thorium-232 L	7440-29-1L	0.24	4.8E-07	NAP	8.7E-10	NAP	3.0E-06	**3.5E-06**	---	---	---	NAP	---	---
Uranium-238 L	7440-61-1L	0.68	1.6E-06	NAP	9.6E-10	NAP	6.0E-06	**7.6E-06**	---	---	---	NAP	---	---
TOTAL			**7.4E-06**	3.5E-07	2.0E-08	---	**9.5E-06**	**1.7E-05**	1.4E-01	1.6E-03	---	---	---	1.4E-01

bold values represent estimates that exceed acceptable thresholds

Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Ext.: External

Inhal.: Inhalation

L: long lived decay

EPC: Exposure Point Concentration

HI: Hazard Index

NA: Not available; insufficient toxicity data

NAP: not an applicable pathway

VOCs: volatile organic compounds

SVOCs: semi-volatile organic compounds

CAS: Chemical Abstract Service

numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 19: Total Residual Soil Risk for the Site Employee Scenario

Analyte	CAS No.	EPC	CANCER EFFECTS					NON-CANCER EFFECTS			
			Route-Specific Risk				Total	Route-Specific HI			Total
			Oral	Inhalation Dust	Inhalation VOCs	External	Cancer Risk	Oral	Inhalation Dust	Inhalation VOCs	Non-Cancer Hazard
Metals (mg/kg)											
Arsenic	7440-38-2	8.9E+00	2.3E-06	7.1E-09	NAP	NAP	**2.3E-06**	1.4E-02	---	NAP	1.4E-02
Bismuth	7440-69-9	7.3E+01	---	---	NAP	NAP	---	---	---	NAP	---
Pesticides (mg/kg)											
Chlordane	57-74-9	1.6E-02	---	---	NAP	NAP	0.0E+00	---	---	NAP	---
SVOCs (mg/kg)											
Benzo(a)pyrene	50-32-8	3.5E-01	4.5E-07	5.7E-11	NAP	NAP	4.5E-07	---	---	NAP	---
Benzo(g,h,i)perylene	191-24-2	3.3E-01	---	---	NAP	NAP	---	---	---	NAP	---
Phenanthrene	85-01-8	4.0E-01	---	---	NAP	NAP	---	---	---	NAP	---
Radionuclides (pCi/g)											
Actinium-227 long lived decay	14952-40-0L	3.5E-01	1.3E-07	7.0E-09	NAP	5.9E-07	7.3E-07	---	---	NAP	---
Plutonium-238	13981-16-3	2.5E+01	2.1E-06	7.9E-08	NAP	2.1E-09	**2.2E-06**	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.7E+00	1.8E-06	3.1E-08	NAP	2.4E-05	**2.6E-05**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	2.0E+00	2.4E-06	1.4E-08	NAP	1.9E-05	**2.2E-05**	---	---	NAP	---
TOTAL			**9.2E-06**	1.4E-07	---	**4.4E-05**	**5.3E-05**	1.4E-02	---	---	1.4E-02

bold values represent estimates that exceed acceptable thresholds
HI: Hazard Index
Inhal.: inhalation
SVOCs: semivolatile organic compounds
EPC: Exposure Point Concentration
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 20: Background Residual Soil Risk for the Site Employee Scenario

Analyte	CAS No.	EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Inhalation Dust	Inhal. VOCs	External	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Inhal. Dust	Inhal. VOCs	Total Non-Cancer Hazard
Metals (mg/kg)											
Arsenic	7440-38-2	8.6E+00	2.3E-06	6.9E-09	NAP	NAP	**2.3E-06**	1.4E-02	---	NAP	1.4E-02
Bismuth	7440-69-9		---	---	NAP	NAP	---	---	---	NAP	---
Pesticides (mg/kg)											
Chlordane	57-74-9		---	---	NAP	NAP	---	---	---	NAP	---
SVOCs (mg/kg)											
Benzo(a)pyrene	50-32-8		---	---	NAP	NAP	---	---	---	NAP	---
Benzo(g,h,i)perylene	191-24-2		---	---	NAP	NAP	---	---	---	NAP	---
Phenanthrene	85-01-8		---	---	NAP	NAP	---	---	---	NAP	---
Radionuclides (pCi/g)											
Actinium-227 long lived decay	14952-40-0L	---	---	---	NAP	---	---	---	---	NAP	---
Plutonium-238	13981-16-3	1.3E-01	1.1E-08	4.1E-10	NAP	1.1E-11	1.1E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.4E+00	1.5E-06	2.5E-08	NAP	2.0E-05	**2.1E-05**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	1.2E+00	1.5E-06	8.5E-09	NAP	1.2E-05	**1.3E-05**	---	---	NAP	---
TOTAL			**5.2E-06**	4.1E-08	---	**3.1E-05**	**3.7E-05**	1.4E-02	---	---	1.4E-02

bold values represent estimates that exceed acceptable thresholds
Inhal.: inhalation
HI: Hazard Index
SVOCs: semivolatile organic compounds
EPC: Exposure Point Concentration
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 21: Incremental Residual Soil Risk for the Site Employee Scenario

			CANCER EFFECTS					NON-CANCER EFFECTS			
			Route-Specific Risk				Total	Route-Specific HI			Total
Analyte	CAS No.	EPC	Oral	Inhalation Dust	Inhal. VOCs	External	Cancer Risk	Oral	Inhal. Dust	Inhal. VOCs	Non-Cancer Hazard
Metals (mg/kg)											
Arsenic	7440-38-2	2.8E-01	7.3E-08	2.2E-10	NAP	NAP	7.4E-08	4.6E-04	---	NAP	4.6E-04
Bismuth	7440-69-9	7.3E+01	---	---	NAP	NAP	---	---	---	NAP	---
Pesticides (mg/kg)											
Chlordane	57-74-9	1.6E-02	---	---	NAP	NAP	---	---	---	NAP	---
SVOCs (mg/kg)											
Benzo(a)pyrene	50-32-8	3.5E-01	4.5E-07	5.7E-11	NAP	NAP	4.5E-07	---	---	NAP	---
Benzo(g,h,i)perylene	191-24-2	3.3E-01	---	---	NAP	NAP	---	---	---	NAP	---
Phenanthrene	85-01-8	4.0E-01	---	---	NAP	NAP	---	---	---	NAP	---
Radionuclides (pCi/g)											
Actinium-227 long lived decay	14952-40-0L	3.5E-01	1.3E-07	7.0E-09	NAP	5.9E-07	**7.3E-07**	---	---	NAP	---
Plutonium-238	13981-16-3	2.5E+01	2.1E-06	7.9E-08	NAP	2.0E-09	**2.2E-06**	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	3.0E-01	3.1E-07	5.4E-09	NAP	4.2E-06	**4.5E-06**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	7.5E-01	9.3E-07	5.3E-09	NAP	7.4E-06	**8.3E-06**	---	---	NAP	---
TOTAL			**4.0E-06**	9.7E-08	---	**1.2E-05**	**1.6E-05**	4.6E-04	---	---	4.6E-04

bold values represent estimates that exceed acceptable thresholds
Inhal.: inhalation
SVOCs: semivolatile organic compounds
VOCs: volatile organic compounds
EPC: Exposure Point Concentration
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 22: Current Total Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	---	---	---	---	---	4.8E-07	4.8E-07
Trichloroethylene (TCE)	79-01-6	0.002	3.4E-07	1.3E-06	6.7E-10	1.6E-06	7.5E-02	2.8E-01	---	3.6E-01
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	---	NAP	NA	3.5E-01	7.6E-03	NAP	3.6E-01
Cadmium	7440-43-9w	0.007	---	---	NAP	NA	1.3E-01	1.7E-02	NAP	1.5E-01
Copper	7440-50-8	0.042	---	---	NAP	NA	1.0E-02	3.3E-05	NAP	1.0E-02
Lead	7439-92-1	0.013	---	---	NAP	NA	---	---	NAP	---
Radionuclides (pCi/L)										
Uranium-238 long lived decay	7440-61-1L	2.020	4.8E-06	---	---	4.8E-06	---	---	NAP	---
TOTAL			**5.1E-06**	**1.3E-06**	6.7E-10	**6.4E-06**	5.7E-01	3.1E-01	4.8E-07	**8.7E-01**

* the CAS Number and toxicity criteria for cis- isomer used for risk calculations to be conservative.
bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 23: Current Background Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4		---	---	---	---	---	---	---	---
Trichloroethylene (TCE)	79-01-6		---	---	---	---	---	---	---	---
Inorganics (mg/L)										
Antimony	7440-36-0	0.001	---	---	NAP	---	1.4E-02	3.1E-04	NAP	1.4E-02
Cadmium	7440-43-9w		---	---	NAP	---	---	---	NAP	---
Copper	7440-50-8	0.001	---	---	NAP	---	2.9E-04	9.2E-07	NAP	2.9E-04
Lead	7439-92-1		---	---	NAP	---	---	---	NAP	---
Radionuclides (pCi/L)										
Uranium-238 long lived decay	7440-61-1L	0.688	1.6E-06	NA	NAP	1.6E-06	---	---	NAP	---
TOTAL			**1.6E-06**	---	---	**1.6E-06**	1.4E-02	3.1E-04	---	1.5E-02

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 24: Current Incremental Residual Groundwater Risk for the Construction Worker Scenario

			CANCER EFFECTS				NON-CANCER EFFECTS			
			Route-Specific Risk			Total	Route-Specific HI			Total
Analyte	CAS No.	Total EPC	Oral	Dermal	Inhalation $VOC_{(shower)}$	Cancer Risk	Oral	Dermal	Inhalation VOCs	Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	---	---	---	---	---	4.8E-07	4.8E-07
Trichloroethylene (TCE)	79-01-6	0.002	3.4E-07	1.3E-06	6.7E-10	1.6E-06	7.5E-02	2.8E-01	---	3.6E-01
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	---	NAP	---	3.4E-01	7.3E-03	NAP	3.5E-01
Cadmium	7440-43-9w	0.007	---	---	NAP	---	1.3E-01	1.7E-02	NAP	1.5E-01
Copper	7440-50-8	0.040	---	---	NAP	---	9.9E-03	3.2E-05	NAP	9.9E-03
Lead	7439-92-1	0.013	---	---	NAP	---	---	---	NAP	---
Radionuclides (pCi/L)										
Uranium-238 long lived decay	7440-61-1L	1.332	3.2E-06	NA	NAP	3.2E-06	---	---	NAP	---
TOTAL			**3.5E-06**	**1.3E-06**	6.7E-10	**4.8E-06**	5.5E-01	3.1E-01	4.8E-07	**8.6E-01**

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 25: Current Total Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation $VOC_{(shower)}$	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6	0.002	1.7E-06	NAP	NAP	**1.7E-06**	7.5E-02	NAP	NAP	7.5E-02
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	NAP	NAP	---	3.5E-01	NAP	NAP	3.5E-01
Cadmium	7440-43-9w	0.007	---	NAP	NAP	---	1.3E-01	NAP	NAP	1.3E-01
Copper	7440-50-8	0.042	---	NAP	NAP	---	1.0E-02	NAP	NAP	1.0E-02
Lead	7439-92-1	0.013	---	NAP	NAP	---	---	NAP	NAP	---

Radionuclides (pCi/L)										
Plutonium-239/240	PU-239/240	2.000	1.7E-06	NA	NAP	**1.7E-06**	---	NAP	NAP	---
Uranium-233/234	U-233/234	0.246	9.2E-07	NA	NAP	9.2E-07	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.170	2.0E-05	NA	NAP	**2.0E-05**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	2.020	7.6E-06	NA	NAP	**7.6E-06**	---	NAP	NAP	---
TOTAL			**3.1E-05**	---	---	**3.1E-05**	5.7E-01	---	---	5.7E-01

VOCs: volatile organic compounds
bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 26: Current Background Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4		---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6		---	NAP	NAP	---	---	NAP	NAP	---
Inorganics (mg/L)										
Antimony	7440-36-0	0.001	---	NAP	NAP	---	1.4E-02	NAP	NAP	1.4E-02
Cadmium	7440-43-9w		---	NAP	NAP	---	---	NAP	NAP	---
Copper	7440-50-8	0.001	---	NAP	NAP	---	2.9E-04	NAP	NAP	2.9E-04
Lead	7439-92-1		---	NAP	NAP	---	---	NAP	NAP	---
Radionuclides (pCi/L)										
Plutonium-239/240	PU-239/240	0.125	1.1E-07	NAP	NAP	1.1E-07	---	NAP	NAP	---
Uranium-233/234	U-233/234		---	NAP	NAP	---	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	0.314	2.8E-06	NAP	NAP	**2.8E-06**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	0.688	8.2E-06	NAP	NAP	**8.2E-06**	---	NAP	NAP	---
TOTAL			**1.1E-05**	---	---	**1.1E-05**	1.4E-02	---	---	1.4E-02

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 27: Current Incremental Residual Groundwater Risk for the Site Employee Scenario

			CANCER EFFECTS				NON-CANCER EFFECTS			
			Route-Specific Risk			Total	Route-Specific HI			Total
Analyte	CAS No.	Total EPC	Oral	Dermal	Inhalation $VOC_{(shower)}$	Cancer Risk	Oral	Dermal	Inhalation VOCs	Non-Cancer Hazard
VOCs (mg/L)										
Tert-butyl methyl ether	1634-04-4	0.001	---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6	0.002	1.7E-06	NAP	NAP	**1.7E-06**	7.5E-02	NAP	NAP	7.5E-02
Inorganics (mg/L)										
Antimony	7440-36-0	0.014	---	NAP	NAP	---	3.4E-01	NAP	NAP	3.4E-01
Cadmium	7440-43-9w	0.007	---	NAP	NAP	---	1.3E-01	NAP	NAP	1.3E-01
Copper	7440-50-8	0.040	---	NAP	NAP	---	9.9E-03	NAP	NAP	9.9E-03
Lead	7439-92-1	0.013	---	NAP	NAP	---	---	NAP	NAP	---
Radionuclides (pCi/L)										
Plutonium-239/240	PU-239/240	1.875	1.6E-06	NAP	NAP	**1.6E-06**	---	NAP	NAP	---
Uranium-233/234	U-233/234	0.246	9.2E-07	NAP	NAP	9.2E-07	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.856	1.7E-05	NAP	NAP	**1.7E-05**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	1.332	5.0E-06	NAP	NAP	**5.0E-06**	---	NAP	NAP	---
TOTAL			**2.6E-05**	---	---	**2.6E-05**	5.5E-01	---	---	5.5E-01

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NAP: not an applicable pathway
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 28: Future Total Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	0.006	---	---	---	---	---	---	---	---
Dichloromethane (Methylene Chloride)	75-09-2	0.015	8.1E-08	4.3E-09	1.2E-09	8.6E-08	2.5E-03	1.3E-04	1.2E-05	2.7E-03
Fluorobenzene	462-06-6	0.009	---	---	---	---	---	---	---	---
O-Chloroflurobenzene	348-51-6	0.007	---	---	---	---	---	---	---	---
Tetrachloroethene	127-18-4	0.002	5.5E-08	---	1.5E-10	5.6E-08	1.5E-03	---	---	1.5E-03
Tert-butyl methyl ether	1634-04-4	0.002	---	---	---	---	---	---	1.9E-06	1.9E-06
Trichloroethylene (TCE)	79-01-6	0.004	5.7E-07	2.1E-06	1.1E-09	2.7E-06	1.3E-01	4.7E-01	---	6.0E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	0.018	1.7E-07	9.7E-08	NAP	2.7E-07	8.6E-03	4.8E-03	NAP	1.3E-02
Inorganics (mg/L)										
Aluminum	7429-90-5	2.024	---	---	NAP	---	2.0E-02	6.4E-04	NAP	2.0E-02
Antimony	7440-36-0	0.018	---	---	NAP	---	4.5E-01	9.7E-03	NAP	4.6E-01
Bismuth	7440-69-9	0.024	---	---	NAP	---	---	---	NAP	---
Cadmium	7440-43-9w	0.008	---	---	NAP	---	1.6E-01	2.0E-02	NAP	1.8E-01
Chromium (used VI CAS #)	18540-29-9	0.964	---	---	NAP	---	3.1E+00	4.1E-01	NAP	**3.6E+00**
Copper	7440-50-8	0.056	---	---	NAP	---	1.4E-02	4.4E-05	NAP	1.4E-02
Lead	7439-92-1	0.019	---	---	NAP	---	---	---	NAP	---
Lithium	7439-93-2	0.151	---	---	NAP	---	---	---	NAP	---
Molybdenum	7439-98-7	0.015	---	---	NAP	---	2.9E-02	2.5E-04	NAP	2.9E-02
Nickel	7440-02-0	0.278	---	---	NAP	---	1.4E-01	1.1E-02	NAP	1.5E-01
Nitrate/Nitrite	14797-65-0nn	6.510	---	---	NAP	---	6.4E-01	4.1E-03	NAP	6.4E-01
Thallium	7440-28-0	0.004	---	---	NAP	---	4.5E-01	1.4E-03	NAP	4.5E-01
Vanadium	7440-62-2	0.026	---	---	NAP	---	3.6E-02	4.5E-03	NAP	4.0E-02
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	0.259	4.2E-08	NA	NAP	4.2E-08	---	---	NAP	---
Potassium-40	13966-00-2	48.305	1.5E-06	NA	NAP	**1.5E-06**	---	---	NAP	---
Strontium-90	10098-97-2	1.417	9.9E-08	NA	NAP	9.9E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.588	4.7E-06	NA	NAP	**4.7E-06**	---	---	NAP	---
Tritium	10028-17-8w	66797.957	4.2E-06	2.1E-08	4.4E-08	**4.3E-06**	---	---	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.362	1.0E-06	NA	NAP	**1.0E-06**	---	---	NAP	---
Uranium-235 long lived decay	15117-96-1L	2.149	2.0E-06	NA	NAP	**2.0E-06**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	3.702	8.8E-06	NA	NAP	**8.8E-06**	---	---	NAP	---
TOTAL			**2.3E-05**	**2.3E-06**	4.6E-08	**2.6E-05**	**5.2E+00**	9.4E-01	1.4E-05	**6.1E+00**

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Table 28: Future Total Residual Groundwater Risk for the Construction Worker Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 29: Future Background Residual Groundwater Risk for the Construction Worker Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5		---	---	---	---	---	---	---	---
Dichloromethane (Methylene Chloride)	75-09-2		---	---	---	---	---	---	---	---
Fluorobenzene	462-06-6		---	---	---	---	---	---	---	---
O-Chloroflurobenzene	348-51-6		---	---	---	---	---	---	---	---
Tert-butyl methyl ether	1634-04-4		---	---	---	---	---	---	---	---
Tetrachloroethene	127-18-4		---	---	---	---	---	---	---	---
Trichloroethylene (TCE)	79-01-6		---	---	---	---	---	---	---	---
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7		---	---	NAP	---	---	---	NAP	---
Inorganics (mg/L)										
Aluminum	7429-90-5	0.038	---	---	NAP	---	3.7E-04	1.2E-05	NAP	3.8E-04
Antimony	7440-36-0	0.001	---	---	NAP	---	1.4E-02	3.1E-04	NAP	1.4E-02
Bismuth	7440-69-9		---	---	NAP	---	---	---	NAP	---
Cadmium	7440-43-9w		---	---	NAP	---	---	---	NAP	---
Chromium (used VI CAS #)	18540-29-9	0.006	---	---	NAP	---	2.0E-02	2.6E-03	NAP	2.2E-02
Copper	7440-50-8	0.001	---	---	NAP	---	2.9E-04	9.2E-07	NAP	2.9E-04
Lead	7439-92-1		---	---	NAP	---	---	---	NAP	---
Lithium	7439-93-2	0.056	---	---	NAP	---	---	---	NAP	---
Molybdenum	7439-98-7	0.006	---	---	NAP	---	1.1E-02	9.3E-05	NAP	1.1E-02
Nickel	7440-02-0	0.035	---	---	NAP	---	1.7E-02	1.4E-03	NAP	1.8E-02
Nitrate/Nitrite	14797-65-0nn	5.349	---	---	NAP	---	5.2E-01	3.4E-03	NAP	5.3E-01
Thallium	7440-28-0		---	---	NAP	---	---	---	NAP	---
Vanadium	7440-62-2	0.017	---	---	NAP	---	2.4E-02	3.0E-03	NAP	2.7E-02
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	0.087	1.4E-08	NA	NAP	1.4E-08	---	---	NAP	---
Potassium-40	13966-00-2		---	NA	NAP	---	---	---	NAP	---
Strontium-90	10098-97-2	0.975	6.8E-08	NA	NAP	6.8E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	0.314	---	NA	NAP	---	---	---	NAP	---
Tritium	10028-17-8w	1485.470	9.4E-08	4.6E-10	9.7E-10	**9.6E-08**	---	---	NAP	---
Uranium-233 long lived decay	13968-55-3L		---	NA	NAP	---	---	---	NAP	---
Uranium-235 long lived decay	15117-96-1L	0.814	7.4E-07	NA	NAP	7.4E-07	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	0.688	1.6E-06	NA	NAP	**1.6E-06**	---	---	NAP	---
TOTAL			**2.6E-06**	4.6E-10	9.7E-10	**2.6E-06**	6.1E-01	1.1E-02	---	6.2E-01

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Table 29: Future Background Residual Groundwater Risk for the Construction Worker Scenario

footnotes

bold values represent estimates that exceed acceptable thresholds
CAS: Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

ble 30: Future Incremental Residual Groun ater Risk for the Construction Worker Scena

Analyte	CAS No.	Total EPC	CANCER EFFECTS: Route-Specific Risk: Oral	Dermal	Inhalation VOC(shower)	Total Cancer Risk	NON-CANCER EFFECTS: Route-Specific HI: Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	0.006	---	---	---	---	---	---	---	---
Dichloromethane (Methylene Chloride)	75-09-2	0.015	8.1E-08	4.3E-09	1.2E-09	8.6E-08	2.5E-03	1.3E-04	1.2E-05	2.7E-03
Fluorobenzene	462-06-6	0.009	---	---	---	---	---	---	---	---
O-Chloroflurobenzene	348-51-6	0.007	---	---	---	---	---	---	---	---
Tert-butyl methyl ether	1634-04-4	0.002	---	---	---	---	---	---	1.9E-06	1.9E-06
Tetrachloroethene	127-18-4	0.002	5.5E-08	---	1.5E-10	5.6E-08	1.5E-03	---	---	1.5E-03
Trichloroethylene (TCE)	79-01-6	0.004	5.7E-07	2.1E-06	1.1E-09	**2.7E-06**	1.3E-01	4.7E-01	---	6.0E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	0.018	1.7E-07	9.7E-08	NAP	2.7E-07	8.6E-03	4.8E-03	NAP	1.3E-02
Inorganics (mg/L)										
Aluminum	7429-90-5	1.986	---	---	NAP	---	1.9E-02	6.3E-04	NAP	2.0E-02
Antimony	7440-36-0	0.018	---	---	NAP	---	4.4E-01	9.4E-03	NAP	4.4E-01
Bismuth	7440-69-9	0.024	---	---	NAP	---	---	---	NAP	---
Cadmium	7440-43-9w	0.008	---	---	NAP	---	1.6E-01	2.0E-02	NAP	1.8E-01
Chromium (used VI CAS #)	18540-29-9	0.958	---	---	NAP	---	3.1E+00	4.0E-01	NAP	**3.5E+00**
Copper	7440-50-8	0.055	---	---	NAP	---	1.3E-02	4.3E-05	NAP	1.3E-02
Lead	7439-92-1	0.019	---	---	NAP	---	---	---	NAP	---
Lithium	7439-93-2	0.095	---	---	NAP	---	---	---	NAP	---
Molybdenum	7439-98-7	0.009	---	---	NAP	---	1.8E-02	1.5E-04	NAP	1.8E-02
Nickel	7440-02-0	0.243	---	---	NAP	---	1.2E-01	9.6E-03	NAP	1.3E-01
Nitrate/Nitrite	14797-65-0nn	1.161	---	---	NAP	---	1.1E-01	7.4E-04	NAP	1.1E-01
Thallium	7440-28-0	0.004	---	---	NAP	---	4.5E-01	1.4E-03	NAP	4.5E-01
Vanadium	7440-62-2	0.009	---	---	NAP	---	1.2E-02	1.5E-03	NAP	1.4E-02
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	0.172	2.8E-08	NA	NAP	2.8E-08	---	---	NAP	---
Potassium-40	13966-00-2	48.305	1.5E-06	NA	NAP	**1.5E-06**	---	---	NAP	---
Strontium-90	10098-97-2	0.442	3.1E-08	NA	NAP	3.1E-08	---	---	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.274	4.1E-06	NA	NAP	**4.1E-06**	---	---	NAP	---
Tritium	10028-17-8w	65312.487	4.1E-06	2.0E-08	4.3E-08	**4.2E-06**	---	---	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.362	1.0E-06	NA	NAP	**1.0E-06**	---	---	NAP	---
Uranium-235 long lived decay	15117-96-1L	1.335	1.2E-06	NA	NAP	**1.2E-06**	---	---	NAP	---
Uranium-238 long lived decay	7440-61-1L	3.014	7.2E-06	NA	NAP	**7.2E-06**	---	---	NAP	---
TOTAL			**2.0E-05**	**2.3E-06**	4.5E-08	**2.2E-05**	**4.6E+00**	9.3E-01	1.4E-05	**5.5E+00**

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Table 30: Future Incremental Residual Groundwater Risk for the Construction Worker Scenario

footnotes

bold values represent estimates that exceed acceptable thresholds
CAS - Chemical Abstract Service
EPC: Exposure Point Concentration
HI: Hazard Index
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
SVOCs: semivolatile organic compounds
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 31: Future Total Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS Route-Specific Risk Oral	Dermal	Inhalation VOC	Total Cancer Risk	NON-CANCER EFFECTS Route-Specific HI Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	5.8E-03	---	NAP	NAP	---	---	NAP	NAP	---
Dichloromethane (Methylene Chloride)	75-09-2	1.5E-02	4.0E-07	NAP	NAP	4.0E-07	2.5E-03	NAP	NAP	2.5E-03
Fluorobenzene	462-06-6	8.7E-03	---	NAP	NAP	---	---	NAP	NAP	---
O-Chloroflurobenzene	348-51-6	7.2E-03	---	NAP	NAP	---	---	NAP	NAP	---
Tert-butyl methyl ether	1634-04-4	6.1E-04	---	NAP	NAP	---	---	NAP	NAP	---
Tetrachloroethene	127-18-4	1.5E-03	2.8E-07	NAP	NAP	2.8E-07	1.5E-03	NAP	NAP	1.5E-03
Trichloroethylene (TCE)	79-01-6	3.9E-03	2.9E-06	NAP	NAP	2.9E-06	1.3E-01	NAP	NAP	1.3E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	1.8E-02	8.6E-07	NAP	NAP	8.6E-07	8.6E-03	NAP	NAP	8.6E-03
Inorganics (mg/L)										
Aluminum	7429-90-5	2.0E+00	---	NAP	NAP	---	2.0E-02	NAP	NAP	2.0E-02
Antimony	7440-36-0	1.8E-02	---	NAP	NAP	---	4.5E-01	NAP	NAP	4.5E-01
Bismuth	7440-69-9	2.4E-02	---	NAP	NAP	---	---	NAP	NAP	---
Cadmium	7440-43-9w	8.0E-03	---	NAP	NAP	---	1.6E-01	NAP	NAP	1.6E-01
Chromium (used VI CAS #)	18540-29-9	9.6E-01	---	NAP	NAP	---	3.1E+00	NAP	NAP	**3.1E+00**
Copper	7440-50-8	5.6E-02	---	NAP	NAP	---	1.4E-02	NAP	NAP	1.4E-02
Lead	7439-92-1	1.9E-02	---	NAP	NAP	---	---	NAP	NAP	---
Lithium	7439-93-2	1.5E-01	---	NAP	NAP	---	---	NAP	NAP	---
Molybdenum	7439-98-7	1.5E-02	---	NAP	NAP	---	2.9E-02	NAP	NAP	2.9E-02
Nickel	7440-02-0	2.8E-01	---	NAP	NAP	---	1.4E-01	NAP	NAP	1.4E-01
Thallium	7440-28-0	3.6E-03	---	NAP	NAP	---	4.5E-01	NAP	NAP	4.5E-01
Vanadium	7440-62-2	2.6E-02	---	NAP	NAP	---	3.6E-02	NAP	NAP	3.6E-02
Nitrate/Nitrite	14797-65-0nn	6.5E+00	---	NAP	NAP	---	6.4E-01	NAP	NAP	6.4E-01
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	2.6E-01	2.1E-07	NAP	NAP	2.1E-07	NAP	NAP	NAP	---
Potassium-40	13966-00-2	4.8E+01	7.5E-06	NAP	NAP	**7.5E-06**	NAP	NAP	NAP	---
Strontium-90	10098-97-2	1.4E+00	5.0E-07	NAP	NAP	**5.0E-07**	NAP	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	2.6E+00	2.3E-05	NAP	NAP	2.3E-05	NAP	NAP	NAP	---
Tritium	10028-17-8w	6.7E+04	2.1E-05	NAP	NAP	**2.1E-05**	NAP	NAP	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.4E+00	5.1E-06	NAP	NAP	**5.1E-06**	NAP	NAP	NAP	---
Uranium-235 long lived decay	15117-96-1L	2.1E+00	9.8E-06	NAP	NAP	**9.8E-06**	NAP	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	3.7E+00	4.4E-05	NAP	NAP	**4.4E-05**	NAP	NAP	NAP	---
TOTAL			**1.2E-04**	---	---	**1.2E-04**	**5.2E+00**	---	---	**5.2E+00**

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Table 31: Future Total Residual Groundwater Risk for the Site Employee Scenario

footnotes

bold values represent estimates that exceed acceptable thresholds
EPC: Exposure Point Concentration
HI: Hazard Index
CAS: Chemical Abstract Service
NA: not available; insufficient toxicity data
NAP: not an applicable pathway; not a VOC
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 32: Future Background Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS Route-Specific Risk Oral	Dermal	Inhalation VOC	Total Cancer Risk	NON-CANCER EFFECTS Route-Specific HI Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5		---	NAP	NAP	---	---	NAP	NAP	---
Dichloromethane (Methylene Chloride)	75-09-2		---	NAP	NAP	---	---	NAP	NAP	---
Fluorobenzene	462-06-6		---	NAP	NAP	---	---	NAP	NAP	---
O-Chloroflurobenzene	348-51-6		---	NAP	NAP	---	---	NAP	NAP	---
Tert-butyl methyl ether	1634-04-4		---	NAP	NAP	---	---	NAP	NAP	---
Tetrachloroethene	127-18-4		---	NAP	NAP	---	---	NAP	NAP	---
Trichloroethylene (TCE)	79-01-6		---	NAP	NAP	---	---	NAP	NAP	---
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7		---	NAP	NAP	---	---	NAP	NAP	---
Inorganics (mg/L)										
Aluminum	7429-90-5	3.8E-02	---	NAP	NAP	---	3.7E-04	NAP	NAP	3.7E-04
Antimony	7440-36-0	5.8E-04	---	NAP	NAP	---	1.4E-02	NAP	NAP	1.4E-02
Bismuth	7440-69-9		---	NAP	NAP	---	---	NAP	NAP	---
Cadmium	7440-43-9w		---	NAP	NAP	---	---	NAP	NAP	---
Chromium (used VI CAS #)	18540-29-9	6.1E-03	---	NAP	NAP	---	2.0E-02	NAP	NAP	2.0E-02
Copper	7440-50-8	1.2E-03	---	NAP	NAP	---	2.9E-04	NAP	NAP	2.9E-04
Lead	7439-92-1		---	NAP	NAP	---	---	NAP	NAP	---
Lithium	7439-93-2	5.6E-02	---	NAP	NAP	---	---	NAP	NAP	---
Molybdenum	7439-98-7	5.6E-03	---	NAP	NAP	---	1.1E-02	NAP	NAP	1.1E-02
Nickel	7440-02-0	3.5E-02	---	NAP	NAP	---	1.7E-02	NAP	NAP	1.7E-02
Thallium	7440-28-0		---	NAP	NAP	---	---	NAP	NAP	---
Vanadium	7440-62-2	1.7E-02	---	NAP	NAP	---	2.4E-02	NAP	NAP	2.4E-02
Nitrate/Nitrite	14797-65-0nn	5.3E+00	---	NAP	NAP	---	5.2E-01	NAP	NAP	5.2E-01
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	8.7E-02	7.1E-08	NAP	NAP	7.1E-08	---	NAP	NAP	---
Potassium-40	13966-00-2		---	NAP	NAP	---	---	NAP	NAP	---
Strontium-90	10098-97-2		---	NAP	NAP	---	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	9.8E-01	8.8E-06	NAP	NAP	8.8E-06	---	NAP	NAP	---
Tritium	10028-17-8w		---	NAP	NAP	---	---	NAP	NAP	---
Uranium-233 long lived decay	13968-55-3L		---	NAP	NAP	---	---	NAP	NAP	---
Uranium-235 long lived decay	15117-96-1L	8.1E-01	3.7E-06	NAP	NAP	3.7E-06	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	6.9E-01	8.2E-06	NAP	NAP	8.2E-06	---	NAP	NAP	---
TOTAL			**2.1E-05**	---	---	**2.1E-05**	6.1E-01	---	---	6.1E-01

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Table 32: Future Background Residual Groundwater Risk for the Site Employee Scenario

footnotes

bold values represent estimates that exceed acceptable thresholds
EPC: Exposure Point Concentration
HI: Hazard Index
CAS: Chemical Abstract Service
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 33: Future Incremental Residual Groundwater Risk for the Site Employee Scenario

Analyte	CAS No.	Total EPC	CANCER EFFECTS Route-Specific Risk Oral	Dermal	Inhalation VOC	Total Cancer Risk	NON-CANCER EFFECTS Route-Specific HI Oral	Dermal	Inhalation VOCs	Total Non-Cancer Hazard
VOCs (mg/L)										
Bromochloromethane	74-97-5	5.8E-03	---	NAP	NAP	---	---	NAP	NAP	---
Dichloromethane (Methylene Chloride)	75-09-2	1.5E-02	4.0E-07	NAP	NAP	4.0E-07	2.5E-03	NAP	NAP	2.5E-03
Fluorobenzene	462-06-6	8.7E-03	---	NAP	NAP	---	---	NAP	NAP	---
O-Chloroflurobenzene	348-51-6	7.2E-03	---	NAP	NAP	---	---	NAP	NAP	---
Tert-butyl methyl ether	1634-04-4	6.1E-04	---	NAP	NAP	---	---	NAP	NAP	---
Tetrachloroethene	127-18-4	1.5E-03	2.8E-07	NAP	NAP	2.8E-07	1.5E-03	NAP	NAP	1.5E-03
Trichloroethylene (TCE)	79-01-6	3.9E-03	2.9E-06	NAP	NAP	2.9E-06	1.3E-01	NAP	NAP	1.3E-01
SVOCs (mg/L)										
Bis(2-ethylhexyl)phthalate	117-81-7	1.8E-02	8.6E-07	NAP	NAP	8.6E-07	8.6E-03	NAP	NAP	8.6E-03
Inorganics (mg/L)										
Aluminum	7429-90-5	2.0E+00	---	NAP	NAP	---	1.9E-02	NAP	NAP	1.9E-02
Antimony	7440-36-0	1.8E-02	---	NAP	NAP	---	4.4E-01	NAP	NAP	4.4E-01
Bismuth	7440-69-9	2.4E-02	---	NAP	NAP	---	---	NAP	NAP	---
Cadmium	7440-43-9w	8.0E-03	---	NAP	NAP	---	1.6E-01	NAP	NAP	1.6E-01
Chromium (used VI CAS #)	18540-29-9	9.6E-01	---	NAP	NAP	---	3.1E+00	NAP	NAP	**3.1E+00**
Copper	7440-50-8	5.5E-02	---	NAP	NAP	---	1.3E-02	NAP	NAP	1.3E-02
Lead	7439-92-1	1.9E-02	---	NAP	NAP	---	---	NAP	NAP	---
Lithium	7439-93-2	9.5E-02	---	NAP	NAP	---	---	NAP	NAP	---
Molybdenum	7439-98-7	9.3E-03	---	NAP	NAP	---	1.8E-02	NAP	NAP	1.8E-02
Nickel	7440-02-0	2.4E-01	---	NAP	NAP	---	1.2E-01	NAP	NAP	1.2E-01
Thallium	7440-28-0	3.6E-03	---	NAP	NAP	---	4.5E-01	NAP	NAP	4.5E-01
Vanadium	7440-62-2	8.6E-03	---	NAP	NAP	---	1.2E-02	NAP	NAP	1.2E-02
Nitrate/Nitrite	14797-65-0nn	1.2E+00	---	NAP	NAP	---	1.1E-01	NAP	NAP	1.1E-01
Radionuclides (pCi/L)										
Plutonium-238	13981-16-3	1.7E-01	1.4E-07	NAP	NAP	1.4E-07	---	NAP	NAP	---
Potassium-40	13966-00-2	4.8E+01	7.5E-06	NAP	NAP	**7.5E-06**	---	NAP	NAP	---
Strontium-90	10098-97-2	1.4E+00	5.0E-07	NAP	NAP	**5.0E-07**	---	NAP	NAP	---
Thorium-232 long lived decay	7440-29-1L	1.6E+00	1.5E-05	NAP	NAP	1.5E-05	---	NAP	NAP	---
Tritium	10028-17-8w	6.7E+04	2.1E-05	NAP	NAP	**2.1E-05**	---	NAP	NAP	---
Uranium-233 long lived decay	13968-55-3L	1.4E+00	5.1E-06	NAP	NAP	**5.1E-06**	---	NAP	NAP	---
Uranium-235 long lived decay	15117-96-1L	2.1E+00	9.8E-06	NAP	NAP	**9.8E-06**	---	NAP	NAP	---
Uranium-238 long lived decay	7440-61-1L	2.5E+00	3.0E-05	NAP	NAP	3.0E-05	---	NAP	NAP	---
TOTAL			**9.3E-05**	---	---	**9.3E-05**	**4.6E+00**	---	---	**4.6E+00**

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Table 33: Future Incremental Residual Groundwater Risk for the Site Employee Scenario
footnotes

bold values represent estimates that exceed acceptable thresholds
EPC: Exposure Point Concentration
HI: Hazard Index
CAS: Chemical Abstract Service
NA: not available; insufficient toxicity data
NAP: not an applicable pathway
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001
Toxicity criteria used to calculate risk in long lived decay isotopes include radionuclide daughters

Table 34: Total Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	1.7E-01	**1.3E-05**
			Dermal Contact	1.6E-03	3.5E-07
			Inhalation of Dust	NA	2.6E-08
			Inhalation of VOCs	NA	NA
			External	NA	**3.8E-05**
			Soil Total Risk	1.7E-01	**5.1E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.7E-01	**5.1E-06**
			Dermal Contact	3.1E-01	**1.3E-06**
			Inhalation while Showering	4.8E-07	6.7E-10
			Current Groundwater Total Risk	**8.7E-01**	**6.4E-06**
	Future Groundwater	Chemical & Radiological	Oral	**5.2E+00**	**2.3E-05**
			Dermal Contact	9.4E-01	**2.3E-06**
			Inhalation while Showering	1.4E-05	4.6E-08
			Future Groundwater Total Risk	**6.1E+00**	**2.6E-05**
	Air*	Radiological	Inhalation	NA	2.1E-07
			Air Total Risk	NA	2.1E-07
			Cumulative Total Current Risk	**1.0E+00**	**5.8E-05**
			Cumulative Total Future Risk	**6.3E+00**	**7.7E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	1.4E-02	**9.2E-06**
			Inhalation of Dust	NA	1.4E-07
			Inhalation of VOCs	NA	NA
			External	NA	**4.4E-05**
			Soil Total Risk	1.4E-02	**5.3E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.7E-01	**3.1E-05**
			Current Groundwater Total Risk	5.7E-01	**3.1E-05**
	Future Groundwater	Chemical & Radiological	Oral	**5.2E+00**	**1.2E-04**
			Future Groundwater Total Risk	**5.2E+00**	**1.2E-04**
	Air*	Radiological	Inhalation	NA	**1.0E-06**
			Air Total Risk	NA	**1.0E-06**
			Cumulative Total Current Risk	5.8E-01	**8.5E-05**
			Cumulative Total Future Risk	**5.2E+00**	**1.7E-04**

HI: Hazard Index
NA - not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls - below land surface
VOCs - volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 35: Background Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	2.7E-02	**5.7E-06**
			Dermal Contact	6.0E-05	NA
			Inhalation of Dust	NA	6.9E-09
			Inhalation of VOCs	NA	NA
			External	NA	**2.8E-05**
			Soil Total Risk	2.7E-02	**3.4E-05**
	Current Groundwater	Chemical & Radiological	Oral	1.4E-02	**1.6E-06**
			Dermal Contact	3.1E-04	NA
			Inhalation While Showering	NA	NA
			Current Groundwater Total Risk	1.5E-02	**1.6E-06**
	Future Groundwater	Chemical & Radiological	Oral	6.1E-01	**2.6E-06**
			Dermal Contact	1.1E-02	4.6E-10
			Inhalation While Showering	NA	9.7E-10
			Future Groundwater Total Risk	6.2E-01	**2.6E-06**
	Air*	Radiological	Inhalation	NA	7.7E-09
			Air Total Risk	NA	7.7E-09
			Cumulative Background Current Risk	4.2E-02	**3.6E-05**
			Cumulative Background Future Risk	**6.5E-01**	**3.7E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	1.4E-02	**5.2E-06**
			Inhalation of Dust	NA	4.1E-08
			Inhalation of VOCs	NA	NA
			External	NA	**3.1E-05**
			Soil Total Risk	1.4E-02	**3.7E-05**
	Current Groundwater	Chemical & Radiological	Oral	1.4E-02	**1.1E-05**
			Current Groundwater Total Risk	1.4E-02	**1.1E-05**
	Future Groundwater	Chemical & Radiological	Oral	6.1E-01	**2.1E-05**
			Future Groundwater Total Risk	6.1E-01	**2.1E-05**
	Air*	Radiological	Inhalation	NA	3.9E-08
			Air Total Risk	NA	3.9E-08
			Cumulative Background Current Risk	2.8E-02	**4.8E-05**
			Cumulative Background Future Risk	**6.2E-01**	**5.7E-05**

HI: Hazard Index
NA - not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls - below land surface
VOCs - volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 36: Incremental Residual Risk Summary

Scenario and Receptor	Media	Constituents	Pathway	Total Non-Cancer Hazard or HI	Total Cancer Risk
Construction Worker Scenario	Current & Future Soil (all depths)	Chemical & Radiological	Oral	1.4E-01	**7.4E-06**
			Dermal Contact	1.6E-03	3.5E-07
			Inhalation of Dust	NA	2.0E-08
			Inhalation of VOCs	NA	NA
			External	NA	**9.5E-06**
			Soil Total Risk	1.4E-01	**1.7E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.5E-01	**3.5E-06**
			Dermal Contact	3.1E-01	**1.3E-06**
			Inhalation While Showering	4.8E-07	NA
			Current Groundwater Total Risk	**8.6E-01**	**4.8E-06**
	Future Groundwater	Chemical & Radiological	Oral	**4.6E+00**	**2.0E-05**
			Dermal Contact	9.3E-01	**2.3E-06**
			Inhalation While Showering	1.4E-05	4.5E-08
			Future Groundwater Total Risk	**5.5E+00**	**2.2E-05**
	Air*	Radiological	Inhalation	NA	2.0E-07
			Air Total Risk	NA	2.0E-07
			Cumulative Incremental Current Risk	1.0E+00	**2.2E-05**
			Cumulative Incremental Future Risk	**5.7E+00**	**4.0E-05**
Site Employee Scenario	Current & Future Soil (0-2 feet bls)	Chemical & Radiological	Oral	4.6E-04	**4.0E-06**
			Inhalation of Dust	NA	9.7E-08
			Inhalation of VOCs	NA	NA
			External	NA	**1.2E-05**
			Soil Total Risk	4.6E-04	**1.6E-05**
	Current Groundwater	Chemical & Radiological	Oral	5.5E-01	**2.6E-05**
			Current Groundwater Total Risk	5.5E-01	**2.6E-05**
	Future Groundwater	Chemical & Radiological	Oral	**4.6E+00**	**9.3E-05**
			Future Groundwater Total Risk	**4.6E+00**	**9.3E-05**
	Air*	Radiological	Inhalation	NA	9.9E-07
			Air Total Risk	NA	9.9E-07
			Cumulative Incremental Current Risk	5.5E-01	**4.3E-05**
			Cumulative Incremental Future Risk	**4.6E+00**	**1.1E-04**

HI: Hazard Index
NA: not applicable
*RRE values for air were brought forward from the Technical Position Report for Release Blocks D and H. (DOE 1999).
bolded values exceed cancer risk of 10^{-6} or non-cancer Hazard Index greater than 1.
bls: below land surface
VOCs: volatile organic compounds
numbers written as 1.0E-3 equal 1x10-3 and 0.001

Table 37: Background Values for Soil Analytes

Analyte	CAS Number	Background Concentration
Inorganics (mg/kg)		
Aluminum	7429-90-5	19000.000
Antimony	7440-36-0	
Arsenic	7440-38-2	8.600
Barium	7440-39-3	180.000
Beryllium	7440-41-7	1.300
Bismuth	7440-69-9	
Cadmium	7440-43-9s	2.100
Calcium	7440-70-2	310000.000
Chromium	7440-47-3	20.000
Chromium VI	18540-29-9	20.000
Cobalt	7440-48-4	19.000
Copper	7440-50-8	26.000
Cyanide	57-12-5	
Iron	7439-89-6	35000.000
Lead	7439-92-1	48.000
Lithium	7439-93-2	26.000
Magnesium	7439-95-4	40000.000
Manganese	7439-96-5s	1400.000
Mercury	7439-97-6	
Molybdenum	7439-98-7	27.000
Nickel	7440-02-0	32.000
Potassium	7440-09-7	1900.000
Selenium	7782-49-2	
Silver	7440-22-4	1.700
Sodium	7440-23-5	240.000
Thallium	7440-28-0	0.460
Tin	7440-31-5	20.000
Vanadium	7440-62-2	25.000
Zinc	7440-66-6	140.000
Pesticides (mg/kg)		
4,4'-DDE	72-55-9	0.004
Chlordane	57-74-9	
SVOCs (mg/kg)		
Anthracene	120-12-7	
Benzo(a)anthracene	56-55-3	
Benzo(a)pyrene	50-32-8	
Benzo(b)fluoranthene	205-99-2	
Benzo(g,h,i)perylene	191-24-2	
Benzo(k)fluoranthene	207-08-9	
Bis(2-ethylhexyl)phthalate	117-81-7	
Chrysene	218-01-9	
Di-n-butyl Phthalate	84-74-2	
Fluoranthene	206-44-0	
Indeno(1,2,3-cd)pyrene	193-39-5	

Table 37: Background Values for Soil Analytes

Analyte	CAS Number	Background Concentration
N-Nitrosodiphenylamine	86-30-6	
Phenanthrene	85-01-8	
Pyrene	129-00-0	
VOCs (mg/kg)		
2-Butanone	78-93-3	
4-Methyl-2-pentanone	108-10-1	
Acetone	67-64-1	
Dichloromethane (Methylene Chloride)	75-09-2	
Naphthalene	91-20-3	
Tetrachloroethene	127-18-4	
Toluene	108-88-3	
Xylenes, Total	1330-20-7	
mp-Xylene	mp-Xylene	
Radionuclides (pCi/g)		
Actinium-227	14952-40-0	
Actinium-227 +D	14952-40-0(+D)	
Actinium-227 long lived decay	14952-40-0L	
Actinium-228	14331-83-0	
Bismuth-214	14733-03-0	
Cesium-137	10045-97-3	0.420
Cesium-137 +D	10045-97-3(+D)	0.420
Cesium-137 long lived decay	10045-97-3L	0.420
Lead-210	14255-04-0	
Lead-210+D	14255-04-0(+D)	
Lead-210 long lived decay	14255-04-0L	
Lead-212	15092-94-1	
Lead-214	15067-28-4	
Plutonium-238	13981-16-3	0.130
Plutonium-239	15117-48-3	0.180
Plutonium-239/240	PU-239/240	0.180
Potassium-40	13966-00-2	37.000
Radium-224	13233-32-4	
Radium-226	13982-63-3	2.000
Radium-226+D	13982-63-3(+D)	2.000
Radium-226 long lived decay	13982-63-3L	2.000
Radium-228	15262-20-1	
Radium-228+D	15262-20-1(+D)	
Radium-228 long lived decay	15262-20-1L	
Thallium-208	14913-50-9	
Thorium-227	15623-47-9	
Thorium-228	14274-82-9	1.500
Thorium-228+D	14274-82-9(+D)	1.500
Thorium-228 long lived decay	14274-82-9L	1.500
Thorium-230	14269-63-7	1.900
Thorium-230 long lived decay	14269-63-7L	1.900

Table 37: Background Values for Soil Analytes

Analyte	CAS Number	Background Concentration
Thorium-232	7440-29-1	1.400
Thorium-232 long lived decay	7440-29-1L	1.400
Uranium-234	13966-29-5	1.100
Uranium-235	15117-96-1	0.110
Uranium-235+D	15117-96-1(+D)	0.110
Uranium-235 long lived decay	15117-96-1L	0.110
Uranium-238	7440-61-1	1.200
Uranium-238+D	7440-61-1(+D)	1.200
Uranium-238 long lived decay	7440-61-1L	1.200

CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal $1x10^{-3}$ and 0.001

Table 38: Background Values for Groundwater Analytes

Analyte	CAS Number	Background Concentration
(mg/L)		
Nitrate	7697-37-2	5.3490
Nitrate/Nitrite	1497-55-8	5.3490
Nitrite	14797-65-0	
Metals (mg/L)		
Aluminum	7429-90-5	0.0375
Antimony	7440-36-0	0.0006
Arsenic	7440-38-2	0.0330
Barium	7440-39-3	0.3102
Beryllium	7440-41-7	
Bismuth	7440-69-9	
Boron	7440-42-8	
Cadmium	7440-43-9w	
Calcium	7440-70-2	111.1107
Chromium	7440-47-3	0.0061
Cobalt	7440-48-4	
Copper	7440-50-8	0.0012
Cyanide	57-12-5	
Iron	7439-89-6	4.0649
Lead	7439-92-1	
Lithium	7439-93-2	0.0557
Magnesium	7439-95-4	40.4281
Manganese	7439-96-5	0.2296
Molybdenum	7439-98-7	0.0056
Nickel	7440-02-0	0.0350
Potassium	7440-09-7	4.4611
Selenium	7782-49-2	
Silver	7440-22-4	
Sodium	7440-23-5	62.4256
Thallium	7440-28-0	
Tin	7440-31-5	0.0344
Vanadium	7440-62-2	0.0171
Zinc	7440-66-6	0.1196
SVOCs (mg/L)		
Bis(2-ethylhexyl)phthalate	117-81-7	
VOCs (mg/L)		
1,1,1-Trichloroethane	71-55-6	
1,2-Dichloroethene *	540-59-0	
1,2-cis-Dichloroethene	156-59-2	
2-Butanone	78-93-3	
Acetone	67-64-1	
Bromochloromethane	74-97-5	
Dichloromethane (Methylene Chloride)	75-09-2	

Table 38: Background Values for Groundwater Analytes

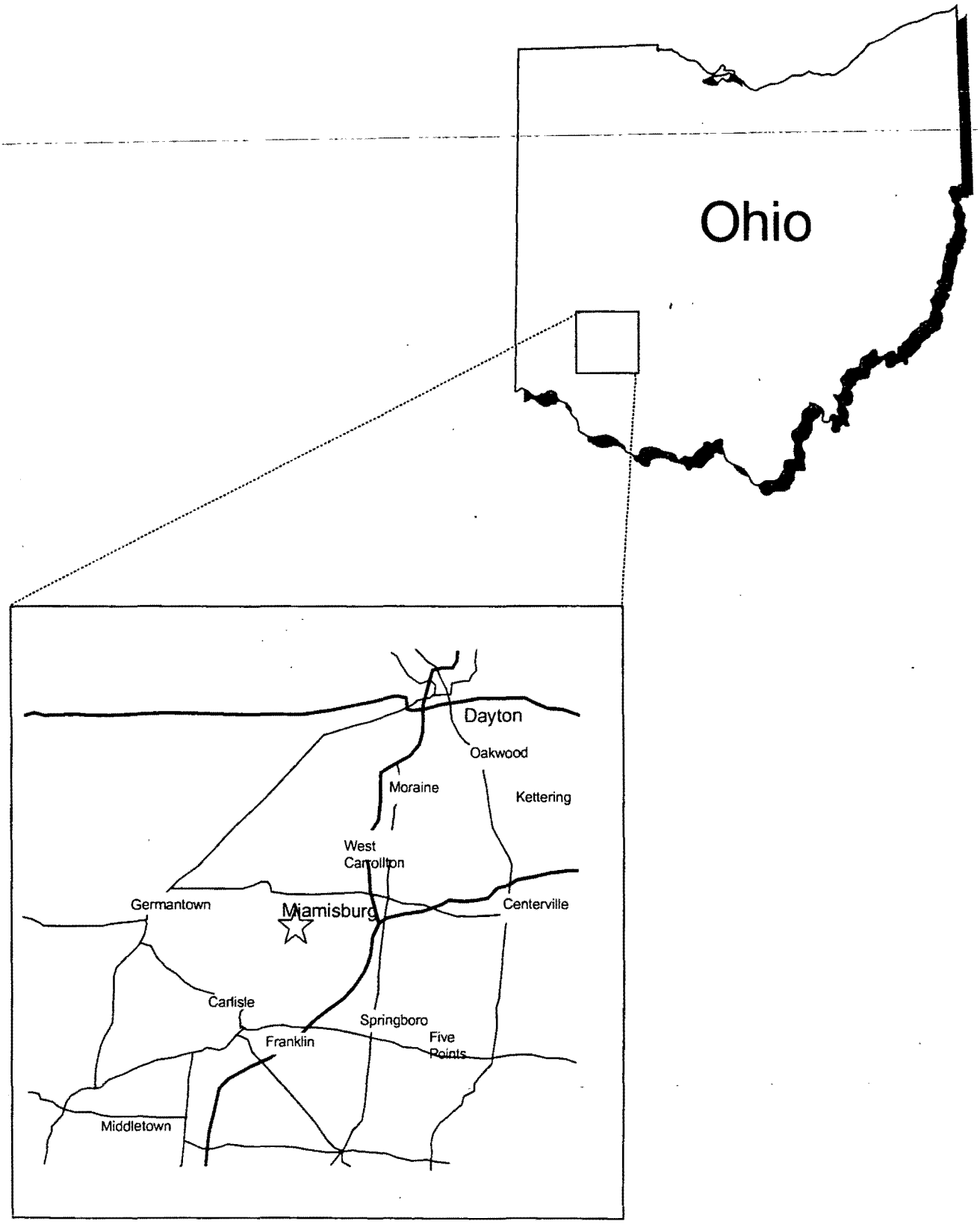
Analyte	CAS Number	Background Concentration
Fluorobenzene	462-06-6	
O-Chloroflurobenzene	348-51-6	
Tetrachloroethene	127-18-4	
Trichloroethylene (TCE)	79-01-6	
Radionuclides (pCi/L)		
Americium-241	14596-10-2	0.1390
Plutonium-238	13981-16-3	0.0870
Plutonium-239/240	PU-239/240	0.1250
Plutonium-242	13982-10-0	
Potassium-40	13966-00-2	
Radium-226	13982-63-3	0.9960
Radium-226 +D	13982-63-3(+D)	0.9960
Radium-226 long lived decay	13982-63-3L	0.9960
Radium-228	15262-20-1	
Radium-228 +D	15262-20-1(+D)	
Radium-228 long lived decay	15262-20-1L	
Strontium-90	10098-97-2	
Thorium-227	15623-47-9	
Thorium-228	14274-82-9	0.7790
Thorium-228+D	14274-82-9(+D)	0.7790
Thorium-228 long lived decay	14274-82-9L	0.7790
Thorium-230	14269-63-7	
Thorium-230 long lived decay	14269-63-7L	
Thorium-232	7440-29-1	0.3140
Thorium-232 long lived decay	7440-29-1L	0.3140
Tritium	10028-17-8w	1485.5000
Uranium-233	13968-55-3	
Uranium-233 long lived decay	13968-55-3L	
Uranium-233/234	U-233/234	
Uranium-234	13966-29-5	0.7920
Uranium-235	15117-96-1	0.8140
Uranium-235+D	15117-96-1(+D)	0.8140
Uranium-235 long lived decay	15117-96-1L	0.8140
Uranium-235/236	U-235/236	
Uranium-238	7440-61-1	0.6880
Uranium-238+D	7440-61-1(+D)	0.6880
Uranium-238 long lived decay	7440-61-1L	0.6880

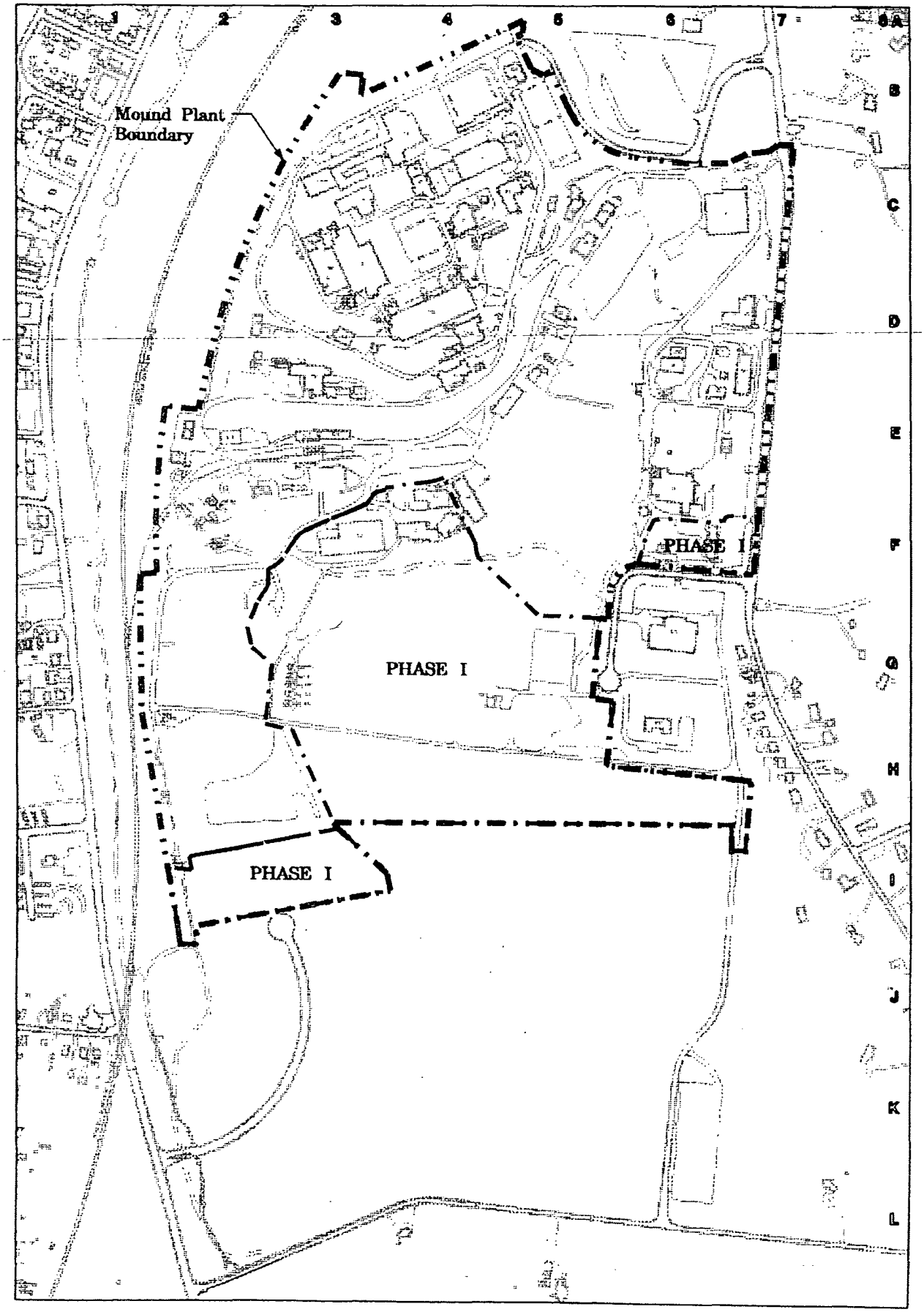
CAS: Chemical Abstract Service
VOCs: volatile organic compounds
SVOCs: semivolatile organic compounds
numbers written as 1.0E-3 equal $1x10^{-3}$ and 0.001

APPENDIX D

Figures

Figure 1: Regional Context of the Mound Plant





Legend

- Structures
- Paved roadway
- Unpaved roadway
- Railroad
- Water course
- Fence
- Mound Plant boundary
- Contour line

0 100 200 400 600 800 1000
Scale In Feet

	05/08/02	ISSUE FOR GENERAL USE	SSP
ISS	DATE	REVISION	BY

MOUND
Environmental Restoration Geographic Information System

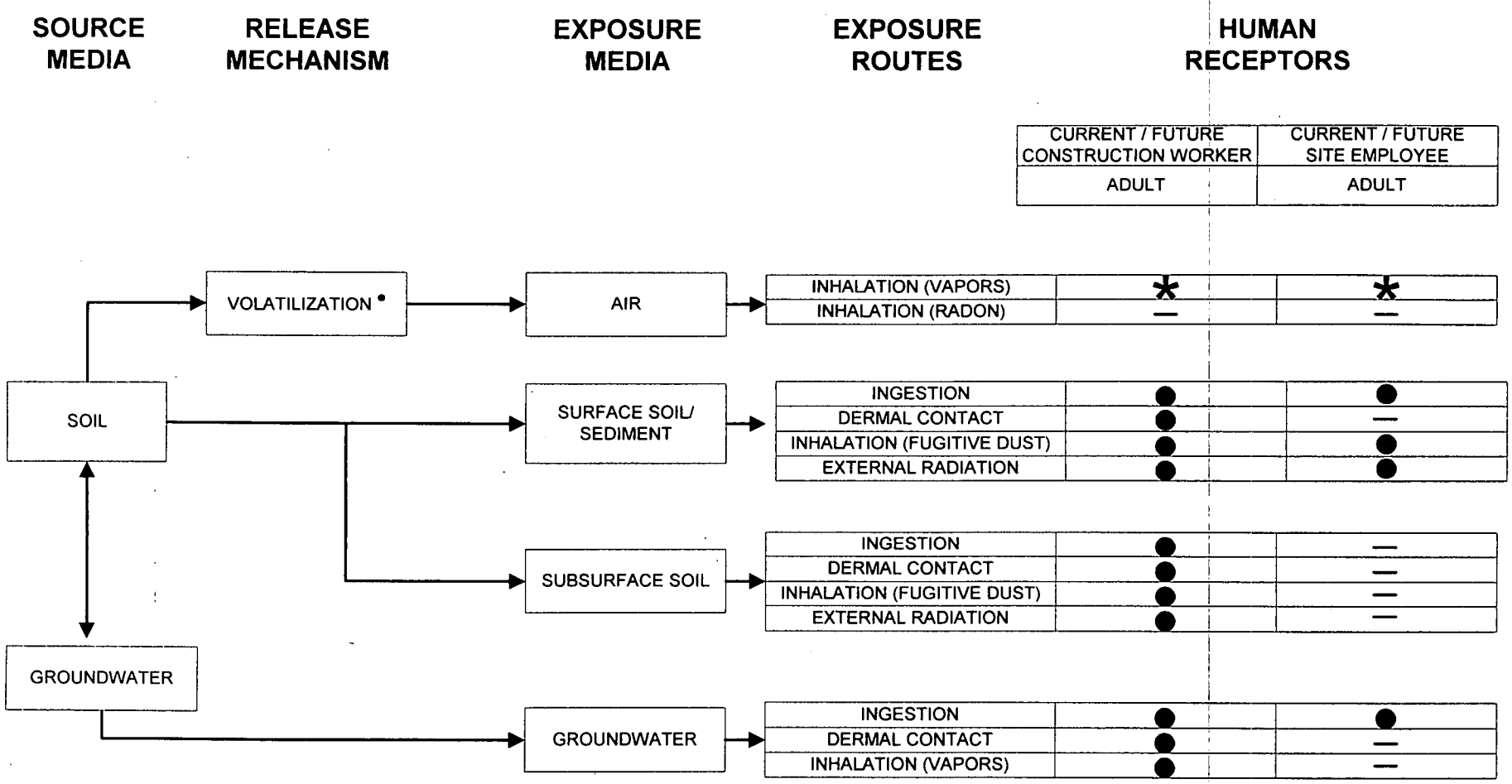
SHEET 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
ISSUE
SHEET 1 2 3 4 5 6
ISSUE A
PART CLASSIFICATION

TITLE CLASSIFICATION

Figure 2
Location of Phase I

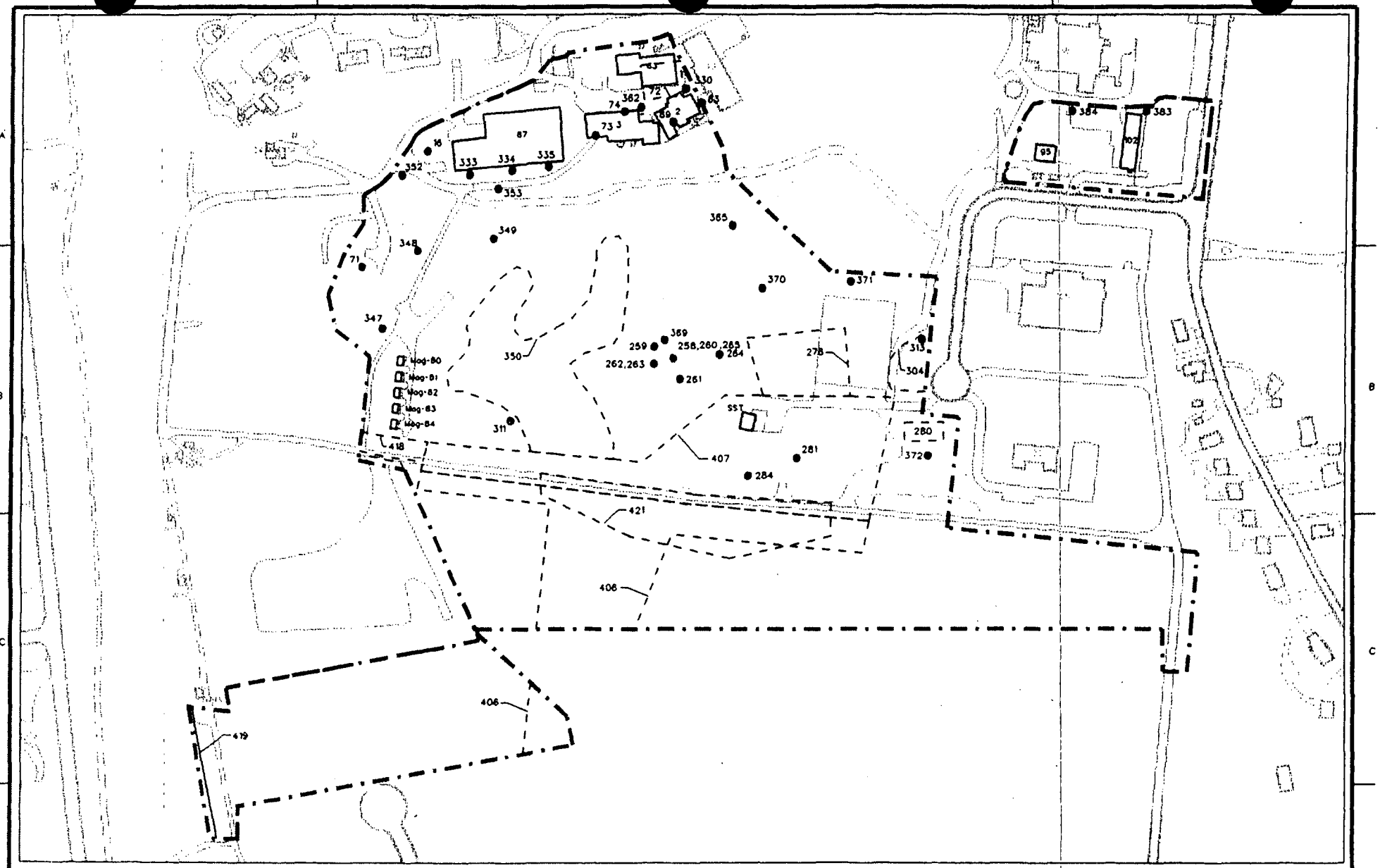
DRAWING CLASSIFICATION: UNCLASSIFIED
SIZE: D
DRAWING NUMBER: gen_site_plan.dgn
JOB NUMBER:
DWG TYPE: SITE
DRWG
CLASS
SCALE: Graphic
SHEET 1 OF
STATUS: MD-REL-03/14/95
ORIGIN: MSTATION 7.1

gen_site_plan.dgn



● COMPLETE PATHWAY EVALUATED QUANTITATIVELY
○ COMPLETE PATHWAY EVALUATED QUALITATIVELY
— INCOMPLETE PATHWAY, NOT EVALUATED
* NO VOLATILE COPCs IN AREA

Figure 3
Conceptual Site Model for the Phase I RRE



129	DATE	REVISION	BY	CHKR	CAD	UPDTE	APVD	R
	05/08/02		SSP					

MOUND

Environmental Restoration Geographic Information System

Figure 4: Phase I Buildings and PRSs

APPENDIX E

CD of Phase I Database Information

APPENDIX F

Building Information

Phase I includes 53.8 acres of land located in three distinct sections or parcels of the site property (Figure 2). The first parcel, the largest block of property in Phase I includes lands located on the south central part of the original 182 acres of the site that was purchased in 1947. This piece of property also contains a portion of the South Property (purchased in 1982). The second parcel of property included in Phase I is situated to the south of the Spoils Area and the site well pump houses, in the area designated as the South Property. The third parcel of property in Phase I lies to the south-southwest of Building 38.

Phase I includes 13 existing buildings and explosives magazines and 25 former production-era building sites including buildings, explosives storage magazines, and an electrical generator. Since the plant became operational, the properties in Phase I, with the exception of the South Property, have supported a number of plant related operations. Included in the activities that once took place in Phase I is explosives testing and production-related activities, administrative activities (i.e., offices and site security operations), utilities operations, waste processing operations (the Burn Area), and cleanup waste storage operations.

In addition to the 38 production-era buildings noted above, Phase I also includes building sites for around seven buildings constructed in 1947 with the sole purpose to support the construction of the original site buildings. An additional building location includes the site of a building that was transferred from Dayton Unit III to the Mound site in 1949. This building was again moved to another location on the Mound site, and is known as "Building 19." The building sites dating from the construction era include a storage warehouse, a quonset-type building, and some other temporary buildings.

Phase I lands have also been used for various waste and non-waste storage activities including waste container management, equipment management, and for other general plant uses.

BUILDINGS CURRENTLY LOCATED IN PHASE I

There are 13 existing buildings located within Phase I (as shown in Figure 4), including five buildings located in the Test Fire Area that have supported detonator and explosives testing operations (Buildings 2, 3, 63E, 63W, and 87). In addition to the five Test Fire Area buildings, there are five explosives magazines located to the southwest of the Test Fire Area (Magazines 80, 81, 82, 83, and 84). All of the buildings in the Test Fire Area, with the exception of Building 2, as well as the explosives magazines, are currently operated under users agreements that are being administered by MMCIC.

The remaining three buildings located in Phase I include Building 95, which is a chiller and steam plant that is located on the SM/PP Hill; Building 102, an office building located on the SM/PP Hill; and the Salt Storage (SST) Building.

Buildings currently located in Phase I are described below.

Building 2. The former Energetic Materials Destructive Testing Facility (Building 2) was constructed in 1956. At the time of construction, the building contained approximately

3,130 square feet of floor space. With five additions to the building, the square footage of Building 2 has grown to 6,291 square feet. Today, Building 2 exists as a reinforced concrete and concrete block structure that is constructed slab-on-grade with a built-up membrane roof. In addition to the more permanent parts of the building, Building 2 includes two attached metal storage sheds.

From the time of its construction in 1956 until the construction of Building 87 in the late 1980s, the function of Building 2 remained the same, a facility for the destructive testing of energetic materials.

Building 3. Building 3 was constructed in 1963 and is an explosives material destructive test firing and environmental testing laboratory. With four additions to the building, including two attached corrugated fiberglass faced metal framed storage sheds, the square footage of Building 3 is currently 12,400 square feet.

When operated by DOE and the contractor, Building 3 included 17 environmental chambers for thermal testing, six systems for mechanical testing operations, two vibration testing systems, one centrifuge testing system, and three shock testing systems.

Building 3 was used as a facility for the destructive and environmental testing of explosives materials from the time of construction in 1963 until the building was turned over to EG&G Star City (now Perkin-Elmer) in 1994 under a lease agreement with the DOE. Building 3 has operated under that agreement since that time.

Buildings 63E and 63W. Building 63 East/West is actually two separate, or two distinct buildings, that are adjacent and therefore share the same building number. There is no shared point of entry between either building.

Building 63 East contains 14,418 square feet of floor space, and was constructed to provide a facility to test systems design and for related development activities.

Building 63 West contains 3,050 square feet of floor space and was constructed to provide a facility for long-term environmental conditioning studies. When constructed, one-half of the building consisted of administrative areas (i.e., offices). The other part of Building 63 West was used for environmental storage and conditioning chambers, ovens, and spin testing equipment. Building 63 West included 10 environmental chambers for spin testing and eight chambers for thermal testing.

Building 63 East/West functioned as a facility for testing and testing research and related support activities, from the time of construction in 1981 until the building was turned over to EG&G Star City (now Perkin-Elmer). The transition of Building 63 East and Building 63 West to private industry took place in the mid-1990s. Building 63 East/West has continued to operate under this lease agreement since that time.

Building 87. Building 87 (or CTF-the Component Test Facility) is a two-story, 38,882 square foot, concrete structure, built slab-on-grade. The CTF offices and support facilities and other operational control/testing facilities that supported the testing cells

were located on the first floor. The mechanical penthouse, on the second floor, contains HVAC heating and air conditioning, air handling units for the test cell areas, and a heat exchanger for hot water. The mechanical area occupies approximately 600 square feet. Building 87 was constructed in the 1980s and underwent shut down in about 1995.

Building 87 is currently being renovated by MMCIC for use by private industry.

Building 95. Building 95, the "SM/PP Chiller" consists of one larger building (Building 95) with 2,000 square feet of floor space, and two smaller ancillary buildings (Buildings 95-A and 95-B, each having 450 square feet of floor space. Buildings 95 (collectively) was constructed in the mid-1980s, in order to supplement P Building (Power Plant) operations, and in order to satisfy the demand for a chiller on the SM/PP Hill.

Building 102. Building 102 is a 10,982 square-foot two-story office building that was constructed in 1987 to support Mound's Decontamination and Decommissioning Program (D&D Program), and to provide an administrative area to house cleanup related staff. Through time, Building 102 has continued in its mission as an office, however, the building tenants have differed, including staff members from the PST Program, Soil Project team staff, as well as D&D Program staff members.

SST Building. SST Building was constructed in the early 1970s and is located in the vicinity of the former Burn Area, just to the southwest of where that area was located, and just to the east of the former Building 21 location. SST has been used for salt storage for snow control on site.

SST Building is a one-story, 590 square-foot, slab-on grade structure with wood framing for the walls and roof. The front of SST Building is open from wall to wall and from the ground to the roof. A 3-foot high concrete wall separates the wood structure from the slab and divides the area into two sections. Wood siding and the roof are covered with tar paper. SST Building was renovated in 2000.

Magazines 80, 81, 82, 83, and 84. Magazines 80, 81, 82, 83, and 84, are smaller explosives storage bunkers (explosives magazines) that were constructed in 1985.

Magazines 80, 81, 82, 83, and 84 each contain two-units or compartments. Each of the magazines is constructed of reinforced concrete as a box-shaped structure and considered non-standard earthen-covered magazines. The configuration of Magazines 80, 81, 82, 83, and 84 appears to be one unit. These magazines were used for the storage of energetic materials, and were used for that purpose, until they were transferred to EG&G Star City (now Perkin-Elmer) under a user agreement initiated with DOE.

The transition of Magazines 80, 81, 82, 83, and 84 to private industry took place in the mid-1990s, and these magazines have continued to operate under a user lease agreement since that time.

FORMER PRODUCTION ERA BUILDING SITES

There are 24 sites where production era buildings were once located within Phase I. Included in the former buildings that were located in Phase I are 4 buildings (Buildings 13, 14, 35, and 59) in the Test Fire Area that supported detonator and explosives testing operations. In addition to the Test Fire buildings, there were six explosives storage magazines to the southwest of the Test Fire Area (Magazines 4, 5, 8, 9, 10, and 20) that supported explosive operations.

Buildings 12 and 18 were located near the current Building 87 location into the 1980s. These buildings were apparently storage warehouses that were used to support explosives operations.

There was also an explosive storage magazine (Magazine 6) that was later converted from an explosive storage magazine to a storage area for use by the security force to store weapons. Magazine 6 was located between Buildings 49 and 63.

An additional four buildings or facilities were located in an area designated as the "Burn Area." This area was located to the northwest of SST Building, and included the Pyroshed Energetic Materials Waste Storage Unit, the Open Burn Energetic Materials Treatment Unit, Building 90 and the retort unit (an explosives treatment unit), and Magazine 53 (an explosives storage area).

Other building sites in Phase I also include the location for Building 39, a maintenance building, the location for an emergency electrical generator (Electric Generator Number 7), a process material storage building (Building 21), and four modular office buildings (Buildings 77, 78, 97, and 101).

The last of the building sites in Phase I is for Building 85. Building 85 is also the last building to be demolished in Phase I. Building 85 was an explosives powder process facility that was never placed into production.

The buildings once located on the former building sites within Phase I are described below.

Buildings 12 and 18. Building 12, titled the "Detonator Storage Building" was constructed in 1960, as a 57' x 32' long "Armco" steel building. Building 18, constructed in 1963, was similar in size and construction to Building 12. Both buildings were used to support explosives operations and were located about where Building 87 is currently located. Buildings 12 and Building 18 were demolished in the 1980s.

Building 13. Building 13 was a one-story, 44 square-foot wood-framed asbestos-coated steel structure on a concrete slab. Building 13 was located to the west of Building 21, and was used to support a program for remote monitoring of energetic materials destructed in the Burn Area, located to the east. Building 13 contained a video monitor and electrical initiation equipment for firing explosive materials treatment devices. The building use, as described in 1990, was a "firing shed." Building 13 was demolished in 1997.

Building 14. Building 14 was a 42 square-foot, one-story, structure. This building was constructed with a wood and metal-frame and asbestos-coated sidewalls, with concrete deck roof on concrete footings. This building was used as an observation post in association with the former Burn Area to the east. The facility had no heating, cooling, or electrical services. The building use, as described in 1990, was metal melting. Building 14 was demolished in 1997.

Building 21. Building 21 was used for the storage of materials associated with two of Mound's processing missions, including thorium ores and protactinium ores (Cotter Concentrates). This structure was located along the south central border of the improved plant property; adjacent to the area designated as the Burn Area.

Building 21 was a 4,032 square-foot concrete structure with 10-inch thick floors and 14- to 16-inch thick walls. The roof was constructed of iron and steel. The facility was designed to ensure liquid tightness and was divided into two separate isolated bay areas. Building 21 became operational in 1964. Storage operations ended in 1987. Beginning in 1964, 1,338 drums of thorium oxalate were dumped in bulk form into the small bay area, while 3,576 drums of thorium hydroxide sludge were dumped in bulk form into the larger bay. The thorium sludge was ultimately sold to General Atomic Company for reclamation and was removed from Building 21 in 1975. Following removal of the thorium sludge, the building was cleaned and used as a staging area for Cotter Concentrates (high-level waste resulting from uranium milling). Approximately 1,258 drums of Cotter Concentrate were stored in Building 21. These drums were eventually shipped to the Nevada Test Site (NTS) in 1987 and use of Building 21 ceased. Since 1987, the building and surrounding area were maintained in a safe mode until the building was demolished in 1997.

Building 35. Building 35 was a 2,500 square-foot single-story structure built of concrete block. Building 35 was designed to provide x-ray and eddy current non-destructive testing of explosives. Building 35 was also used as the control room for the californium-252 multiplier (CFX) neutron radiography facility that was located in adjacent Building 59. Building 35 was demolished in the spring of 1998.

Building 39. Building 39, constructed in 1969, was a one-story structure constructed of prefabricated metal with a metal roof.

Initially, the eastern end of Building 39 was used by the Decontamination and Decommissioning project, which worked to produce fiberglass wooden boxes that were used for radioactive trash. The turntable used for this operation is still in place. Indications are that the facility was also used to perform gamma spectroscopy on these boxes.

From 1984 to 1988, the building was either inactive or used for storage.

In 1988, Building 39 was converted to a maintenance shop, and was divided into three sections: the east end was a machine shop; the middle was a break room; and the west

end was used primarily for storage of building materials, parts, paints, and some solvents.

Building 39 was demolished in 1998.

Building 59. Building 59, the neutron radiography facility, was a 700 square-foot, two-story reinforced concrete structure with a rolled roof. Building 59 was constructed in 1970 to provide neutron radiography capability to the site.

Building 59 housed a neutron-radiation source (californium-252) that was used to supply neutrons to an assembly of uranium plates. The californium-252 source was stored remotely from the core when not in use; when radiography operations were to be conducted, the source would be transported via a hand-cranked source transfer system into its proper location within the core assembly. The californium-252 source was removed from the facility and transported to Oak Ridge National Lab in 1995. Building 59 was demolished in the spring of 1998.

Building 77 and 78. Building 77 and 78, both located to the north of Building 39 were modular office structures that were used in the early 1980s. Both Building 77 and Building 78 contained 12 rooms, each with overall dimensions of 23.5 feet by 60 feet, and a combined square footage of 2,995. Both of these buildings were removed from service or were dismantled by the 1990s.

Building 85. Building 85 was constructed in late 1980s as a 3,160 square-foot building for the processing and blending of explosive powders. Designed much like an above ground bunker, each of the building's eight rooms had its own outside entry door. There were no passage doors between any of the rooms. There was an earthen embankment on the buildings eastern side, where the powder blending cells were located.

Building 85 was constructed as a Class I explosive powder processing facility, with reinforced interior and exterior concrete walls that vary in thickness, dependent upon the function of the rooms in the building. Wall thickness varied between 1 foot and 3.5 feet. The building was constructed on a slab that also varied in thickness dependent upon intended room function. Building 85 had a reinforced concrete roof where the thickness was also a function of the rooms.

Building 85, at the time of its demolition in 2002, existed much as it did when constructed, with the exception of the fact that some of the equipment installed at the completion of construction had been removed.

Site history indicates that Building 85 was never placed into production.

Building 97. Building 97 was a 12-room, 7,410 square-foot, 23.5 foot by 60 foot modular office structure, located to the south of Building 39. Building 97 was constructed in the early to late 1980s and was removed from service and dismantled in the 1990s.

Building 101. Building 101 was a single-story modular building with wooden exterior and Hypalon roof. The square footage of Building 101 was 1,815. Building 101 was brought

on site in 1986, and was used as offices for the area maintenance foreman and planner. It was sold and removed from the site in 1999.

Building 120. Building 120 was a 350 square-foot, one-story, wood-sided building with a metal roof. Building 120 was located just to the south of Building 102 and was used as an administrative office for the Decontamination and Decommissioning (D&D) Group. It was dismantled in 1998.

Burn Area Buildings. The Burn Area, excluding Magazine 53, described below, included three buildings and/or areas, as follows:

1. Pyroshed Energetic Materials Waste Storage Unit. This structure, known as the "Pyroshed" was used for the storage of pyrotechnic wastes and other energetic materials prior to their treatment at the Burn Area. The Pyroshed was located inside the fenced Burn Area and was constructed on a concrete pad measuring approximately 9 feet by 15 feet. The shed was approximately 7 feet high, with chain-link fence walls. A locked entry gate was located in the front side of the structure.

2. Open Burn Energetic Materials Treatment Unit. The open burn unit was used for op en burning of non-liquid explosive waste, pyrotechnic waste, and thermal treatment of explosive-contaminated material.

   The open burn unit consisted of a 12.3-foot by 18-foot base encircled by a 10-foot high composite metal wall with a sand core. The treatment zone measured approximately 12 feet by 12 feet, and the remainder of the floor space was occupied by an access-way. The entrance consisted of a 4-foot wide aisle that turned at a right angle to enter the treatment zone. The unit was developed on an 18-inch wide by 30-inch deep continuous, concrete footing developed on native soil. The enclosure's sides consisted of 0.25-inch thick milled steel plates.

3. Building 90. Building 90, constructed in 1984 and demolished in 1997, was a pre-engineered sheet metal building constructed on a reinforced concrete slab. The retort unit part of this building was located within a rectangular enclosure attached to the east side of Building 90 that was approximately 30 feet long and 15 feet wide with 9-foot high walls. Building 90 was designed to house the unit controls and waste feed operations for the Retort Unit (rotary-kiln-thermal-treatment-unit). Operations in Building 90 were suspended in January 1996, and the building was demolished in 1996-1997.

The buildings and facilities within the Burn Area were used for the destruction of pyrotechnics and energetic materials, including regulated hazardous waste explosives. Consequently, these operations underwent a RCRA closure, and as a part of that process were demolished in 1997 and 1998.

Electrical Generator 7. EG-7 (emergency generator) was constructed in 1972 to provide emergency electrical power to the Test Fire Area. The generator was an internal combustion key-starting engine generator housed in an 80-foot square metal structure,

which was located just to the north of Building 63. EG-7 remained available as an emergency generator until the 1990s, when it was taken out of use. EG-7 was sold in 1998.

Magazines 5, 8, 10, and 20. Magazines 5, 8, 10, and 20 were smaller explosive storage magazines or bunkers that were constructed in the mid-1950s and into the early 1960's. These magazines were located in the Test Fire Area, in a fenced area behind the former Building 85 site and behind Building 87. The purpose of these structures was for the storage of Mounds energetic materials. These buildings were demolished.

Magazine 53. Magazine 53 was a one-story, 239 square-foot reinforced concrete structure. The roof was made of reinforced steel, and the structure was covered with earth. Magazine 53 was constructed in 1970 and was used for the storage of pyrotechnics and energetic materials that were destroyed in the Burn Area. Magazine 53 was also used as a storage area for hazardous waste regulated explosives, and consequently underwent a RCRA closure. Magazine 53, as part of this closure, was demolished in January 1998.

Magazines 4 and 9. Magazine 4, the bulk storage magazine, was constructed in 1962 as an earthen covered magazine. Magazine 53 was constructed in an area adjacent to Magazine 9. Magazine 4 contained 4 units, with the front of the structure measuring 53 feet across. Magazine 9 was constructed in 1956, also as an earthen covered magazine. Magazine 9 contained a single cell that measured 17-feet by 14-feet. Both magazines were in the vicinity of Building 87. Magazines 4 and 9 were demolished by the 1980s.

Magazine 6. Magazine 6,constructed with reinforced concrete walls and roof, was located just to the east of Building 63E in the Test Fire Area. Magazine 6 was a 90 square-foot storage bunker or magazine that was constructed in 1956. Construction of this building appears to be associated with the construction of Building 2 located just to the south. Building 2, an explosives materials test firing facility, was the second building that was constructed on the site to support the newly assigned detonator mission.

FORMER CONSTRUCTION-ERA BUILDING SITES LOCATED IN PHASE I

There are three locations within Phase I that were used during the time that the original 1948-era buildings were constructed on the Mound site. These locations are summarized below:

Warehouse 12. Warehouse 12 was located in the approximate vicinity of the Building 39 site and was constructed by Maxon Construction Company to provide an administrative area (i.e., storage warehouse) in 1947 during the construction era for Mound's original buildings. Later plant records do not indicate any mission-related uses for Warehouse 12. Based upon comparisons of site photographs and available information, Warehouse 12 was likely demolished in the late 1940s or the early 1950s.

Tropical Huts and other Temporary Buildings. A number of shacks and tents (tropical huts) were used in conjunction with the construction of the original plant buildings in the

very early 1950s for the storage of debris and other polonium contaminated materials. Little information is available on these buildings. However, based upon early photographs, there were three of these structures located near the current location of Building 2.

Building 19 Quonset Hut. The Quonset Hut is a 40-foot by 60-foot Stransteel brand structure that was originally located at Dayton Unit III and was relocated to the Mound site. When Unit III was being cleaned up, this building was disassembled and was moved from Unit III. In 1949, it was relocated to the lower valley of the Mound Laboratory site where the existing Building 3 is now located.

The Quonset Hut was used for shipping, receiving, and storing of radioactive field materials in the 1950s.

The Quonset Hut was also used for storage of bismuth-chloride sludges from the polonium separations. At that time, 500 to 600 drums of sludge generated by the hydrolysis process were stored in the Quonset Hut awaiting a determination on potential reuse or shipment to the Oak Ridge site for burial.

The Quonset Hut was also used for the storage of thorium in 1952 and for the storage of Purex residues from 1949 to 1954.

In 1963, the Quonset Hut was again relocated when it was moved to its current location near the western property boundary.

OTHER LAND USE AREAS IN PHASE I

In addition to uses of the Test Fire Area (i.e., around Building 2) for the management of materials during the construction era and use of those same areas for early production era uses, the lands in Phase I have also been used for the following purposes:

SM/PP Pad. The SM/PP Pad is a concrete pad that was used by waste management for the management of low-level waste boxes containing soil and debris, as well as being used as a staging site for unused or empty low-level waste boxes. This pad is located to the east of the former Building 21 site and north of the SST Building.

Fenced Location for Storage of Equipment and Drums near Building 21. A fenced area to the east-southeast of Building 21 was used for the management of low-level waste drums and potentially contaminated equipment. This area was addressed as part of the Building 21 cleanup activities.

Building 21 soils management area, east of SST Building. This area was used for the management of soils excavated after the Building 21 operations ceased and was addressed as part of the Building 21 cleanup activities.

South Property Portions of Phase I. The portions of the south property included in Phase I are part of two property parcels containing 124 acres of rolling hills to the south of the main processing related areas. DOE had purchased the South Property (also

called the "New Property") in 1981 in part as a buffer and in part for possible future expansions. Despite its purchase for possible future expansion, it has for the most part remained unused since the date of purchase. The only plant uses that have taken place in the areas to be transferred in Phase I are the installation of boundary fences, the grading of the surface and the associated filling in of low-lying areas, and road installation and mobile laboratory operations in support of the Canal Removal Action.

An older unimproved road. The road running from the vicinity of Building 105 to the area behind Buildings 2, 3, and 87 was improved and the curves banked to utilize the area as a haul road in support of clean up activities in the Building 21 area and in the Burn Area.

Unidentified trailers near Building 21 and the SST Building. A grouping of office-type trailers existed in the vicinity of Building 21 and the SST Building were removed from this location by the 1990s.

Concrete Pad West of Building 35. The Building 35 concrete pad area was used by waste management for the management of low-level waste boxes of soil and debris.

P Building Soils Management Area-"Petro Piles". In the early 1990s, soil that was removed in conjunction with the removal of the P Building fuel oil tank removal were staged in the vicinity of Building 87 and Building 85 for treatment in a biodegradation facility for petroleum contaminated soils.

Management Area for Equipment. In 1996 and 1997, along the current property line for (previously transferred) Release Block D and Phase I (west of Building 100), an area was used to store portable office trailers, modular guard shacks, portable utility buildings, and various types of equipment that had been removed from an equipment management area in the Spoils Area.

Storage of Bird-Cage Drums. In the mid-1990s, empty blue transport drums that had been used for the transportation of fissile (product) material were located along the current property line for Release Block D and Phase I (west of Building 100). These drums were constructed with an internal framework that suspended the material contained in the drum in the drums' center, allowing the placement of the drums in a manner that was consistent with the criticality requirements for the contained material.

APPENDIX G

PRS Information

PRS 16. Area C (Old Building 72) was a former Hazardous Waste Storage Area dismantled in accordance with an Ohio Environmental Protection Agency approved RCRA closure plan. Core Team decided that PRS 16 requires No Further Assessment.

PRS 71. Building 85 Waste Solvent Tank was designed to store waste solvent associated with explosives processing; however, historical information indicates that the tank was never used. Core Team decided that PRS 71 requires No Further Assessment.

PRS 72. Area 13, Polonium from Dayton Unit IV, was identified as the storage site of contaminated materials brought to Mound from the former Dayton Unit operations in the 1950s. Core Team decided that PRS 72 requires No Further Assessment.

PRS 73. PRS 73, the Evaporator Storage Area, was an equipment storage area located in the Test Fire Valley. Further Assessment sampling in July 2001 identified no levels of concern. Core Team decided that PRS 73 requires No Further Assessment.

PRS 74. Quonset Hut (former), placed on a potentially contaminated concrete floor shows no indication that its shell was ever contaminated. The concrete floor was removed in 1963. Core Team decided that PRS 74 requires No Further Assessment.

PRS 83. Building 2 Propane Storage Tank (Tank 122). Core Team decided that PRS 83 requires No Further Assessment.

PRS 89. The Test Fire Residual Storage Tank is still active. Core Team decided that PRS 89 requires No Further Assessment.

PRS 258-265. PRSs 258-265 refer to the waste storage and treatment facilities formerly located in the "Burn Area" where a variety of wastes such as explosive powders, pyrotechnic materials, solid wastes contaminated with energetic materials, and non-radiological weapons components were thermally treated. Beryllium was the only COC identified as exceeding its Guideline Value during sampling events. There are no reported recent historical events to indicate other reasons for concern. Core Team decided that PRSs 258-265 require No Further Assessment.

PRS 276. Area 22, Orphan Soil from Other Areas, was a potentially contaminated site due to its use as a temporary storage area for contaminated soils. The soils were removed in accordance with the Core Team recommendation. Core Team decided that PRS 276 requires No Further Assessment.

PRS 280. Further Assessment sampling in the Waste Oil Drum Field yielded only low-level and isolated exceedances were noted above 10^{-6} RBGVs/screening levels; however, none were above cleanup objectives (10^{-5} RBGV + background). Core Team decided that PRS 280 requires No Further Assessment.

PRS 281. Area E, identified as a historical, isolated waste oil spill, produced levels of radiological contamination over Mound soils guidelines for radium-226. The area was subject to the removal action associated with the Building 21 demolition. Core Team decided that PRS 281 requires No Further Assessment.

PRS 284. The Building 21 Thorium Sludge Storage Facility held 4,914 drums of thorium

oxalate from 1966-1975 and 1,258 drums of Cotter Concentrate (high-level nuclear waste) until 1987. Cleanup and removal of Building 21 was completed 31 March 1997. Core Team decided that PRS 284 requires No Further Assessment.

PRS 304. This Excavated Material Disposal Area was created due to the dumping of low-level thorium soils. Sampling in 1984 found plutonium and thorium levels below the risk-based guideline values. Core Team decided that PRS 304 requires No Further Assessment.

PRS 311. Potential Hot Spot Location S0706 was identified during a 1983 site survey project, which discovered an isolated plutonium-238 reading of 29 pCi/g. This level is below all associated cleanup levels and guideline values. Core Team decided that PRS 311 requires No Further Assessment.

PRS 313. Potential Hot Spot Location S0982 was identified as a thorium hot spot during the Radiological Site Survey Project. Results from sampling in 1995 indicated no radioactive contamination in excess of guideline criteria. Core Team decided that PRS 313 requires No Further Assessment.

PRS 330. In 1994, qualitative hydrocarbon detections were found in the Building 2 Fuel Oil Tank (Tank 260) during the PETREX soil gas portion of the OU5, Non Area of Concern investigation. However, the 1996 sampling effort detected no contamination above the acceptable risk range. Core Team decided that PRS 330 requires No Further Assessment.

PRS 333. PRS 333 is an explosive surge tank (Tank 263) located along the southern border of Building 87,a previous explosives testing area that has since undergone Safe Shutdown. Core Team decided that PRS 333 requires No Further Assessment.

PRS 334. PRS 334 is an explosive surge tank (Tank 264) located along the southern border of Building 87,a previous explosives testing area that has since undergone Safe Shutdown. Core Team decided that PRS 334 requires No Further Assessment.

PRS 335. PRS 335 is an explosive surge tank (Tank 265) located along the southern border of Building 87,a previous explosives testing area that has since undergone Safe Shutdown. Core Team decided that PRS 335 requires No Further Assessment.

PRS 347. PRS 347 was identified according to qualitative hydrocarbon detections found during the PETREX soil gas portion of OU5, Non Area of Concern investigation. The 1996 Soil Gas confirmation sampling effort discovered no contamination above the 10^{-6} risk range. Core Team decided that PRS 347 requires No Further Assessment.

PRS 348. PRS 348 was identified according to qualitative hydrocarbon detections found during the PETREX soil gas portion of OU5, Non Area of Concern investigation. The 1996 Soil Gas confirmation sampling effort discovered no contamination above the 10^{-6} risk range. Core Team decided that PRS 348 requires No Further Assessment.

PRS 349. PRS 349 was identified due to plutonium detections found during the Mound Soil Screening Analysis performed as part of the June 1994 OU5, Operational Area Phase I Investigation. All concentrations are below the 10^{-5} Risk Based Guideline Value. Core Team decided that PRS 349 requires No Further Assessment.

PRS 350. Soil Contamination, Area West of Building 21, consists of detectable plutonium concentrations; however, concentrations were below all associated cleanup levels and guideline values. Core Team decided that PRS 350 requires No Further Assessment.

PRS 352. PRS 352 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas portion of the OU5, Non Area of Concern investigation. Soil gas confirmation sampling indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 352 requires No Further Assessment.

PRS 353. PRS 353 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas portion of the OU5, Non Area of Concern investigation. Soil gas confirmation sampling indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 353 requires No Further Assessment.

PRS 362. PRS 362 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas portion of the OU5, Non Area of Concern investigation. Soil gas confirmation sampling indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 362 requires No Further Assessment.

PRS 365. PRS 365 was identified as an elevated soil gas location due to an elevated PETREX passive soil gas survey result in 1994. A soil gas confirmation sample collected within 50 feet of this PRS indicated that all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 365 requires No Further Assessment.

PRS 369. PRS 369 was identified as an elevated soil gas location due to elevation qualitative PETREX hydrocarbon levels. During the 1996 soil gas confirmation sampling, all concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 369 requires No Further Assessment.

PRS 370. PRS 370 was identified according to qualitative hydrocarbon detections found during the PETREX soil gas portion of OU5, Non Area of Concern investigation. The 1996 Soil Gas confirmation sampling effort discovered no contamination above the 10^{-6} risk range. Core Team decided that PRS 370 requires No Further Assessment.

PRS 371. PRS 371 was identified due to a single, elevated plutonium-238 detection during the OU5, Operational Area Phase I Investigation in 1994. In 1996, a sample was collected within approximately 25 feet of PRS 371 during the Soil Gas Confirmation Investigation. All concentrations of volatile, semivolatile, PCBs, pesticides, metals, radionuclides, and explosives within the soil were below applicable guideline criteria. Core Team decided that PRS 371 requires No Further Assessment.

PRS 372. PRS 372 was identified due to elevated soil gas measurements. Subsequent quantitative sampling showed that all soil samples taken in the area were at or below their respective 10^{-6} Risk Based Guideline Value. Core Team decided that PRS 372 requires No Further Assessment.

PRS 383. PRS 383 was identified as an area of possible organic contamination during the 1992 PETREX Survey. However, additional sampling in 1995 quantitatively determined that no volatile, semivolatile, PCBs, pesticides, metals, radionuclides, or explosives exceeded applicable guideline values. Core Team decided that PRS 383 requires No Further Assessment.

PRS 384. PRS 384 was identified due to elevated qualitative PETREX hydrocarbon levels. However, the soil gas confirmation investigation in 1996 determined that no volatile, semivolatile, PCBs, pesticides, metals, radionuclides, or explosives exceeded applicable guideline values. Core Team decided that PRS 384 requires No Further Assessment.

PRS 406. The southern portion of PRS 283 became a PRS due to potential thorium dust from the thorium sludge redrumming. However, radionuclides in the soils were scattered and infrequent, and all occurrences were below the 10^{-5} risk-based guideline values. Core Team decided that PRS 406 requires No Further Assessment.

PRS 407. Soil Contamination West of Building 21 resulted in a removal action in which one to two feet of soil was excavated and disposed of via railcar shipments to Envirocare. PRS 407 was later binned No Further Action in 2000. Core Team decided that PRS 407 requires No Further Assessment.

PRS 418. PRS 418, the Overflow Pond South Inlet, was created to address potential plutonium-238, thorium-228, thorium-232, and Radium-226 contamination from PRS 407. Since the PRS 407 removal action, there are no known PRSs draining into the inlet. Although sample results for benzo(a)pyrene exceed the 10^{-6} guideline value, they are below the 10^{-5} risk-based guideline value. All other constituents are below guideline criteria. Core Team decided that PRS 418 requires No Further Assessment.

PRS 419. The Mound Plant Drainage Outflow Reroute, constructed during the Miami-Erie Canal Remediation Project, is monitored for radiological parameters under DOE Order 5400.1 and the DOE Regulatory Guide. It is also monitored for non-radiological parameters in accordance with the site's NPDES permit. To address potential radiological releases, the Outflow Reroute is also monitored daily for gross alpha and tritium, and bi-weekly from flow-proportional 24-hour composite samples for multiple radionuclides. Core Team decided that PRS 419 requires No Further Assessment.

PRS 421. PRS 421 is "The Ridge" across the road south of the location of the former Building 21. It was identified as a PRS when historical sampling data indicated the presence of contaminated soil. Contamination was confirmed during the verification sampling for PRS 407. The source of the contamination was surface runoff from the PRS 407 cleanup that followed preferential and intermediate drainage pathways south to the PRS 421 area. The removal action resulted in the excavation and containerization for disposal of approximately 105,133 cubic feet of soil, concrete, and asphalt. The cleanup objectives were 55 pCi/g for plutonium-238, 2.1 pCi/g for thorium-232, and 2.6

pCi/g for thorium-228. The OSC report documented that all verification sample results were below cleanup objectives.

APPENDIX H

Demonstration of Equilibrium

Several of the radionuclides of interest at Mound are part of the naturally occurring decay chains. The naturally occurring decay chains are the uranium-238 chain (The Uranium Series), the uranium-235 chain (The Actinium Series) and the thorium-232 chain (The Thorium Series). These chains satisfy the conditions of secular equilibrium. The conditions for secular equilibrium are met if a parent substance decays much more slowly than any of the other members of the chain. Secular equilibrium means the activities of each member of the decay chain are equal.

By assuming secular equilibrium for radionuclides of interest at Mound, one can conservatively calculate risk using the sum of the member's slope factors. Table 1 lists the members of the extended chains (designated "long lived decay" in the text of the RRE).

The Phase I Risk Working group (MEMP, OEPA, USEPA, and BWXTO) identified overlap of the mean plus/minus two standard deviations as the metric to demonstrate secular equilibrium. Figures 1-3 for the uranium-235, uranium-238 and thorium-232 chains illustrate that the data for Phase I demonstrate that the parent and daughters can be assumed to be in equilibrium for the purposes of this risk evaluation. Figures 4- 6 for the uranium-235, uranium-238, and thorium-232 chains illustrate that the production well data for Phase I demonstrate that the parent and daughter radionuclides can be assumed to be in equilibrium. Figures 7- 9 for the uranium-235, uranium-238, and thorium-232 chains illustrate that the bedrock well data for Phase I demonstrate that the parent and daughters can be assumed to be in equilibrium.

For calculating soil risk, the exposure point concentration for each chain was assigned as follows:

U-238 chain represented by U-238 EPC

U-235 chain represented by Ac-227 EPC

Th-232 chain represented by Th-228 EPC

For calculating ground water risk, the exposure point concentration for each chain was assigned as follows:

<u>Current Ground Water</u>
U-238 chain represented by U-234 EPC

U-235 chain represented by U-235 EPC

Th-232 chain represented by Th-228 EPC

Future Ground Water
U-238 chain represented by Ra-226 EPC

U-235 chain represented by U-235 EPC

Th-232 chain represented by Ra-228 EPC

The Total Future Ground Water EPC will be represented by the sum of the current and future ground water EPCs identified by chain in the above.

The process used to select the EPC to represent the chain was based on process history; knowledge of sampling analysis and methods; contaminants of concern for Phase I; use of a conservative concentration and a review of the distribution of the data.

For calculating background risk, the established background value for the principal (parent) nuclide of the chain is used.

The risk is then calculated or quantified using the EPC and the total of the slope factors for each daughter (Table 2).

Th-232 screens out of the risk evaluation as a contaminant of concern for soil, current ground water and future ground water. Due to the uncertainty and understanding that the Mound onsite gamma results for Th-232 are biased low, the contaminant is retained for the risk evaluation. Risk calculations for the Th-232 chain begin with the slope factor for Th-232 and includes the slope factors of long-lived decay daughters.

An example of how the risk is calculated for the Th-232 chain is as follows: In soil, Th-232 screens out as a contaminant of concern as shown on Tables 3 and 5 in Appendix C of the RRE. To calculate risk, from contaminated soil, for the Th-232 chain, the EPC for Th-228 is used. Table 3 in Appendix C indicates the EPC for Th-228 for the construction worker is 1.640 pCi/g and Table 5 in Appendix C indicates the EPC for Th-228 for the site employee is 1.7 pCi/g. On Tables 16 and 19 in Appendix C of the RRE, Th-232 is listed with the EPC of Th-228 for the construction worker and site employee, respectively. The slope factors used to calculate risk start with Th-232 and incorporate the long lived decay daughters as shown in Table 2. These summed slope factors are multiplied by the intake concentrations for soil (see Section 3.4.1, page 16) to derive risk levels (see Section 5.1.1, page 24), which are quantified on Tables 16 and 19 in Appendix C of the RRE.

Example 2: The U-238 risk for Current Groundwater for the Construction Worker is calculated based on the EPC of U-234. On Table 7 in Appendix C, the EPC for U-238 is 0.4090 pCi/L. U-234 is a daughter of U-238. On Table 22 in

Appendix C, only U-238 is listed with the EPC of U-234 (2.02 pCi/L). The EPC of U-234 was selected to ensure using a conservative approach to assessing risk. On Table 2, for the oral pathway the summed slope factor for U-238 can be found in the Oral Water Ingestion SF column, as a total, representing the appropriate daughters. This value is 1.90E-09. The U-234 EPC is used in an equation (see Section 3.4.2, page 21) to obtain an Intake value. The Intake value is then multiplied by the 1.90E-09 slope factor to obtain a risk value. The resulting risk value incorporates risk from all appropriate daughters and for this example can be found in Table 22 in Appendix C under the Cancer Effects, Oral column.

Figure 1: Phase I Soils U-235 Series

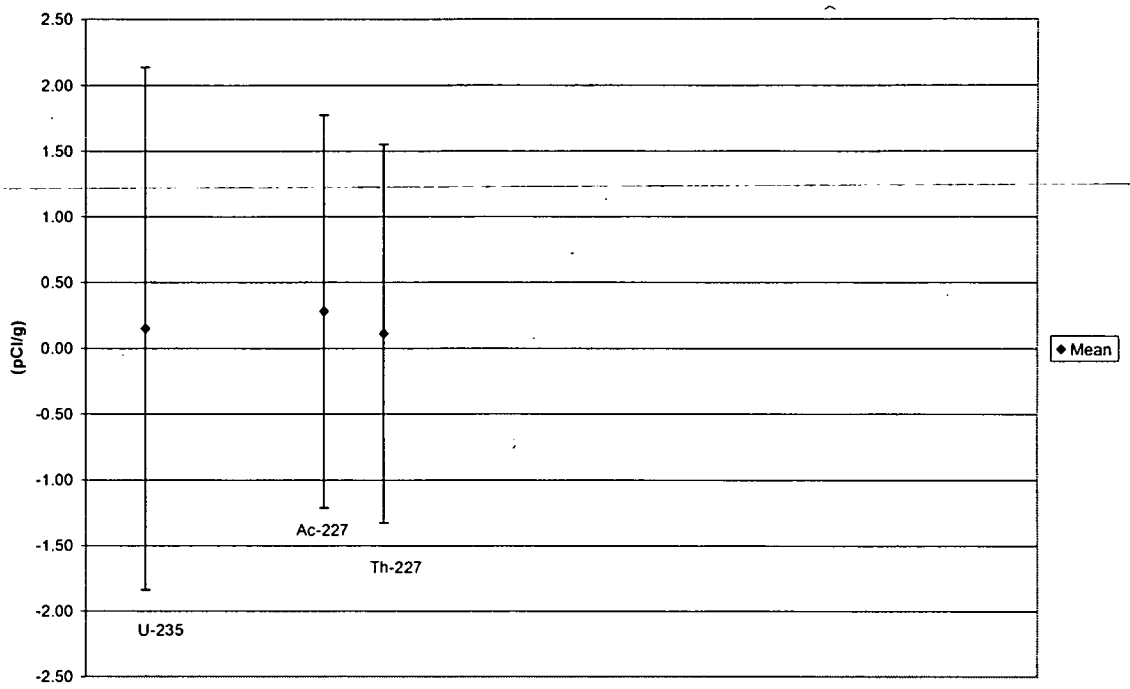


Figure 2: Phase I Soils U-238 Series

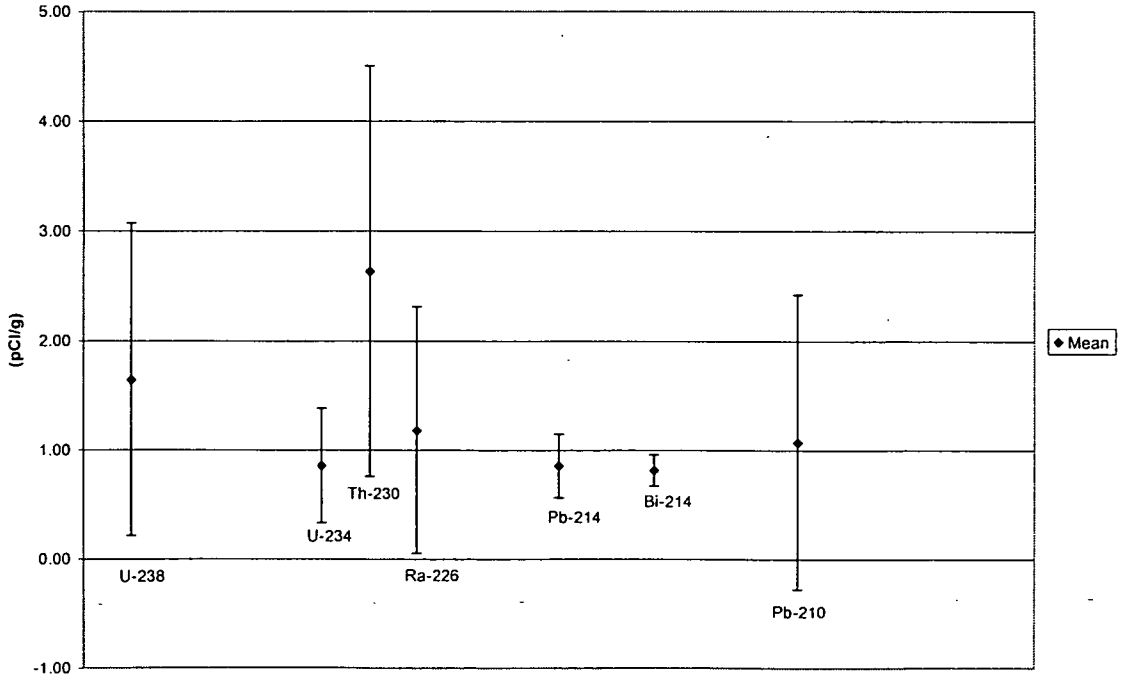


Figure 3: Phase I Soils Th-232 Series

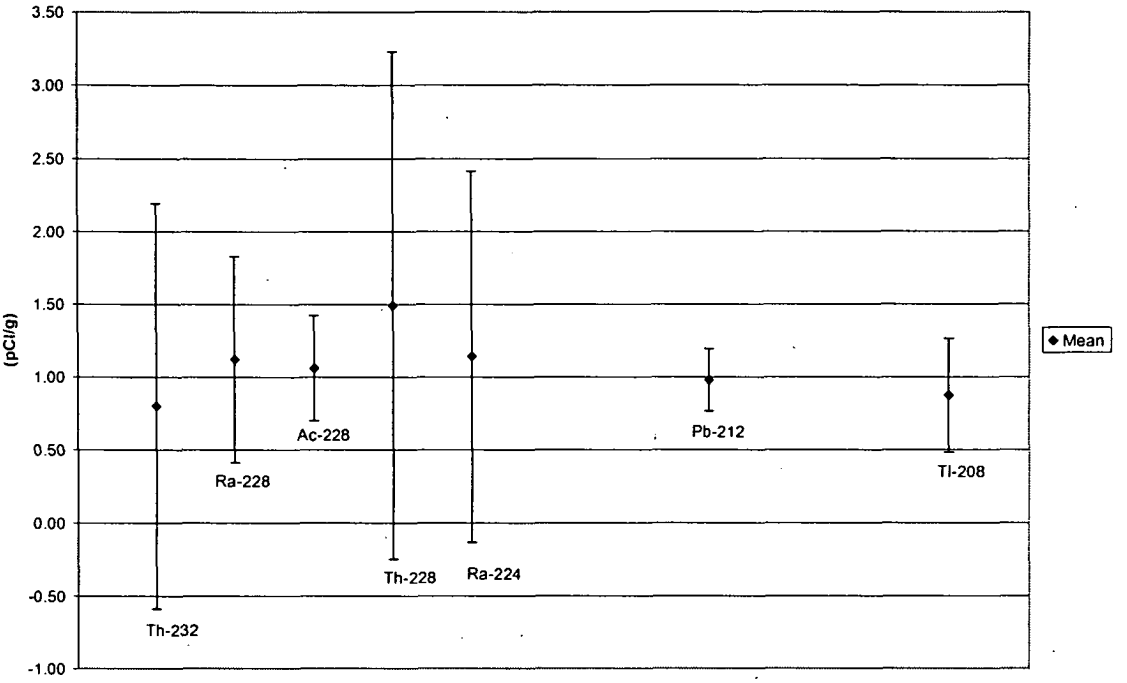


Figure 4: Production Wells U-235 Series

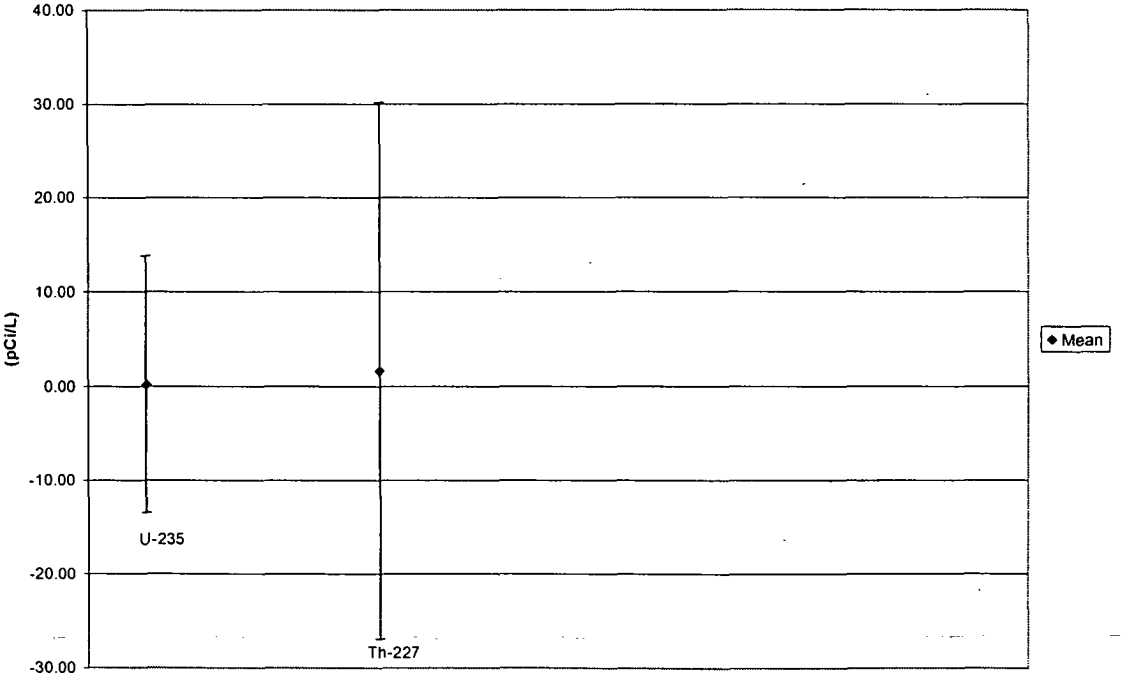


Figure 5: Production Wells U-238 Series

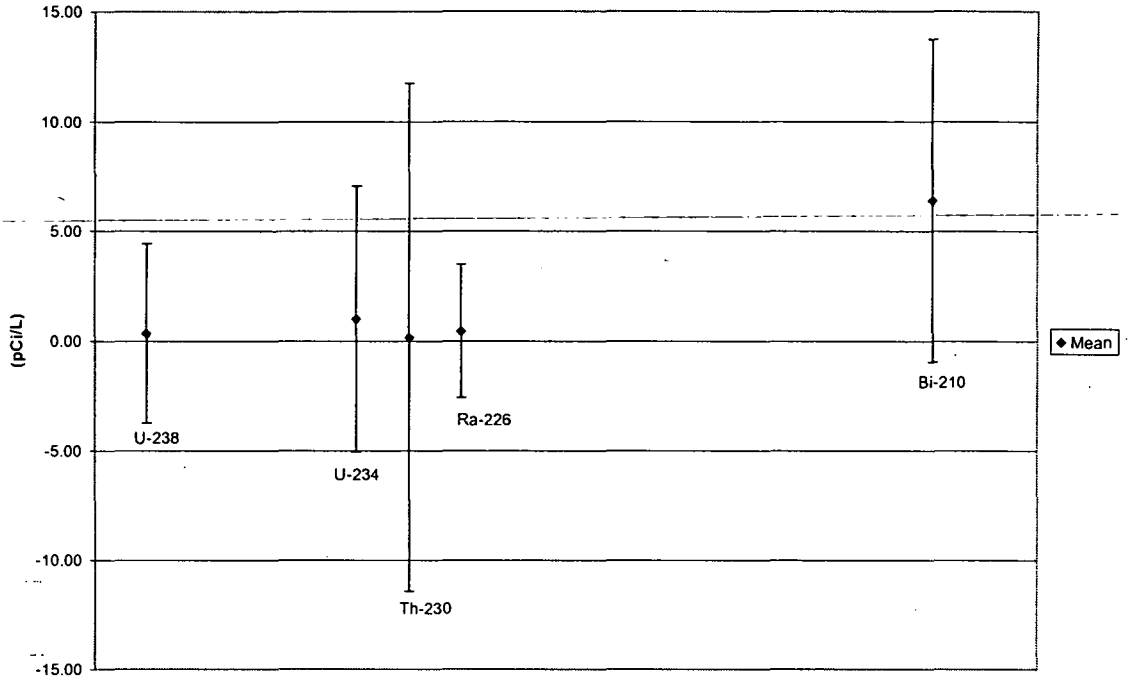


Figure 6: Production Wells Th-232 Series

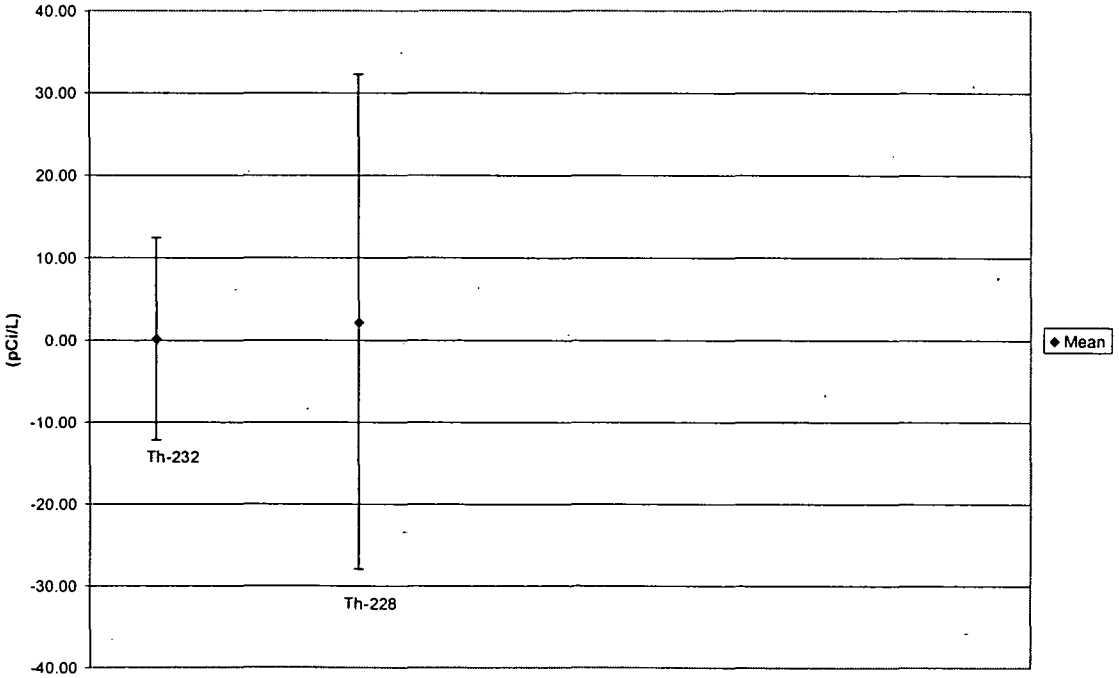


Figure 7: Bedrock Wells U-235 Series

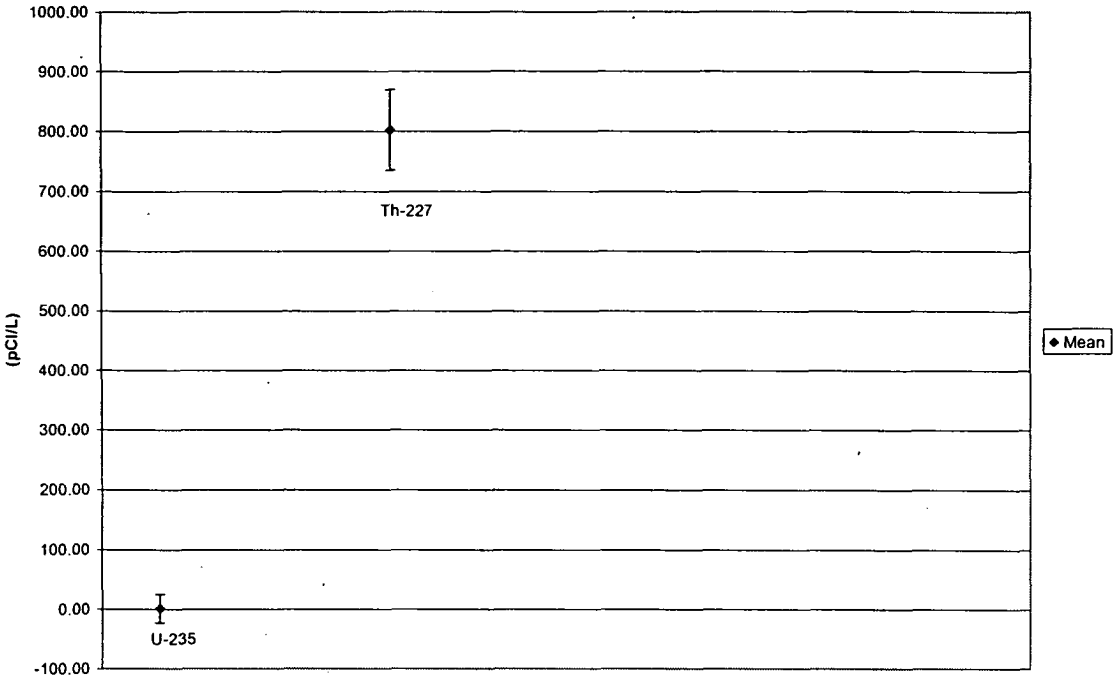


Figure 8: Bedrock Wells U-238 Series

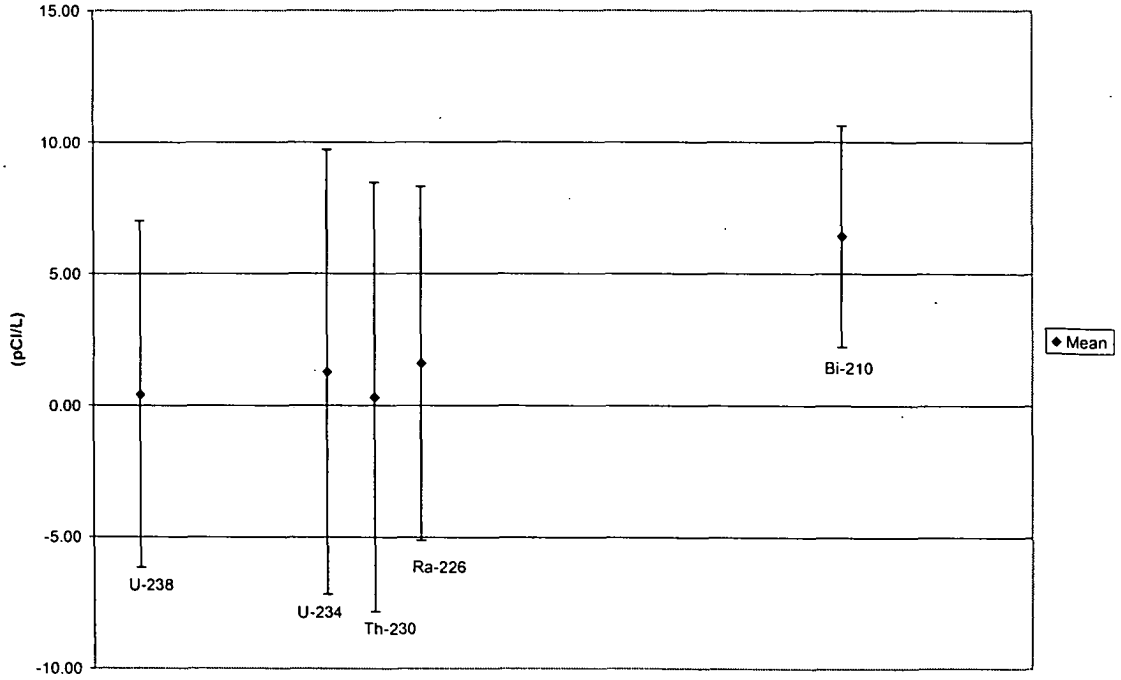


Figure 9: Bedrock Wells Th-232 Series

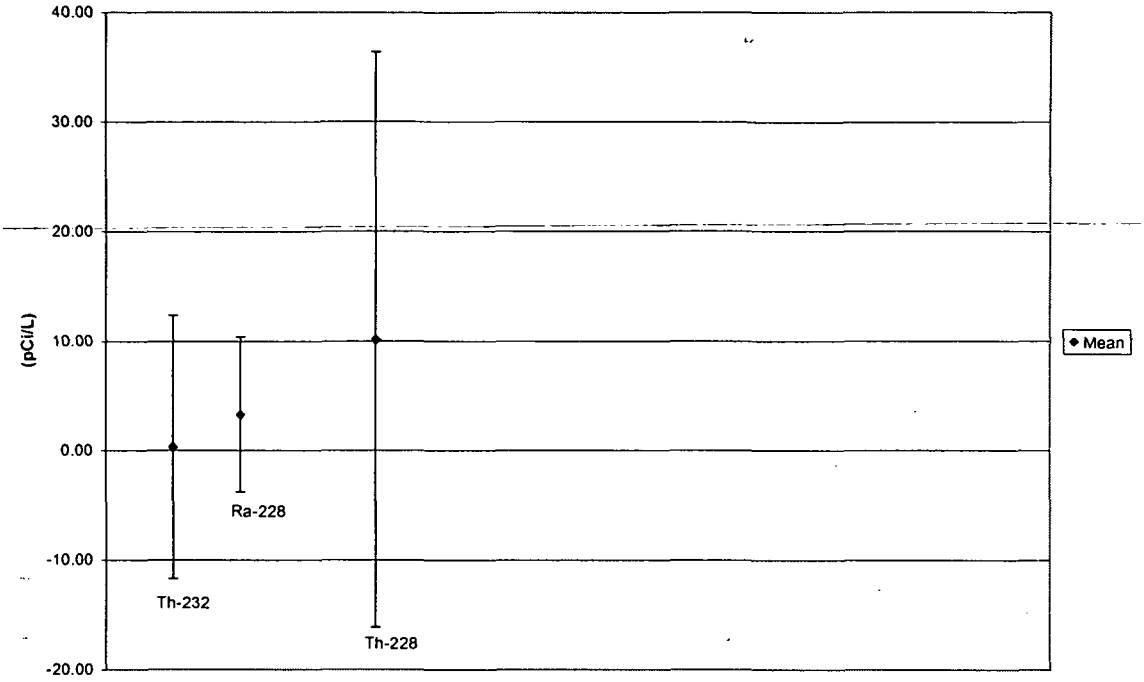


Table: Long Lived Decay Chains

Long Lived Decay Chain	Parent	Terminal Nuclide	$HEAST_1$	$HEAST_2$	$HEAST_3$	$HEAST_4$	$HEAST_5$	Compare to HEAST
Ac-227	Ac-227	Pb-207	Ac-227+D					Same as HEAST Ac-227+D
Cs-137	Cs-137	Ba-137	Cs-137+D					Same as HEAST Cs-137+D
Pb-210	Pb-210	Pb-206	Pb-210+D					Same as HEAST Pb-210+D
Pa-231	Pa-231	Pb-207	Pa-231	Ac-227+D				Differs, HEAST lists no '+D'
Ra-226	Ra-226	Pb-206	Ra226+D	Pb210+D				Differs, HEAST does not include Pb210+D
Ra-228	Ra-228	Pb-208	Ra-228+D	Th-228+D				Differs, HEAST does not include Th-228+D
Th-228	Th-228	Pb-208	Th-228+D					Same as HEAST Th-228+D
Th-229	Th-229	Bi-209	Th-229+D					Same as HEAST Th-229+D
Th-230	Th-230	Pb-208	Th-230	Ra-226+D	Pb-210+D			Differs, no "+D" in HEAST
Th-232	Th-232	Pb-208	Th-232	Ra-228+D	Th-228+D			Differs, No '+D' in HEAST
U-233	U-233	Bi-209	U-233	Th-229+D				Differs, HEAST does not include Th-229+D
U-235	U-235	Pb-207	U-235+D	Pa-231	Ac-227+D			Differs, HEAST does not include Pa-231 and Ac-227+D
U-238	U-238	Pb-206	U-238+D	U-234	Th-230	Ra-226+D	Pb-210+D	Differs, HEAST does not include U-234, Th-230, Ra-226+D and Pb-210+D

Slope factor of Chain 'X+11d' = Sum of slope factors of $HEAST_n$

Table 2: Slope Factors for Long Lived Decay Chains

Chemical	CAS Number	Decay Chain Additions	Oral Soil Ingestion SF (risk/pCi)	Oral Water Ingestion SF (risk/pCi)	Inhalation SF (risk/pCi)	External SF (risk/yr per pCi/g soil)
Actinium-227 + long lived decay	14952-40-0(+D)	Actinium-227+D	1.16E-09	4.86E-10	2.09E-07	1.47E-06
	14952-40-0L	Total	1.16E-09	4.86E-10	2.09E-07	1.47E-06
Cesium-137 + long lived decay	10045-97-3(+D)	Cesium-137+D	4.33E-11	3.04E-11	1.19E-11	2.55E-06
	10045-97-3L	Total	4.33E-11	3.04E-11	1.19E-11	2.55E-06
Lead-210 + long lived decay	14255-04-0(+D)	Pb-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	14255-04-0L	Total	2.66E-09	1.27E-09	1.39E-08	4.21E-09
Protactinium-231 + long lived Decay	14331-85-2	Protactinium-231	3.74E-10	1.73E-10	4.55E-08	1.39E-07
	14952-40-0(+D)	Actinium-227+D	1.16E-09	4.86E-10	2.09E-07	1.47E-06
	14331-85-2L	Total	1.53E-09	6.59E-10	2.55E-07	1.61E-06
Radium-226 + long lived decay	13982-63-3(+D)	Radium-226+D	7.30E-10	3.86E-10	1.16E-08	8.49E-06
	14255-04-0(+D)	Lead-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	13982-63-3L	Total	3.39E-09	1.66E-09	2.55E-08	8.49E-06
Radium-228 + long lived decay	15262-20-1(+D)	Radium-228+D	2.29E-09	1.04E-09	5.23E-09	4.53E-06
	14274-82-9(+D)	Thorium-228+D	8.09E-10	3.00E-10	1.43E-07	7.76E-06
	15262-20-1L	Total	3.10E-09	1.34E-09	1.48E-07	1.23E-05
Thorium-228 +Long lived Decay	14274-82-9(+D)	Thorium-228+D	8.09E-10	3.00E-10	1.43E-07	7.76E-06
	14274-82-9L	Total	8.09E-10	3.00E-10	1.43E-07	7.76E-06
Thorium-229 +Long lived Decay	15594-54-4(+D)	Thorium-229+D	1.29E-09	5.28E-10	2.25E-07	1.17E-06
	15594-54-4L	Total	1.29E-09	5.28E-10	2.25E-07	1.17E-06

Table 2: Slope Factors for Long Lived Decay Chains

Chemical	CAS Number	Decay Chain Additions	Oral Soil Ingestion SF (risk/pCi)	Oral Water Ingestion SF (risk/pCi)	Inhalation SF (risk/pCi)	External SF (risk/yr per pCi/g soil)
Thorium-230 + Long lived Decay	14269-63-7	Thorium-230	2.02E-10	9.10E-11	2.85E-08	8.19E-10
	13982-63-3(+D)	Radium-226+D	7.30E-10	3.86E-10	1.16E-08	8.49E-06
	14255-04-0(+D)	Lead-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	14269-63-7L	Total	3.59E-09	1.75E-09	5.40E-08	8.50E-06
Thorium-232 + long lived decay	7440-29-1	Thorium-232	2.31E-10	1.01E-10	4.33E-08	3.42E-10
	15262-20-1(+D)	Radium-228+D	2.29E-09	1.04E-09	5.23E-09	4.53E-06
	14274-82-9(+D)	Thorium-228+D	8.09E-10	3.00E-10	1.43E-07	7.76E-06
	7440-29-1L	Total	3.33E-09	1.44E-09	1.92E-07	1.23E-05
Uranium-233 + long lived Decay	13968-55-3	Uranium-233	1.60E-10	7.18E-11	1.16E-08	9.82E-10
	15594-54-4(+D)	Thorium-229+D	1.29E-09	5.28E-10	2.25E-07	1.17E-06
	13968-55-3L	Total	1.45E-09	6.00E-10	2.37E-07	1.17E-06
Uranium-235 + long lived Decay	15117-96-1(+D)	Uranium-235+D	1.63E-10	7.18E-11	1.01E-08	5.43E-07
	14331-85-2	Protactinium-231	3.74E-10	1.73E-10	4.55E-08	1.39E-07
	14952-40-0(+D)	Actinium-227+D	1.16E-09	4.86E-10	2.09E-07	1.47E-06
	15117-96-1L	Total	1.70E-09	7.31E-10	2.65E-07	2.15E-06
Uranium-238 + long lived Decay	7440-61-1(+D)	Uranium-238+D	2.10E-10	8.71E-11	9.35E-09	1.14E-07
	13966-29-5	Uranium-234	1.58E-10	7.07E-11	1.14E-08	2.52E-10
	14269-63-7	Thorium-230	2.02E-10	9.10E-11	2.85E-08	8.19E-10
	13982-63-3(+D)	Radium-226+D	7.30E-10	3.86E-10	1.16E-08	8.49E-06
	14255-04-0(+D)	Lead-210+D	2.66E-09	1.27E-09	1.39E-08	4.21E-09
	7440-61-1L	Total	3.96E-09	1.90E-09	7.48E-08	8.61E-06

Source for slope factors: HEAST, April 2002

APPENDIX I

Listing of All Detected Analytes

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
BTEX Compounds										
Benzene (UG/KG)	71-43-2	0			O	0/ 15	0.0			NO
Ethylbenzene (UG/KG)	100-41-4	0			O	0/ 15	0.0			NO
Toluene (UG/KG)	108-88-3	0			O	0/ 15	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	0			O	0/ 15	0.0			NO
Explosives										
1,3,5-Trinitrobenzene (UG/KG)	99-35-4	0			O	0/ 81	0.0			NO
1,3-Dinitrobenzene (UG/KG)	99-65-0	0			O	0/ 81	0.0			NO
2,4,6-Trinitrotoluene (UG/KG)	118-96-7	1	1.1E+02	1.1E+02	D	1/ 91	1.1	6.3E+02	1.1E+02	NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 75	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 32	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/KG)	35572-78-2	0			O	0/ 61	0.0			NO
4-Amino-2,6-Dinitrotoluene (UG/KG)	1946-51-0	0			O	0/ 19	0.0			NO
HMX (UG/KG)	2691-41-0	0			O	0/ 98	0.0			NO
Nitrobenzene (UG/KG)	98-95-3	1	3.8E+02	3.8E+02	D	1/ 32	3.1	4.7E+02	3.8E+02	NO
Nitroglycerin (UG/KG)	55-63-0	0			O	0/ 76	0.0			NO
PETN (UG/KG)	78-11-5	0			O	0/ 99	0.0			NO
RDX (UG/KG)	121-82-4	0			O	0/ 99	0.0			NO
Tetryl (UG/KG)	479-45-8	0			O	0/ 71	0.0			NO
Metals										
Aluminum (UG/KG)	7429-90-5	145	5.9E+05	2.3E+07	N	145/ 146	99.3	1.5E+07	1.5E+07	YES
Antimony (UG/KG)	7440-36-0	64	2.1E+02	4.5E+04	D	64/ 209	30.6	8.5E+03	8.5E+03	YES
Arsenic (UG/KG)	7440-38-2	137	4.9E+02	2.0E+04	X	137/ 143	95.8	8.2E+03	8.2E+03	YES
Barium (UG/KG)	7440-39-3	226	4.4E+03	6.0E+05	X	226/ 227	99.6	1.0E+05	1.0E+05	YES
Beryllium (UG/KG)	7440-41-7	220	5.0E+01	3.6E+03	X	220/ 226	97.3	1.1E+03	1.1E+03	YES
Bismuth (UG/KG)	7440-69-9	33	8.2E+02	7.3E+04	X	33/ 59	55.9	1.3E+05	7.3E+04	YES
Cadmium (UG/KG)	7440-43-9	69	2.5E+02	1.2E+04	D	69/ 227	30.4	1.5E+03	1.5E+03	YES
Calcium (UG/KG)	7440-70-2	145	1.4E+06	3.4E+08	X	145/ 146	99.3	1.5E+08	1.5E+08	YES
Chromium (UG/KG)	7440-47-3	226	1.1E+03	3.7E+04	X	226/ 227	99.6	1.7E+04	1.7E+04	YES
Cobalt (UG/KG)	7440-48-4	145	7.9E+02	2.5E+04	X	145/ 146	99.3	1.3E+04	1.3E+04	YES
Copper (UG/KG)	7440-50-8	143	1.8E+03	1.1E+06	X	143/ 146	97.9	2.2E+04	2.2E+04	YES
Cyanide (UG/KG)	57-12-5	35	1.0E+02	8.9E+03	D	35/ 162	21.6	5.8E+02	5.8E+02	YES
Iron (UG/KG)	7439-89-6	145	2.3E+04	4.3E+07	N	145/ 146	99.3	3.1E+07	3.1E+07	YES
Lead (UG/KG)	7439-92-1	242	1.6E+03	2.2E+05	X	242/ 256	94.5	1.5E+04	1.5E+04	YES
Lithium (UG/KG)	7439-93-2	53	2.3E+03	3.4E+04	N	53/ 55	96.4	1.8E+04	1.8E+04	YES

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Magnesium (UG/KG)	7439-95-4	145	1.2E+04	1.2E+08	X	145/ 146	99.3	2.9E+07	2.9E+07	YES
Manganese (UG/KG)	7439-96-5	137	6.5E+04	8.2E+06	X	137/ 138	99.3	6.8E+05	6.8E+05	YES
Mercury (UG/KG)	7439-97-6	61	3.0E+01	1.4E+03	D	61/ 139	43.9	1.2E+02	1.2E+02	YES
Molybdenum (UG/KG)	7439-98-7	49	2.2E+02	9.7E+03	L	49/ 54	90.7	4.0E+03	4.0E+03	YES
Nickel (UG/KG)	7440-02-0	224	2.3E+03	2.5E+05	X	224/ 227	98.7	2.2E+04	2.2E+04	YES
Potassium (UG/KG)	7440-09-7	142	3.1E+05	3.3E+08	X	142/ 147	96.6	1.9E+06	1.9E+06	YES
Selenium (UG/KG)	7782-49-2	19	4.6E+02	2.3E+03	D	19/ 131	14.5	9.6E+02	9.6E+02	YES
Silver (UG/KG)	7440-22-4	65	1.1E+02	2.1E+04	D	65/ 227	28.6	2.4E+03	2.4E+03	YES
Sodium (UG/KG)	7440-23-5	136	4.2E+04	3.5E+06	X	136/ 146	93.2	1.1E+06	1.1E+06	YES
Thallium (UG/KG)	7440-28-0	29	2.0E+02	3.5E+03	D	29/ 142	20.4	1.1E+03	1.1E+03	YES
Tin (UG/KG)	7440-31-5	22	6.7E+02	3.3E+03	D	22/ 54	40.7	1.2E+04	3.3E+03	YES
Vanadium (UG/KG)	7440-62-2	145	1.7E+03	4.3E+04	X	145/ 146	99.3	2.5E+04	2.5E+04	YES
Zinc (UG/KG)	7440-66-6	145	5.5E+03	4.6E+05	X	145/ 146	99.3	9.3E+04	9.3E+04	YES
Pesticides and/or PCBs										
4,4'-DDD (UG/KG)	72-54-8	0			O	0/ 122	0.0			NO
4,4'-DDE (UG/KG)	72-55-9	7	2.8E-01	1.8E+00	D	7/ 121	5.8	3.3E+00	1.8E+00	YES
4,4'-DDT (UG/KG)	50-29-3	0			O	0/ 122	0.0			NO
Aldrin (UG/KG)	309-00-2	1	5.4E-02	5.4E-02	D	1/ 122	0.8	2.2E+00	5.4E-02	NO
Alpha Chlordane (UG/KG)	5103-71-9	0			O	0/ 99	0.0			NO
Alpha-BHC (UG/KG)	319-84-6	0			O	0/ 122	0.0			NO
Aroclor-1016 (UG/KG)	12674-11-2	0			O	0/ 151	0.0			NO
Aroclor-1221 (UG/KG)	11104-28-2	0			O	0/ 151	0.0			NO
Aroclor-1232 (UG/KG)	11141-16-5	1	1.2E+02	1.2E+02	D	1/ 151	0.7	3.3E+01	3.3E+01	NO
Aroclor-1242 (UG/KG)	53469-21-9	1	1.2E+02	1.2E+02	D	1/ 151	0.7	3.3E+01	3.3E+01	NO
Aroclor-1248 (UG/KG)	12672-29-6	3	7.4E+01	9.1E+02	D	3/ 150	2.0	3.7E+01	3.7E+01	NO
Aroclor-1254 (UG/KG)	11097-69-1	1	2.2E+02	2.2E+02	D	1/ 151	0.7	5.8E+01	5.8E+01	NO
Aroclor-1260 (UG/KG)	11096-82-5	0			O	0/ 150	0.0			NO
Beta-BHC (UG/KG)	319-85-7	3	1.8E-01	1.2E+02	D	3/ 120	2.5	3.1E+00	3.1E+00	NO
Chlordane (UG/KG)	57-74-9	2	1.9E+01	9.8E+01	D	2/ 23	8.7	1.6E+01	1.6E+01	YES
Delta-BHC (UG/KG)	319-86-8	1	1.7E-01	1.7E-01	D	1/ 122	0.8	3.4E+00	1.7E-01	NO
Dieldrin (UG/KG)	60-57-1	3	5.2E-01	4.4E+00	D	3/ 122	2.5	3.1E+00	3.1E+00	NO
Endosulfan I (UG/KG)	959-98-8	0			O	0/ 122	0.0			NO
Endosulfan II (UG/KG)	33213-65-9	0			O	0/ 122	0.0			NO
Endosulfan Sulfate (UG/KG)	1031-07-8	0			O	0/ 122	0.0			NO
Endrin (UG/KG)	72-20-8	2	1.5E-01	2.3E+01	D	2/ 121	1.7	4.6E+00	4.6E+00	NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Endrin Aldehyde (UG/KG)	7421-93-4	0			O	0/ 108	0.0			NO
Endrin Ketone (UG/KG)	53494-70-5	2	5.2E-01	7.6E-01	D	2/ 122	1.6	1.3E+01	7.6E-01	NO
Gamma Chlordane (UG/KG)	5103-74-2	1	5.7E-02	5.7E-02	D	1/ 99	1.0	1.7E+01	5.7E-02	NO
Gamma-BHC (Lindane) (UG/KG)	58-89-9	0			O	0/ 122	0.0			NO
Heptachlor (UG/KG)	76-44-8	2	1.1E-01	1.3E-01	D	2/ 122	1.6	2.0E+00	1.3E-01	NO
Heptachlor Epoxide (UG/KG)	1024-57-3	2	1.1E-01	3.5E-01	D	2/ 122	1.6	1.3E+01	3.5E-01	NO
Methoxychlor (UG/KG)	72-43-5	0			O	0/ 122	0.0			NO
Toxaphene (UG/KG)	8001-35-2	0			O	0/ 122	0.0			NO
Phenols										
Phenolics (UG/KG)	64743-03-9	0			O	0/ 24	0.0			NO
Radiological										
Actinium-227 (PCI/G)	14952-40-0	37	5.0E-02	2.1E+00	D	37/ 282	13.1	3.0E-01	3.0E-01	YES
Actinium-228 (PCI/G)	14331-83-0	7	7.6E-01	1.4E+00	D	7/ 7	100.0	1.2E+00	1.4E+00	YES
Americium-241 (PCI/G)	14596-10-2	12	5.0E-02	3.8E+01	D	12/ 558	2.2	1.1E-01	1.1E-01	NO
Bismuth-207 (PCI/G)	13982-38-2	0			O	0/ 126	0.0			
Bismuth-210 (PCI/G)	14331-79-4	1	6.8E-02	6.8E-02	D	1/ 222	0.5	2.9E-02	2.9E-02	NO
Bismuth-210M (PCI/G)	BI-210M	3	1.4E-01	2.7E-01	D	3/ 84	3.6	5.5E-02	5.5E-02	NO
Bismuth-214 (PCI/G)	14733-03-0	10	7.0E-01	9.3E-01	N	10/ 10	100.0	8.6E-01	9.3E-01	YES
Cesium-137 (PCI/G)	10045-97-3	276	2.1E-02	1.6E+00	D	276/ 564	48.9	1.6E-01	1.6E-01	YES
Cobalt-60 (PCI/G)	10198-40-0	14	2.0E-02	5.0E-01	D	14/ 575	2.4	3.6E-02	3.6E-02	NO
Europium-152 (PCI/G)	14683-23-9	1	8.7E-02	8.7E-02	D	1/ 191	0.5	4.7E-02	4.7E-02	NO
Europium-154 (PCI/G)	15585-10-1	0			O	0/ 180	0.0			NO
Lead-210 (PCI/G)	14255-04-0	180	4.9E-01	3.7E+00	X	180/ 344	52.3	1.2E+00	1.2E+00	YES
Lead-212 (PCI/G)	15092-94-1	10	8.4E-01	1.2E+00	L	10/ 10	100.0	1.1E+00	1.2E+00	YES
Lead-214 (PCI/G)	15067-28-4	20	5.7E-01	1.1E+00	N	20/ 20	100.0	9.2E-01	9.2E-01	YES
Plutonium-238 (PCI/G)	13981-16-3	665	1.2E-02	4.0E+02	D	665/1545	43.0	2.6E+01	2.6E+01	YES
Plutonium-239 (PCI/G)	15117-48-3	83	3.5E-03	1.3E+00	X	83/ 90	92.2	6.9E-02	6.9E-02	YES
Plutonium-239/240 (PCI/G)	PU-239/240	79	3.7E-03	1.0E+00	D	79/ 254	31.1	4.4E-02	4.4E-02	YES
Plutonium-242 (PCI/G)	13982-10-0	0			O	0/ 5	0.0			NO
Potassium-40 (PCI/G)	13966-00-2	122	7.2E+00	3.7E+01	X	122/ 126	96.8	2.1E+01	2.1E+01	YES
Protactinium-231 (PCI/G)	14331-85-2	0			O	0/ 36	0.0			NO
Radium-224 (PCI/G)	13233-32-4	190	7.3E-02	6.3E+00	X	190/ 190	100.0	1.3E+00	1.3E+00	YES
Radium-226 (PCI/G)	13982-63-3	494	1.8E-01	3.7E+00	X	494/ 567	87.1	1.2E+00	1.2E+00	YES
Radium-228 (PCI/G)	15262-20-1	80	3.1E-01	2.0E+00	N	80/ 81	98.8	1.2E+00	1.2E+00	YES
Strontium-90 (PCI/G)	10098-97-2	0			O	0/ 21	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Thallium-208 (PCI/G)	14913-50-9	10	1.6E-01	4.0E-01	N	10/ 10	100.0	3.8E-01	4.0E-01	YES
Thorium-227 (PCI/G)	15623-47-9	17	6.0E-02	4.4E-01	L	17/ 33	51.5	1.4E-01	1.4E-01	YES
Thorium-228 (PCI/G)	14274-82-9	342	3.7E-02	4.5E+00	X	342/ 384	89.1	1.6E+00	1.6E+00	YES
Thorium-229 (PCI/G)	15594-54-4	0			O	0/ 36	0.0			NO
Thorium-230 (PCI/G)	14269-63-7	340	1.0E-01	7.5E+00	X	340/ 595	57.1	2.8E+00	2.8E+00	YES
Thorium-232 (PCI/G)	7440-29-1	789	4.5E-02	8.0E+01	D	789/1805	43.7	8.3E-01	8.3E-01	YES
Tritium (PCI/G)	10028-17-8	1	1.4E+00	1.4E+00	D	1/ 21	4.8	2.0E+00	1.4E+00	NO
Uranium-234 (PCI/G)	13966-29-5	46	3.8E-01	1.6E+00	N	46/ 54	85.2	1.0E+00	1.0E+00	YES
Uranium-235 (PCI/G)	15117-96-1	28	2.7E-02	2.1E-01	D	28/ 77	36.4	1.9E-01	1.9E-01	YES
Uranium-235/236 (PCI/G)	U-235/236	0			O	0/ 2	0.0			NO
Uranium-238 (PCI/G)	7440-61-1	72	4.1E-01	2.0E+00	X	72/ 119	60.5	1.9E+00	1.9E+00	YES
Semi-Volatile Organics										
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 159	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 159	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 159	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 159	0.0			NO
1-chloro-4-phenoxybenzene (UG/KG)	7005-72-3	0			O	0/ 159	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/KG)	108-60-1	0			O	0/ 159	0.0			NO
2,4,5-Trichlorophenol (UG/KG)	95-95-4	0			O	0/ 159	0.0			NO
2,4,6-Trichlorophenol (UG/KG)	88-06-2	0			O	0/ 159	0.0			NO
2,4-Dichlorophenol (UG/KG)	120-83-2	0			O	0/ 159	0.0			NO
2,4-Dimethylphenol (UG/KG)	105-67-9	0			O	0/ 159	0.0			NO
2,4-Dinitrophenol (UG/KG)	51-28-5	0			O	0/ 159	0.0			NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 91	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 134	0.0			NO
2-Benzyl-4-Chlorophenol (UG/KG)	120-32-1	0			O	0/ 30	0.0			NO
2-Chloronaphthalene (UG/KG)	91-58-7	0			O	0/ 174	0.0			NO
2-Chlorophenol (UG/KG)	95-57-8	0			O	0/ 159	0.0			NO
2-Methylnaphthalene (UG/KG)	91-57-6	3	5.4E+01	9.9E+01	D	3/ 174	1.7	2.8E+02	9.9E+01	NO
2-Methylphenol (UG/KG)	95-48-7	0			O	0/ 159	0.0			NO
2-Nitroaniline (UG/KG)	88-74-4	0			O	0/ 159	0.0			NO
2-Nitrophenol (UG/KG)	88-75-5	0			O	0/ 159	0.0			NO
3,3'-Dichlorobenzidine (UG/KG)	91-94-1	0			O	0/ 159	0.0			NO
3-Nitroaniline (UG/KG)	99-09-2	0			O	0/ 157	0.0			NO
4,6-Dinitro-o-Cresol (UG/KG)	534-52-1	0			O	0/ 159	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
4-Bromophenyl-phenyl Ether (UG/KG)	101-55-3	0			O	0/ 159	0.0			NO
4-Chloro-3-methylphenol (UG/KG)	59-50-7	0			O	0/ 159	0.0			NO
4-Chloroaniline (UG/KG)	106-47-8	0			O	0/ 159	0.0			NO
4-Methylphenol (UG/KG)	106-44-5	1	4.1E+02	4.1E+02	D	1/ 159	0.6	2.8E+02	2.8E+02	NO
4-Nitroaniline (UG/KG)	100-01-6	0			O	0/ 159	0.0			NO
4-Nitrophenol (UG/KG)	100-02-7	1	1.8E+02	1.8E+02	D	1/ 159	0.6	1.2E+03	1.8E+02	NO
Acenaphthene (UG/KG)	83-32-9	6	2.7E+01	4.3E+02	D	6/ 174	3.4	2.9E+02	2.9E+02	NO
Acenaphthylene (UG/KG)	208-96-8	0			O	0/ 174	0.0			NO
Anthracene (UG/KG)	120-12-7	13	2.2E+01	2.8E+03	D	13/ 174	7.5	3.1E+02	3.1E+02	YES
Benzidine (UG/KG)	92-87-5	0			O	0/ 21	0.0			NO
Benzo(a)anthracene (UG/KG)	56-55-3	31	2.3E+01	4.2E+03	D	31/ 174	17.8	3.2E+02	3.2E+02	YES
Benzo(a)pyrene (UG/KG)	50-32-8	29	2.3E+01	3.6E+03	D	29/ 174	16.7	3.2E+02	3.2E+02	YES
Benzo(b)fluoranthene (UG/KG)	205-99-2	35	2.5E+01	2.8E+03	D	35/ 174	20.1	3.2E+02	3.2E+02	YES
Benzo(g,h,i)perylene (UG/KG)	191-24-2	16	2.7E+01	2.1E+03	D	16/ 174	9.2	3.0E+02	3.0E+02	YES
Benzo(k)fluoranthene (UG/KG)	207-08-9	27	2.1E+01	3.4E+03	D	27/ 174	15.5	3.2E+02	3.2E+02	YES
Benzoic Acid (UG/KG)	65-85-0	5	7.8E+01	9.5E+01	D	5/ 139	3.6	1.5E+03	9.5E+01	NO
Benzyl Alcohol (UG/KG)	100-51-6	0			O	0/ 139	0.0			NO
Bis(2-chloroethoxy)methane (UG/KG)	111-91-1	0			O	0/ 159	0.0			NO
Bis(2-chloroethyl)ether (UG/KG)	111-44-4	0			O	0/ 159	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/KG)	117-81-7	59	1.9E+01	6.5E+03	D	59/ 159	37.1	3.3E+02	3.3E+02	YES
Butyl Benzyl Phthalate (UG/KG)	85-68-7	3	4.8E+01	6.4E+01	D	3/ 159	1.9	2.8E+02	6.4E+01	NO
Carbazole (UG/KG)	86-74-8	2	1.5E+02	1.7E+02	D	2/ 89	2.2	2.0E+02	1.7E+02	NO
Chrysene (UG/KG)	218-01-9	30	2.0E+01	1.7E+03	D	30/ 159	18.9	3.0E+02	3.0E+02	YES
Di-n-butyl Phthalate (UG/KG)	84-74-2	61	2.1E+01	2.0E+03	D	61/ 240	25.4	3.1E+02	3.1E+02	YES
Di-n-octyl Phthalate (UG/KG)	117-84-0	1	4.0E+02	4.0E+02	D	1/ 159	0.6	2.8E+02	2.8E+02	NO
Dibenz(a,h)anthracene (UG/KG)	53-70-3	6	7.1E+01	8.0E+02	D	6/ 174	3.4	2.8E+02	2.8E+02	NO
Dibenzofuran (UG/KG)	132-64-9	6	3.2E+01	5.8E+02	D	6/ 159	3.8	2.7E+02	2.7E+02	NO
Diethyl Phthalate (UG/KG)	84-66-2	6	3.9E+01	1.1E+02	D	6/ 159	3.8	2.8E+02	1.1E+02	NO
Dimethyl Phthalate (UG/KG)	131-11-3	0			O	0/ 159	0.0			NO
Diphenylamine (UG/KG)	122-39-4	0			O	0/ 81	0.0			NO
Fluoranthene (UG/KG)	206-44-0	48	2.3E+01	1.1E+04	D	48/ 174	27.6	3.7E+02	3.7E+02	YES
Fluorene (UG/KG)	86-73-7	7	3.8E+01	1.1E+03	D	7/ 174	4.0	2.9E+02	2.9E+02	NO
Hexachlorobenzene (UG/KG)	118-74-1	0			O	0/ 159	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 159	0.0			NO
Hexachlorocyclopentadiene (UG/KG)	77-47-4	0			O	0/ 159	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

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Hexachloroethane (UG/KG)	67-72-1	0			O	0/ 159	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/KG)	193-39-5	18	2.5E+01	1.9E+03	D	18/ 174	10.3	3.0E+02	3.0E+02	YES
Isophorone (UG/KG)	78-59-1	0			O	0/ 159	0.0			NO
N-Nitroso-di-n-propylamine (UG/KG)	621-64-7	0			O	0/ 159	0.0			NO
N-Nitrosodiphenylamine (UG/KG)	86-30-6	8	5.7E+01	2.1E+02	D	8/ 159	5.0	2.7E+02	2.1E+02	YES
Naphthalene (UG/KG)	91-20-3	5	2.6E+01	4.1E+02	D	5/ 171	2.9	2.9E+02	2.9E+02	NO
Nitrobenzene (UG/KG)	98-95-3	0			O	0/ 134	0.0			NO
Pentachlorophenol (UG/KG)	87-86-5	0			O	0/ 159	0.0			NO
Phenanthrene (UG/KG)	85-01-8	32	2.7E+01	1.1E+04	D	32/ 174	18.4	3.5E+02	3.5E+02	YES
Phenol (UG/KG)	108-95-2	2	8.5E+01	3.2E+02	D	2/ 159	1.3	2.8E+02	2.8E+02	NO
Pyrene (UG/KG)	129-00-0	45	2.6E+01	9.7E+03	D	45/ 174	25.9	3.6E+02	3.6E+02	YES
Volatile Organics										
1,1,1,2-Tetrachloroethane (UG/KG)	630-20-6	0			O	0/ 23	0.0			NO
1,1,1-Trichloroethane (UG/KG)	71-55-6	4	1.0E+00	8.0E+00	D	4/ 200	2.0	3.4E+00	3.4E+00	NO
1,1,2,2-Tetrachloroethane (UG/KG)	79-34-5	0			O	0/ 200	0.0			NO
1,1,2-Trichloroethane (UG/KG)	79-00-5	0			O	0/ 200	0.0			NO
1,1-Dichloroethane (UG/KG)	75-34-3	1	3.0E+00	3.0E+00	D	1/ 200	0.5	3.4E+00	3.0E+00	NO
1,1-Dichloroethene (UG/KG)	75-35-4	0			O	0/ 200	0.0			NO
1,1-Dichloropropene (UG/KG)	563-58-6	0			O	0/ 23	0.0			NO
1,2,3-Trichlorobenzene (UG/KG)	87-61-6	0			O	0/ 23	0.0			NO
1,2,3-Trichloropropane (UG/KG)	96-18-4	0			O	0/ 23	0.0			NO
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 3	0.0			NO
1,2,4-Trimethylbenzene (UG/KG)	95-63-6	0			O	0/ 23	0.0			NO
1,2-Dibromo-3-Chloropropane (UG/KG)	96-12-8	0			O	0/ 23	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 3	0.0			NO
1,2-Dichloroethane (UG/KG)	107-06-2	0			O	0/ 200	0.0			NO
1,2-Dichloroethene (UG/KG)	540-59-0	5	2.0E+00	2.1E+02	D	5/ 177	2.8	4.1E+00	4.1E+00	NO
1,2-Dichloropropane (UG/KG)	78-87-5	0			O	0/ 200	0.0			NO
1,2-Diethylbenzene (UG/KG)	135-01-3	0			O	0/ 31	0.0			NO
1,2-cis-Dichloroethene (UG/KG)	156-59-2	0			O	0/ 34	0.0			NO
1,2-trans-Dichloroethene (UG/KG)	156-60-5	0			O	0/ 34	0.0			NO
1,3,5-Trimethylbenzene (UG/KG)	108-67-8	0			O	0/ 23	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 3	0.0			NO
1,3-Dichloropropane (UG/KG)	142-28-9	0			O	0/ 23	0.0			NO
1,3-cis-Dichloropropene (UG/KG)	10061-01-5	0			O	0/ 200	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
1,3-trans-Dichloropropene (UG/KG)	10061-02-6	0			O	0/ 200	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 3	0.0			NO
2,2-Dichloropropane (UG/KG)	594-20-7	0			O	0/ 23	0.0			NO
2-Butanone (UG/KG)	78-93-3	18	1.0E+00	3.1E+01	D	18/ 177	10.2	6.8E+00	6.8E+00	YES
2-Chlorotoluene (UG/KG)	95-49-8	0			O	0/ 23	0.0			NO
2-Hexanone (UG/KG)	591-78-6	0			O	0/ 177	0.0			NO
4-Chlorotoluene (UG/KG)	106-43-4	0			O	0/ 23	0.0			NO
4-Methyl-2-pentanone (UG/KG)	108-10-1	9	1.0E+00	7.0E+00	D	9/ 177	5.1	6.0E+00	6.0E+00	YES
Acetone (UG/KG)	67-64-1	48	4.0E+00	1.7E+02	D	48/ 177	27.1	1.4E+01	1.4E+01	YES
Acetonitrile (UG/KG)	75-05-8	0			O	0/ 31	0.0			NO
Acrylonitrile (UG/KG)	107-13-1	0			O	0/ 31	0.0			NO
Benzene (UG/KG)	71-43-2	2	2.0E+00	5.0E+00	D	2/ 200	1.0	3.4E+00	3.4E+00	NO
Bromochloromethane (UG/KG)	74-97-5	0			O	0/ 23	0.0			NO
Bromodichloromethane (UG/KG)	75-27-4	1	5.0E+00	5.0E+00	D	1/ 200	0.5	3.4E+00	3.4E+00	NO
Bromoform (UG/KG)	75-25-2	0			O	0/ 200	0.0			NO
Bromomethane (UG/KG)	74-83-9	0			O	0/ 200	0.0			NO
Carbon Disulfide (UG/KG)	75-15-0	4	1.0E+00	3.0E+00	D	4/ 177	2.3	3.4E+00	3.0E+00	NO
Carbon Tetrachloride (UG/KG)	56-23-5	0			O	0/ 200	0.0			NO
Chlorobenzene (UG/KG)	108-90-7	0			O	0/ 200	0.0			NO
Chloroethane (UG/KG)	75-00-3	0			O	0/ 200	0.0			NO
Chloroform (Trichloromethane) (UG/KG	67-66-3	1	2.4E+01	2.4E+01	D	1/ 200	0.5	3.4E+00	3.4E+00	NO
Chloromethane (UG/KG)	74-87-3	2	1.0E+00	4.0E+00	D	2/ 200	1.0	5.7E+00	4.0E+00	NO
Dibromochloromethane (UG/KG)	124-48-1	1	1.0E+00	1.0E+00	D	1/ 200	0.5	3.4E+00	1.0E+00	NO
Dibromomethane (UG/KG)	74-95-3	0			O	0/ 23	0.0			NO
Dichlorodifluoromethane (UG/KG)	75-71-8	0			O	0/ 23	0.0			NO
Dichloromethane (Methylene Chloride) (UG/KG)	75-09-2	96	3.0E+00	6.8E+01	D	96/ 200	48.0	1.0E+01	1.0E+01	YES
Ethylbenzene (UG/KG)	100-41-4	9	1.0E+00	1.1E+01	D	9/ 200	4.5	3.4E+00	3.4E+00	NO
Ethylene Dibromide (1,2-Dibromoethane) (UG/KG	106-93-4	0			O	0/ 23	0.0			NO
FREON-113 (UG/KG)	76-13-1	0			O	0/ 39	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 3	0.0			NO
Hexane (UG/KG)	110-54-3	0			O	0/ 39	0.0			NO
Iodomethane (UG/KG)	74-88-4	0			O	0/ 31	0.0			NO
Isopropyl Benzene (UG/KG)	98-82-8	0			O	0/ 23	0.0			NO

Analytes Detected in Surface and Subsurface Soil for the Construction Worker Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Distribution	Results Greater than Detection Limit	% Results Greater than Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Monobromobenzene (Phenyl bromide) (UG/KG)	108-86-1	0			O	0/ 23	0.0			NO
Naphthalene (UG/KG)	91-20-3	3	1.0E+00	6.0E+00	D	3/ 6	50.0	1.0E+01	6.0E+00	YES
Styrene (UG/KG)	100-42-5	0			O	0/ 200	0.0			NO
Tetrachloroethene (UG/KG)	127-18-4	13	2.0E+00	4.1E+01	D	13/ 200	6.5	3.9E+00	3.9E+00	YES
Toluene (UG/KG)	108-88-3	35	1.0E+00	5.1E+01	D	35/ 200	17.5	3.8E+00	3.8E+00	YES
Trichloroethylene (TCE) (UG/KG)	79-01-6	7	3.0E+00	7.4E+01	D	7/ 200	3.5	3.8E+00	3.8E+00	NO
Trichlorofluoromethane (UG/KG)	75-69-4	0			O	0/ 23	0.0			NO
Vinyl Acetate (UG/KG)	108-05-4	0			O	0/ 149	0.0			NO
Vinyl Chloride (UG/KG)	75-01-4	0			O	0/ 200	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	16	1.0E+00	3.9E+01	D	16/ 177	9.0	3.7E+00	3.7E+00	YES
m-Xylene (UG/KG)	108-38-3	0			O	0/ 11	0.0			NO
mp-Xylene (UG/KG)	mp-Xylene	23	5.0E+00	6.0E+00	X	23/ 23	100.0	6.0E+00	6.0E+00	YES
n-Butylbenzene (UG/KG)	104-51-8	0			O	0/ 23	0.0			NO
n-propylbenzene (UG/KG)	103-65-1	0			O	0/ 23	0.0			NO
o-Xylene (UG/KG)	95-47-6	0			O	0/ 34	0.0			NO
p-Isopropyltoluene (UG/KG)	99-87-6	0			O	0/ 23	0.0			NO
sec-Butylbenzene (UG/KG)	135-98-8	0			O	0/ 23	0.0			NO
tert-Butylbenzene (UG/KG)	98-06-6	0			O	0/ 23	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
BTEX Compounds										
Benzene (UG/KG)	71-43-2	0			O	0/ 15	0.0			NO
Ethylbenzene (UG/KG)	100-41-4	0			O	0/ 15	0.0			NO
Toluene (UG/KG)	108-88-3	0			O	0/ 15	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	0			O	0/ 15	0.0			NO
Explosives										
1,3,5-Trinitrobenzene (UG/KG)	99-35-4	0			O	0/ 53	0.0			NO
1,3-Dinitrobenzene (UG/KG)	99-65-0	0			O	0/ 53	0.0			NO
2,4,6-Trinitrotoluene (UG/KG)	118-96-7	1	1.1E+02	1.1E+02	D	1/ 59	1.7	7.4E+02	1.1E+02	NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 50	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 12	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/KG)	35572-78-2	0			O	0/ 52	0.0			NO
4-Amino-2,6-Dinitrotoluene (UG/KG)	1946-51-0	0			O	0/ 1	0.0			NO
HMX (UG/KG)	2691-41-0	0			O	0/ 66	0.0			NO
Nitrobenzene (UG/KG)	98-95-3	1	3.8E+02	3.8E+02	D	1/ 12	8.3	1.3E+03	3.8E+02	YES
Nitroglycerin (UG/KG)	55-63-0	0			O	0/ 50	0.0			NO
PETN (UG/KG)	78-11-5	0			O	0/ 53	0.0			NO
RDX (UG/KG)	121-82-4	0			O	0/ 67	0.0			NO
Tetryl (UG/KG)	479-45-8	0			O	0/ 46	0.0			NO
Metals										
Aluminum (UG/KG)	7429-90-5	105	5.9E+05	2.3E+07	N	105/ 105	100.0	1.2E+07	1.2E+07	YES
Antimony (UG/KG)	7440-36-0	42	2.1E+02	4.5E+04	D	42/ 146	28.8	1.3E+04	1.3E+04	YES
Arsenic (UG/KG)	7440-38-2	104	4.9E+02	2.0E+04	X	104/ 105	99.0	8.9E+03	8.9E+03	YES
Barium (UG/KG)	7440-39-3	158	4.4E+03	4.5E+05	X	158/ 158	100.0	1.0E+05	1.0E+05	YES
Beryllium (UG/KG)	7440-41-7	155	1.2E+02	3.6E+03	X	155/ 158	98.1	1.2E+03	1.2E+03	YES
Bismuth (UG/KG)	7440-69-9	26	1.3E+04	7.3E+04	X	26/ 36	72.2	1.0E+05	7.3E+04	YES
Cadmium (UG/KG)	7440-43-9	43	2.5E+02	1.2E+04	D	43/ 158	27.2	1.2E+03	1.2E+03	YES
Calcium (UG/KG)	7440-70-2	105	1.4E+06	3.1E+08	X	105/ 105	100.0	1.3E+08	1.3E+08	YES
Chromium (UG/KG)	7440-47-3	158	1.1E+03	3.7E+04	X	158/ 158	100.0	1.8E+04	1.8E+04	YES
Cobalt (UG/KG)	7440-48-4	105	7.9E+02	2.5E+04	X	105/ 105	100.0	1.3E+04	1.3E+04	YES
Copper (UG/KG)	7440-50-8	103	2.6E+03	1.1E+06	X	103/ 105	98.1	2.3E+04	2.3E+04	YES
Cyanide (UG/KG)	57-12-5	31	1.0E+02	8.9E+03	D	31/ 126	24.6	6.7E+02	6.7E+02	YES
Iron (UG/KG)	7439-89-6	105	2.3E+04	4.3E+07	N	105/ 105	100.0	2.8E+07	2.8E+07	YES
Lead (UG/KG)	7439-92-1	179	1.6E+03	2.2E+05	X	179/ 186	96.2	1.7E+04	1.7E+04	YES
Lithium (UG/KG)	7439-93-2	31	2.3E+03	2.7E+04	N	31/ 31	100.0	1.7E+04	1.7E+04	YES
Magnesium (UG/KG)	7439-95-4	105	1.2E+04	1.2E+08	X	105/ 105	100.0	3.3E+07	3.3E+07	YES
Manganese (UG/KG)	7439-96-5	104	6.5E+04	1.3E+06	X	104/ 104	100.0	5.7E+05	5.7E+05	YES

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Mercury (UG/KG)	7439-97-6	43	3.0E+01	6.5E+02	D	43/ 97	44.3	1.0E+02	1.0E+02	YES
Molybdenum (UG/KG)	7439-98-7	29	4.7E+02	9.7E+03	L	29/ 31	93.5	5.9E+03	5.9E+03	YES
Nickel (UG/KG)	7440-02-0	157	2.3E+03	2.5E+05	X	157/ 158	99.4	2.3E+04	2.3E+04	YES
Potassium (UG/KG)	7440-09-7	103	3.1E+05	5.2E+06	X	103/ 105	98.1	1.7E+06	1.7E+06	YES
Selenium (UG/KG)	7782-49-2	18	4.9E+02	2.3E+03	D	18/ 96	18.8	1.1E+03	1.1E+03	YES
Silver (UG/KG)	7440-22-4	47	1.1E+02	2.1E+04	D	47/ 158	29.7	2.7E+03	2.7E+03	YES
Sodium (UG/KG)	7440-23-5	100	4.2E+04	3.5E+06	X	100/ 105	95.2	1.3E+06	1.3E+06	YES
Thallium (UG/KG)	7440-28-0	27	2.2E+02	3.5E+03	D	27/ 100	27.0	1.8E+03	1.8E+03	YES
Tin (UG/KG)	7440-31-5	7	1.1E+03	2.2E+03	D	7/ 31	22.6	2.2E+04	2.2E+03	YES
Vanadium (UG/KG)	7440-62-2	105	1.7E+03	4.0E+04	X	105/ 105	100.0	2.6E+04	2.6E+04	YES
Zinc (UG/KG)	7440-66-6	105	5.5E+03	4.6E+05	X	105/ 105	100.0	8.4E+04	8.4E+04	YES
Pesticides and/or PCBs										
4,4'-DDD (UG/KG)	72-54-8	0			O	0/ 86	0.0			NO
4,4'-DDE (UG/KG)	72-55-9	7	2.8E-01	1.8E+00	D	7/ 85	8.2	3.1E+00	1.8E+00	YES
4,4'-DDT (UG/KG)	50-29-3	0			O	0/ 86	0.0			NO
Aldrin (UG/KG)	309-00-2	1	5.4E-02	5.4E-02	D	1/ 86	1.2	2.3E+00	5.4E-02	NO
Alpha Chlordane (UG/KG)	5103-71-9	0			O	0/ 63	0.0			NO
Alpha-BHC (UG/KG)	319-84-6	0			O	0/ 86	0.0			NO
Aroclor-1016 (UG/KG)	12674-11-2	0			O	0/ 115	0.0			NO
Aroclor-1221 (UG/KG)	11104-28-2	0			O	0/ 115	0.0			NO
Aroclor-1232 (UG/KG)	11141-16-5	1	1.2E+02	1.2E+02	D	1/ 115	0.9	3.4E+01	3.4E+01	NO
Aroclor-1242 (UG/KG)	53469-21-9	1	1.2E+02	1.2E+02	D	1/ 115	0.9	3.4E+01	3.4E+01	NO
Aroclor-1248 (UG/KG)	12672-29-6	3	7.4E+01	9.1E+02	D	3/ 114	2.6	3.8E+01	3.8E+01	NO
Aroclor-1254 (UG/KG)	11097-69-1	1	2.2E+02	2.2E+02	D	1/ 115	0.9	5.9E+01	5.9E+01	NO
Aroclor-1260 (UG/KG)	11096-82-5	0			O	0/ 114	0.0			NO
Beta-BHC (UG/KG)	319-85-7	3	1.8E-01	1.2E+02	D	3/ 86	3.5	3.9E+00	3.9E+00	NO
Chlordane (UG/KG)	57-74-9	2	1.9E+01	9.8E+01	D	2/ 23	8.7	1.6E+01	1.6E+01	YES
Delta-BHC (UG/KG)	319-86-8	1	1.7E-01	1.7E-01	D	1/ 86	1.2	4.0E+00	1.7E-01	NO
Dieldrin (UG/KG)	60-57-1	3	5.2E-01	4.4E+00	D	3/ 86	3.5	2.8E+00	2.8E+00	NO
Endosulfan I (UG/KG)	959-98-8	0			O	0/ 86	0.0			NO
Endosulfan II (UG/KG)	33213-65-9	0			O	0/ 86	0.0			NO
Endosulfan Sulfate (UG/KG)	1031-07-8	0			O	0/ 86	0.0			NO
Endrin (UG/KG)	72-20-8	2	1.5E-01	2.3E+01	D	2/ 85	2.4	5.2E+00	5.2E+00	NO
Endrin Aldehyde (UG/KG)	7421-93-4	0			O	0/ 79	0.0			NO
Endrin Ketone (UG/KG)	53494-70-5	2	5.2E-01	7.6E-01	D	2/ 86	2.3	1.9E+01	7.6E-01	NO
Gamma Chlordane (UG/KG)	5103-74-2	1	5.7E-02	5.7E-02	D	1/ 63	1.6	2.0E+01	5.7E-02	NO
Gamma-BHC (Lindane) (UG/KG)	58-89-9	0			O	0/ 86	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Heptachlor (UG/KG)	76-44-8	2	1.1E-01	1.3E-01	D	2/ 86	2.3	2.0E+00	1.3E-01	NO
Heptachlor Epoxide (UG/KG)	1024-57-3	2	1.1E-01	3.5E-01	D	2/ 86	2.3	2.6E+01	3.5E-01	NO
Methoxychlor (UG/KG)	72-43-5	0			O	0/ 86	0.0			NO
Toxaphene (UG/KG)	8001-35-2	0			O	0/ 86	0.0			NO
Phenols										
Phenolics (UG/KG)	64743-03-9	0			O	0/ 24	0.0			NO
Radiological										
Actinium-227 (PCI/G)	14952-40-0	36	5.0E-02	2.1E+00	D	36/ 219	16.4	3.5E-01	3.5E-01	YES
Actinium-228 (PCI/G)	14331-83-0	7	7.6E-01	1.4E+00	D	7/ 7	100.0	1.2E+00	1.4E+00	YES
Americium-241 (PCI/G)	14596-10-2	11	5.0E-02	3.8E+01	D	11/ 458	2.4	1.1E-01	1.1E-01	NO
Bismuth-207 (PCI/G)	13982-38-2	0			O	0/ 96	0.0			NO
Bismuth-210 (PCI/G)	14331-79-4	1	6.8E-02	6.8E-02	D	1/ 194	0.5	2.3E-02	2.3E-02	NO
Bismuth-210M (PCI/G)	BI-210M	3	1.4E-01	2.7E-01	D	3/ 78	3.8	5.7E-02	5.7E-02	NO
Bismuth-214 (PCI/G)	14733-03-0	10	7.0E-01	9.3E-01	N	10/ 10	100.0	8.6E-01	9.3E-01	YES
Cesium-137 (PCI/G)	10045-97-3	258	2.1E-02	1.6E+00	X	258/ 461	56.0	1.8E-01	1.8E-01	YES
Cobalt-60 (PCI/G)	10198-40-0	11	2.0E-02	5.0E-01	D	11/ 461	2.4	3.4E-02	3.4E-02	NO
Europium-152 (PCI/G)	14683-23-9	1	8.7E-02	8.7E-02	D	1/ 176	0.6	4.3E-02	4.3E-02	NO
Europium-154 (PCI/G)	15585-10-1	0			O	0/ 176	0.0			NO
Lead-210 (PCI/G)	14255-04-0	146	6.3E-01	3.7E+00	X	146/ 262	55.7	1.3E+00	1.3E+00	YES
Lead-212 (PCI/G)	15092-94-1	10	8.4E-01	1.2E+00	L	10/ 10	100.0	1.1E+00	1.2E+00	YES
Lead-214 (PCI/G)	15067-28-4	10	8.3E-01	1.1E+00	N	10/ 10	100.0	1.0E+00	1.1E+00	YES
Plutonium-238 (PCI/G)	13981-16-3	592	1.2E-02	4.0E+02	D	592/1308	45.3	2.5E+01	2.5E+01	YES
Plutonium-239 (PCI/G)	15117-48-3	83	3.5E-03	1.3E+00	X	83/ 90	92.2	6.9E-02	6.9E-02	YES
Plutonium-239/240 (PCI/G)	PU-239/240	64	3.9E-03	1.0E+00	D	64/ 230	27.8	4.4E-02	4.4E-02	YES
Plutonium-242 (PCI/G)	13982-10-0	0			O	0/ 5	0.0			NO
Potassium-40 (PCI/G)	13966-00-2	96	7.5E+00	3.6E+01	X	96/ 96	100.0	1.9E+01	1.9E+01	YES
Protactinium-231 (PCI/G)	14331-85-2	0			O	0/ 36	0.0			NO
Radium-224 (PCI/G)	13233-32-4	186	7.3E-02	6.3E+00	X	186/ 186	100.0	1.3E+00	1.3E+00	YES
Radium-226 (PCI/G)	13982-63-3	411	1.8E-01	3.7E+00	X	411/ 466	88.2	1.3E+00	1.3E+00	YES
Radium-228 (PCI/G)	15262-20-1	74	5.5E-01	2.0E+00	N	74/ 75	98.7	1.3E+00	1.3E+00	YES
Strontium-90 (PCI/G)	10098-97-2	0			O	0/ 16	0.0			NO
Thallium-208 (PCI/G)	14913-50-9	10	1.6E-01	4.0E-01	N	10/ 10	100.0	3.8E-01	4.0E-01	YES
Thorium-227 (PCI/G)	15623-47-9	17	6.0E-02	4.4E-01	L	17/ 33	51.5	1.4E-01	1.4E-01	YES
Thorium-228 (PCI/G)	14274-82-9	319	3.7E-02	4.5E+00	X	319/ 356	89.6	1.7E+00	1.7E+00	YES
Thorium-229 (PCI/G)	15594-54-4	0			O	0/ 36	0.0			NO
Thorium-230 (PCI/G)	14269-63-7	317	1.0E-01	7.5E+00	X	317/ 499	63.5	2.7E+00	2.7E+00	YES
Thorium-232 (PCI/G)	7440-29-1	675	4.5E-02	8.0E+01	D	675/1518	44.5	8.7E-01	8.7E-01	YES

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Tritium (PCI/G)	10028-17-8	1	1.4E+00	1.4E+00	D	1/ 16	6.3	2.2E+00	1.4E+00	YES
Uranium-234 (PCI/G)	13966-29-5	25	3.9E-01	1.6E+00	N	25/ 29	86.2	9.8E-01	9.8E-01	YES
Uranium-235 (PCI/G)	15117-96-1	13	3.3E-02	2.1E-01	D	13/ 55	23.6	2.5E-01	2.1E-01	YES
Uranium-238 (PCI/G)	7440-61-1	50	4.8E-01	2.0E+00	X	50/ 91	54.9	2.0E+00	2.0E+00	YES
Semi-Volatile Organics										
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 119	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 119	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 119	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 119	0.0			NO
1-chloro-4-phenoxybenzene (UG/KG)	7005-72-3	0			O	0/ 119	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/KG)	108-60-1	0			O	0/ 119	0.0			NO
2,4,5-Trichlorophenol (UG/KG)	95-95-4	0			O	0/ 119	0.0			NO
2,4,6-Trichlorophenol (UG/KG)	88-06-2	0			O	0/ 119	0.0			NO
2,4-Dichlorophenol (UG/KG)	120-83-2	0			O	0/ 119	0.0			NO
2,4-Dimethylphenol (UG/KG)	105-67-9	0			O	0/ 119	0.0			NO
2,4-Dinitrophenol (UG/KG)	51-28-5	0			O	0/ 119	0.0			NO
2,4-Dinitrotoluene (UG/KG)	121-14-2	0			O	0/ 75	0.0			NO
2,6-Dinitrotoluene (UG/KG)	606-20-2	0			O	0/ 113	0.0			NO
2-Benzyl-4-Chlorophenol (UG/KG)	120-32-1	0			O	0/ 27	0.0			NO
2-Chloronaphthalene (UG/KG)	91-58-7	0			O	0/ 134	0.0			NO
2-Chlorophenol (UG/KG)	95-57-8	0			O	0/ 119	0.0			NO
2-Methylnaphthalene (UG/KG)	91-57-6	3	5.4E+01	9.9E+01	D	3/ 134	2.2	3.0E+02	9.9E+01	NO
2-Methylphenol (UG/KG)	95-48-7	0			O	0/ 119	0.0			NO
2-Nitroaniline (UG/KG)	88-74-4	0			O	0/ 119	0.0			NO
2-Nitrophenol (UG/KG)	88-75-5	0			O	0/ 119	0.0			NO
3,3'-Dichlorobenzidine (UG/KG)	91-94-1	0			O	0/ 119	0.0			NO
3-Nitroaniline (UG/KG)	99-09-2	0			O	0/ 117	0.0			NO
4,6-Dinitro-o-Cresol (UG/KG)	534-52-1	0			O	0/ 119	0.0			NO
4-Bromophenyl-phenyl Ether (UG/KG)	101-55-3	0			O	0/ 119	0.0			NO
4-Chloro-3-methylphenol (UG/KG)	59-50-7	0			O	0/ 119	0.0			NO
4-Chloroaniline (UG/KG)	106-47-8	0			O	0/ 119	0.0			NO
4-Methylphenol (UG/KG)	106-44-5	1	4.1E+02	4.1E+02	D	1/ 119	0.8	2.9E+02	2.9E+02	NO
4-Nitroaniline (UG/KG)	100-01-6	0			O	0/ 119	0.0			NO
4-Nitrophenol (UG/KG)	100-02-7	1	1.8E+02	1.8E+02	D	1/ 119	0.8	1.3E+03	1.8E+02	NO
Acenaphthene (UG/KG)	83-32-9	5	6.5E+01	4.3E+02	D	5/ 134	3.7	3.0E+02	3.0E+02	NO
Acenaphthylene (UG/KG)	208-96-8	0			O	0/ 134	0.0			NO
Anthracene (UG/KG)	120-12-7	11	2.2E+01	2.8E+03	D	11/ 134	8.2	3.4E+02	3.4E+02	YES

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Benzidine (UG/KG)	92-87-5	0			O	0/ 21	0.0			NO
Benzo(a)anthracene (UG/KG)	56-55-3	24	2.8E+01	4.2E+03	D	24/ 134	17.9	3.5E+02	3.5E+02	YES
Benzo(a)pyrene (UG/KG)	50-32-8	22	2.4E+01	3.6E+03	D	22/ 134	16.4	3.5E+02	3.5E+02	YES
Benzo(b)fluoranthene (UG/KG)	205-99-2	28	2.5E+01	2.8E+03	D	28/ 134	20.9	3.5E+02	3.5E+02	YES
Benzo(g,h,i)perylene (UG/KG)	191-24-2	12	2.7E+01	2.1E+03	D	12/ 134	9.0	3.3E+02	3.3E+02	YES
Benzo(k)fluoranthene (UG/KG)	207-08-9	24	2.5E+01	3.4E+03	D	24/ 134	17.9	3.4E+02	3.4E+02	YES
Benzoic Acid (UG/KG)	65-85-0	5	7.8E+01	9.5E+01	D	5/ 118	4.2	1.6E+03	9.5E+01	NO
Benzyl Alcohol (UG/KG)	100-51-6	0			O	0/ 118	0.0			NO
Bis(2-chloroethoxy)methane (UG/KG)	111-91-1	0			O	0/ 119	0.0			NO
Bis(2-chloroethyl)ether (UG/KG)	111-44-4	0			O	0/ 119	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/KG)	117-81-7	44	2.0E+01	6.5E+03	D	44/ 119	37.0	3.8E+02	3.8E+02	YES
Butyl Benzyl Phthalate (UG/KG)	85-68-7	3	4.8E+01	6.4E+01	D	3/ 119	2.5	2.9E+02	6.4E+01	NO
Carbazole (UG/KG)	86-74-8	2	1.5E+02	1.7E+02	D	2/ 67	3.0	2.0E+02	1.7E+02	NO
Chrysene (UG/KG)	218-01-9	23	2.0E+01	1.7E+03	D	23/ 119	19.3	3.3E+02	3.3E+02	YES
Di-n-butyl Phthalate (UG/KG)	84-74-2	48	2.1E+01	2.0E+03	D	48/ 172	27.9	3.5E+02	3.5E+02	YES
Di-n-octyl Phthalate (UG/KG)	117-84-0	1	4.0E+02	4.0E+02	D	1/ 119	0.8	2.9E+02	2.9E+02	NO
Dibenz(a,h)anthracene (UG/KG)	53-70-3	6	7.1E+01	8.0E+02	D	6/ 134	4.5	3.0E+02	3.0E+02	NO
Dibenzofuran (UG/KG)	132-64-9	6	3.2E+01	5.8E+02	D	6/ 119	5.0	2.8E+02	2.8E+02	YES
Diethyl Phthalate (UG/KG)	84-66-2	6	3.9E+01	1.1E+02	D	6/ 119	5.0	2.9E+02	1.1E+02	YES
Dimethyl Phthalate (UG/KG)	131-11-3	0			O	0/ 119	0.0			NO
Diphenylamine (UG/KG)	122-39-4	0			O	0/ 53	0.0			NO
Fluoranthene (UG/KG)	206-44-0	40	2.3E+01	1.1E+04	D	40/ 134	29.9	4.3E+02	4.3E+02	YES
Fluorene (UG/KG)	86-73-7	7	3.8E+01	1.1E+03	D	7/ 134	5.2	3.0E+02	3.0E+02	YES
Hexachlorobenzene (UG/KG)	118-74-1	0			O	0/ 119	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 119	0.0			NO
Hexachlorocyclopentadiene (UG/KG)	77-47-4	0			O	0/ 119	0.0			NO
Hexachloroethane (UG/KG)	67-72-1	0			O	0/ 119	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/KG)	193-39-5	14	2.5E+01	1.9E+03	D	14/ 134	10.4	3.3E+02	3.3E+02	YES
Isophorone (UG/KG)	78-59-1	0			O	0/ 119	0.0			NO
N-Nitroso-di-n-propylamine (UG/KG)	621-64-7	0			O	0/ 119	0.0			NO
N-Nitrosodiphenylamine (UG/KG)	86-30-6	5	7.8E+01	2.1E+02	D	5/ 119	4.2	2.8E+02	2.1E+02	NO
Naphthalene (UG/KG)	91-20-3	4	2.6E+01	4.1E+02	D	4/ 131	3.1	3.0E+02	3.0E+02	NO
Nitrobenzene (UG/KG)	98-95-3	0			O	0/ 113	0.0			NO
Pentachlorophenol (UG/KG)	87-86-5	0			O	0/ 119	0.0			NO
Phenanthrene (UG/KG)	85-01-8	25	2.7E+01	1.1E+04	D	25/ 134	18.7	4.0E+02	4.0E+02	YES
Phenol (UG/KG)	108-95-2	1	3.2E+02	3.2E+02	D	1/ 119	0.8	2.9E+02	2.9E+02	NO
Pyrene (UG/KG)	129-00-0	37	2.8E+01	9.7E+03	D	37/ 134	27.6	4.2E+02	4.2E+02	YES

Analytes Detected in Surface Soil for the Site Employee Scenario

Analyte (units)	CAS Number	Number of Detections	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Volatile Organics										
1,1,1,2-Tetrachloroethane (UG/KG)	630-20-6	0			O	0/ 23	0.0			NO
1,1,1-Trichloroethane (UG/KG)	71-55-6	4	1.0E+00	8.0E+00	D	4/ 109	3.7	3.1E+00	3.1E+00	NO
1,1,2,2-Tetrachloroethane (UG/KG)	79-34-5	0			O	0/ 109	0.0			NO
1,1,2-Trichloroethane (UG/KG)	79-00-5	0			O	0/ 109	0.0			NO
1,1-Dichloroethane (UG/KG)	75-34-3	1	3.0E+00	3.0E+00	D	1/ 109	0.9	3.1E+00	3.0E+00	NO
1,1-Dichloroethene (UG/KG)	75-35-4	0			O	0/ 109	0.0			NO
1,1-Dichloropropene (UG/KG)	563-58-6	0			O	0/ 23	0.0			NO
1,2,3-Trichlorobenzene (UG/KG)	87-61-6	0			O	0/ 23	0.0			NO
1,2,3-Trichloropropane (UG/KG)	96-18-4	0			O	0/ 23	0.0			NO
1,2,4-Trichlorobenzene (UG/KG)	120-82-1	0			O	0/ 3	0.0			NO
1,2,4-Trimethylbenzene (UG/KG)	95-63-6	0			O	0/ 23	0.0			NO
1,2-Dibromo-3-Chloropropane (UG/KG)	96-12-8	0			O	0/ 23	0.0			NO
1,2-Dichlorobenzene (UG/KG)	95-50-1	0			O	0/ 3	0.0			NO
1,2-Dichloroethane (UG/KG)	107-06-2	0			O	0/ 109	0.0			NO
1,2-Dichloroethene (UG/KG)	540-59-0	2	2.0E+00	6.0E+00	D	2/ 86	2.3	3.1E+00	3.1E+00	NO
1,2-Dichloropropane (UG/KG)	78-87-5	0			O	0/ 109	0.0			NO
1,2-Diethylbenzene (UG/KG)	135-01-3	0			O	0/ 28	0.0			NO
1,2-cis-Dichloroethene (UG/KG)	156-59-2	0			O	0/ 34	0.0			NO
1,2-trans-Dichloroethene (UG/KG)	156-60-5	0			O	0/ 34	0.0			NO
1,3,5-Trimethylbenzene (UG/KG)	108-67-8	0			O	0/ 23	0.0			NO
1,3-Dichlorobenzene (UG/KG)	541-73-1	0			O	0/ 3	0.0			NO
1,3-Dichloropropane (UG/KG)	142-28-9	0			O	0/ 23	0.0			NO
1,3-cis-Dichloropropene (UG/KG)	10061-01-5	0			O	0/ 109	0.0			NO
1,3-trans-Dichloropropene (UG/KG)	10061-02-6	0			O	0/ 109	0.0			NO
1,4-Dichlorobenzene (UG/KG)	106-46-7	0			O	0/ 3	0.0			NO
2,2-Dichloropropane (UG/KG)	594-20-7	0			O	0/ 23	0.0			NO
2-Butanone (UG/KG)	78-93-3	7	1.0E+00	1.7E+01	D	7/ 86	8.1	6.2E+00	6.2E+00	YES
2-Chlorotoluene (UG/KG)	95-49-8	0			O	0/ 23	0.0			NO
2-Hexanone (UG/KG)	591-78-6	0			O	0/ 86	0.0			NO
4-Chlorotoluene (UG/KG)	106-43-4	0			O	0/ 23	0.0			NO
4-Methyl-2-pentanone (UG/KG)	108-10-1	5	1.0E+00	6.0E+00	D	5/ 86	5.8	6.1E+00	6.0E+00	YES
Acetone (UG/KG)	67-64-1	14	4.0E+00	1.5E+02	D	14/ 86	16.3	9.0E+00	9.0E+00	YES
Acetonitrile (UG/KG)	75-05-8	0			O	0/ 28	0.0			NO
Acrylonitrile (UG/KG)	107-13-1	0			O	0/ 28	0.0			NO
Benzene (UG/KG)	71-43-2	0			O	0/ 109	0.0			NO
Bromochloromethane (UG/KG)	74-97-5	0			O	0/ 23	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

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Bromodichloromethane (UG/KG)	75-27-4	0			O	0/ 109	0.0			NO
Bromoform (UG/KG)	75-25-2	0			O	0/ 109	0.0			NO
Bromomethane (UG/KG)	74-83-9	0			O	0/ 109	0.0			NO
Carbon Disulfide (UG/KG)	75-15-0	2	1.0E+00	2.0E+00	D	2/ 86	2.3	3.1E+00	2.0E+00	NO
Carbon Tetrachloride (UG/KG)	56-23-5	0			O	0/ 109	0.0			NO
Chlorobenzene (UG/KG)	108-90-7	0			O	0/ 109	0.0			NO
Chloroethane (UG/KG)	75-00-3	0			O	0/ 109	0.0			NO
Chloroform (Trichloromethane) (UG/KG)	67-66-3	0			O	0/ 109	0.0			NO
Chloromethane (UG/KG)	74-87-3	1	4.0E+00	4.0E+00	D	1/ 109	0.9	5.6E+00	4.0E+00	NO
Dibromochloromethane (UG/KG)	124-48-1	0			O	0/ 109	0.0			NO
Dibromomethane (UG/KG)	74-95-3	0			O	0/ 23	0.0			NO
Dichlorodifluoromethane (UG/KG)	75-71-8	0			O	0/ 23	0.0			NO
Dichloromethane (Methylene Chloride) (UG/KG)	75-09-2	49	3.0E+00	6.8E+01	D	49/ 109	45.0	1.0E+01	1.0E+01	YES
Ethylbenzene (UG/KG)	100-41-4	3	1.0E+00	3.0E+00	D	3/ 109	2.8	3.1E+00	3.0E+00	NO
Ethylene Dibromide (1,2-Dibromoethane) (UG/KG	106-93-4	0			O	0/ 23	0.0			NO
FREON-113 (UG/KG)	76-13-1	0			O	0/ 28	0.0			NO
Hexachlorobutadiene (UG/KG)	87-68-3	0			O	0/ 3	0.0			NO
Hexane (UG/KG)	110-54-3	0			O	0/ 28	0.0			NO
Iodomethane (UG/KG)	74-88-4	0			O	0/ 28	0.0			NO
Isopropyl Benzene (UG/KG)	98-82-8	0			O	0/ 23	0.0			NO
Monobromobenzene (Phenyl bromide) (UG/KG)	108-86-1	0			O	0/ 23	0.0			NO
Naphthalene (UG/KG)	91-20-3	3	1.0E+00	6.0E+00	D	3/ 6	50.0	1.0E+01	6.0E+00	YES
Styrene (UG/KG)	100-42-5	0			O	0/ 109	0.0			NO
Tetrachloroethene (UG/KG)	127-18-4	7	2.0E+00	2.8E+01	D	7/ 109	6.4	3.7E+00	3.7E+00	YES
Toluene (UG/KG)	108-88-3	18	1.0E+00	5.1E+01	D	18/ 109	16.5	3.4E+00	3.4E+00	YES
Trichloroethylene (TCE) (UG/KG)	79-01-6	2	1.8E+01	2.0E+01	D	2/ 109	1.8	3.4E+00	3.4E+00	NO
Trichlorofluoromethane (UG/KG)	75-69-4	0			O	0/ 23	0.0			NO
Vinyl Acetate (UG/KG)	108-05-4	0			O	0/ 86	0.0			NO
Vinyl Chloride (UG/KG)	75-01-4	0			O	0/ 109	0.0			NO
Xylenes, Total (UG/KG)	1330-20-7	7	1.0E+00	3.9E+01	D	7/ 86	8.1	3.5E+00	3.5E+00	YES
m-Xylene (UG/KG)	108-38-3	0			O	0/ 11	0.0			NO
mp-Xylene (UG/KG)	mp-Xylene	23	5.0E+00	6.0E+00	X	23/ 23	100.0	6.0E+00	6.0E+00	YES
n-Butylbenzene (UG/KG)	104-51-8	0			O	0/ 23	0.0			NO
n-propylbenzene (UG/KG)	103-65-1	0			O	0/ 23	0.0			NO

Analytes Detected in Surface Soil for the Site Employee Scenario

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o-Xylene (UG/KG)	95-47-6	0			O	0/ 34	0.0			NO
p-Isopropyltoluene (UG/KG)	99-87-6	0			O	0/ 23	0.0			NO
sec-Butylbenzene (UG/KG)	135-98-8	0			O	0/ 23	0.0			NO
tert-Butylbenzene (UG/KG)	98-06-6	0			O	0/ 23	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Common Anions									
Nitrate (UG/L)	7697-37-2	738.00	2550.00	D	2/ 2	100.0		2550.00	YES
Nitrate/Nitrite (UG/L)	1497-55-8	680.00	4900.00	L	11/ 11	100.0	3510.00	4900.00	YES
Nitrite (UG/L)	14797-65-0			O	0/ 2	0.0			NO
Explosives									
1,3,5-Trinitrobenzene (UG/L)	99-35-4			O	0/ 2	0.0			NO
1,3-Dinitrobenzene (UG/L)	99-65-0			O	0/ 4	0.0			NO
2,4,6-Trinitrotoluene (UG/L)	118-96-7			O	0/ 2	0.0			NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 2	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 2	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/L)	35572-78-2			O	0/ 4	0.0			NO
HMX (UG/L)	2691-41-0			O	0/ 4	0.0			NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 4	0.0			NO
PETN (UG/L)	78-11-5			O	0/ 3	0.0			NO
RDX (UG/L)	121-82-4			O	0/ 4	0.0			NO
Tetryl (UG/L)	479-45-8			O	0/ 4	0.0			NO
Metals									
Aluminum (UG/L)	7429-90-5	68.80	148.00	D	6/ 22	27.3	163.00	148.00	YES
Antimony (UG/L)	7440-36-0	2.80	14.40	D	3/ 20	15.0	43.60	14.40	YES
Arsenic (UG/L)	7440-38-2			O	0/ 25	0.0			NO
Barium (UG/L)	7440-39-3	75.00	115.00	L	20/ 22	90.9	93.60	93.60	YES
Beryllium (UG/L)	7440-41-7			O	0/ 25	0.0			NO
Bismuth (UG/L)	7440-69-9			O	0/ 4	0.0			NO
Cadmium (UG/L)	7440-43-9	4.60	7.70	D	5/ 25	20.0	6.56	6.56	YES
Calcium (UG/L)	7440-70-2	94300.00	126000.00	L	24/ 24	100.0	110000.00	110000.00	YES
Chromium (UG/L)	7440-47-3	18.30	23.80	D	5/ 25	20.0	20.20	20.20	YES
Cobalt (UG/L)	7440-48-4			O	0/ 22	0.0			NO
Copper (UG/L)	7440-50-8	1.60	593.00	X	15/ 25	60.0	41.60	41.60	YES
Cyanide (UG/L)	57-12-5			O	0/ 4	0.0			NO
Iron (UG/L)	7439-89-6	19.00	1890.00	L	13/ 24	54.2	437.00	437.00	YES
Lead (UG/L)	7439-92-1	3.40	40.00	D	5/ 25	20.0	13.00	13.00	YES
Lithium (UG/L)	7439-93-2	2.90	2.90	D	2/ 4	50.0	604.00	2.90	YES
Magnesium (UG/L)	7439-95-4	29100.00	39600.00	L	24/ 24	100.0	34500.00	34500.00	YES
Manganese (UG/L)	7439-96-5	2.80	224.00	X	22/ 24	91.7	26.90	26.90	YES
Mercury (UG/L)	7439-97-6			O	0/ 22	0.0			NO
Molybdenum (UG/L)	7439-98-7	2.00	2.70	D	2/ 4	50.0	3980000.00	2.70	YES
Nickel (UG/L)	7440-02-0	2.10	27.10	D	5/ 25	20.0	16.30	16.30	YES

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Potassium (UG/L)	7440-09-7	2390.00	3650.00	X	20/ 26	76.9	4540.00	3650.00	YES
Selenium (UG/L)	7782-49-2	1.50	1.50	D	1/ 25	4.0	1.63	1.50	NO
Silver (UG/L)	7440-22-4	16.90	24.20	D	5/ 22	22.7	18.00	18.00	YES
Sodium (UG/L)	7440-23-5	46600.00	84200.00	L	24/ 24	100.0	66400.00	66400.00	YES
Thallium (UG/L)	7440-28-0	2.40	2.40	D	1/ 22	4.5	2.00	2.00	NO
Tin (UG/L)	7440-31-5	8.70	8.70	D	1/ 4	25.0	134.00	8.70	YES
Vanadium (UG/L)	7440-62-2	7.80	14.60	D	7/ 22	31.8	21.90	14.60	YES
Zinc (UG/L)	7440-66-6	4.50	57.70	D	9/ 25	36.0	73.70	57.70	YES
Pesticides and/or PCBs									
4,4'-DDD (UG/L)	72-54-8			O	0/ 18	0.0			NO
4,4'-DDE (UG/L)	72-55-9			O	0/ 18	0.0			NO
4,4'-DDT (UG/L)	50-29-3			O	0/ 18	0.0			NO
Aldrin (UG/L)	309-00-2			O	0/ 18	0.0			NO
Alpha Chlordane (UG/L)	5103-71-9			O	0/ 18	0.0			NO
Alpha-BHC (UG/L)	319-84-6			O	0/ 18	0.0			NO
Aroclor-1016 (UG/L)	12674-11-2			O	0/ 18	0.0			NO
Aroclor-1221 (UG/L)	11104-28-2			O	0/ 18	0.0			NO
Aroclor-1232 (UG/L)	11141-16-5			O	0/ 18	0.0			NO
Aroclor-1242 (UG/L)	53469-21-9			O	0/ 18	0.0			NO
Aroclor-1248 (UG/L)	12672-29-6			O	0/ 18	0.0			NO
Aroclor-1254 (UG/L)	11097-69-1			O	0/ 18	0.0			NO
Aroclor-1260 (UG/L)	11096-82-5			O	0/ 18	0.0			NO
Beta-BHC (UG/L)	319-85-7			O	0/ 18	0.0			NO
Delta-BHC (UG/L)	319-86-8			O	0/ 18	0.0			NO
Dieldrin (UG/L)	60-57-1			O	0/ 18	0.0			NO
Endosulfan I (UG/L)	959-98-8			O	0/ 18	0.0			NO
Endosulfan II (UG/L)	33213-65-9			O	0/ 18	0.0			NO
Endosulfan Sulfate (UG/L)	1031-07-8			O	0/ 18	0.0			NO
Endrin (UG/L)	72-20-8			O	0/ 18	0.0			NO
Endrin Aldehyde (UG/L)	7421-93-4			O	0/ 10	0.0			NO
Endrin Ketone (UG/L)	53494-70-5			O	0/ 18	0.0			NO
Gamma Chlordane (UG/L)	5103-74-2			O	0/ 18	0.0			NO
Gamma-BHC (Lindane) (UG/L)	58-89-9			O	0/ 18	0.0			NO
Heptachlor (UG/L)	76-44-8			O	0/ 18	0.0			NO
Heptachlor Epoxide (UG/L)	1024-57-3			O	0/ 18	0.0			NO
Methoxychlor (UG/L)	72-43-5			O	0/ 18	0.0			NO
Toxaphene (UG/L)	8001-35-2			O	0/ 18	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Radiological									
Americium-241 (PCI/L)	14596-10-2			O	0/ 8	0.0			NO
Antimony-124 (PCI/L)	14683-10-4			O	0/ 2	0.0			NO
Antimony-125 (PCI/L)	14234-35-6			O	0/ 2	0.0			NO
Barium-133 (PCI/L)	13981-41-4			O	0/ 2	0.0			NO
Barium-140 (PCI/L)	14798-08-4			O	0/ 2	0.0			NO
Beryllium-7 (PCI/L)	13966-02-4			O	0/ 2	0.0			NO
Bismuth-207 (PCI/L)	13982-38-2			O	0/ 6	0.0			NO
Bismuth-210 (PCI/L)	14331-79-4	0.11	0.39	D	2/ 18	11.1	21.60	0.39	YES
Bismuth-211 (PCI/L)	15229-37-5			O	0/ 2	0.0			NO
Bismuth-212 (PCI/L)	14913-49-6			O	0/ 2	0.0			NO
Bismuth-214 (PCI/L)	14733-03-0			O	0/ 2	0.0			NO
Cerium-139 (PCI/L)	CE-139			O	0/ 2	0.0			NO
Cerium-141 (PCI/L)	13967-74-3			O	0/ 2	0.0			NO
Cerium-144 (PCI/L)	14762-78-8			O	0/ 2	0.0			NO
Cesium-134 (PCI/L)	13967-70-9			O	0/ 4	0.0			NO
Cesium-137 (PCI/L)	10045-97-3			O	0/ 14	0.0			NO
Cobalt-57 (PCI/L)	13981-50-5			O	0/ 2	0.0			NO
Cobalt-58 (PCI/L)	13981-38-9			O	0/ 2	0.0			NO
Cobalt-60 (PCI/L)	10198-40-0			O	0/ 11	0.0			NO
Europium-152 (PCI/L)	14683-23-9			O	0/ 4	0.0			NO
Europium-154 (PCI/L)	15585-10-1			O	0/ 4	0.0			NO
Europium-155 (PCI/L)	14391-16-3			O	0/ 4	0.0			NO
Iodine-131 (PCI/L)	24267-56-9			O	0/ 2	0.0			NO
Iridium-192 (PCI/L)	12154-84-6			O	0/ 2	0.0			NO
Iron-59 (PCI/L)	14596-12-4			O	0/ 2	0.0			NO
Lanthanum-140 (PCI/L)	13981-28-7			O	0/ 2	0.0			NO
Lead-212 (PCI/L)	15092-94-1			O	0/ 2	0.0			NO
Lead-214 (PCI/L)	15067-28-4			O	0/ 2	0.0			NO
Manganese-54 (PCI/L)	13966-31-9			O	0/ 2	0.0			NO
Mercury-203 (PCI/L)	13982-78-0			O	0/ 2	0.0			NO
Neptunium-237 (PCI/L)	13994-20-2			O	0/ 2	0.0			NO
Niobium-95 (PCI/L)	13967-76-5			O	0/ 2	0.0			NO
Plutonium-238 (PCI/L)	13981-16-3	0.01	0.25	D	8/ 57	14.0	0.18	0.18	YES
Plutonium-238/239 (PCI/L)	PU-238/239	0.01	0.01	D	1/ 6	16.7	0.01	0.01	YES
Plutonium-239 (PCI/L)	15117-48-3			O	0/ 38	0.0			NO
Plutonium-239/240 (PCI/L)	PU-239/240	0.00	2.00	D	5/ 19	26.3	9.64	2.00	YES

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Potassium-40 (PCI/L)	13966-00-2			O	0/ 10	0.0			NO
Protactinium-233 (PCI/L)	13981-14-1			O	0/ 2	0.0			NO
Protactinium-234 (PCI/L)	15100-28-4			O	0/ 2	0.0			NO
Radium-223 (PCI/L)	15623-45-7			O	0/ 2	0.0			NO
Radium-225 (PCI/L)	13981-53-8			O	0/ 2	0.0			NO
Radium-226 (PCI/L)	13982-63-3	0.10	0.52	D	6/ 18	33.3	0.54	0.52	YES
Ruthenium-103 (PCI/L)	13968-53-1			O	0/ 2	0.0			NO
Ruthenium-106 (PCI/L)	13967-48-1			O	0/ 2	0.0			NO
Scandium-46 (PCI/L)	13967-63-0			O	0/ 2	0.0			NO
Sodium-22 (PCI/L)	13966-32-0			O	0/ 2	0.0			NO
Strontium-85 (PCI/L)	13967-73-2	25.00	25.00	D	1/ 2	50.0		25.00	YES
Strontium-89 (PCI/L)	14158-27-1			O	0/ 2	0.0			NO
Strontium-90 (PCI/L)	10098-97-2	0.50	0.50	D	3/ 18	16.7	2.13	0.50	YES
Thallium-208 (PCI/L)	14913-50-9			O	0/ 2	0.0			NO
Thorium-227 (PCI/L)	15623-47-9	0.01	0.23	X	16/ 22	72.7	84.00	0.23	YES
Thorium-228 (PCI/L)	14274-82-9	0.01	2.17	D	17/ 46	37.0	25.60	2.17	YES
Thorium-230 (PCI/L)	14269-63-7	0.01	1.99	D	19/ 43	44.2	0.48	0.48	YES
Thorium-232 (PCI/L)	7440-29-1	0.00	0.10	D	8/ 44	18.2	0.34	0.10	YES
Thorium-234 (PCI/L)	15065-10-8			O	0/ 2	0.0			NO
Tin-126 (PCI/L)	15832-50-5			O	0/ 2	0.0			NO
Tritium (PCI/L)	10028-17-8	30.00	7200.00	X	123/ 139	88.5	799.00	799.00	YES
Uranium-233/234 (PCI/L)	U-233/234	0.17	0.36	L	36/ 36	100.0	0.25	0.25	YES
Uranium-234 (PCI/L)	13966-29-5	0.20	8.14	X	19/ 24	79.2	2.02	2.02	YES
Uranium-235 (PCI/L)	15117-96-1	0.01	2.30	X	30/ 53	56.6	0.47	0.47	YES
Uranium-235/236 (PCI/L)	U-235/236			O	0/ 7	0.0			NO
Uranium-238 (PCI/L)	7440-61-1	0.13	8.25	X	52/ 59	88.1	0.41	0.41	YES
Yttrium-88 (PCI/L)	7440-65-5			O	0/ 2	0.0			NO
Zirconium-95 (PCI/L)	13967-71-0			O	0/ 2	0.0			NO
Semi-Volatile Organics									
1,2,4-Trichlorobenzene (UG/L)	120-82-1			O	0/ 18	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 32	0.0			NO
1,3-Dichlorobenzene (UG/L)	541-73-1			O	0/ 30	0.0			NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 32	0.0			NO
1-chloro-4-phenoxybenzene (UG/L)	7005-72-3			O	0/ 18	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/L)	108-60-1			O	0/ 29	0.0			NO
2,4,5-Trichlorophenol (UG/L)	95-95-4			O	0/ 18	0.0			NO
2,4,6-Trichlorophenol (UG/L)	88-06-2			O	0/ 18	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
2,4-Dichlorophenol (UG/L)	120-83-2			O	0/ 18	0.0			NO
2,4-Dimethylphenol (UG/L)	105-67-9			O	0/ 18	0.0			NO
2,4-Dinitrophenol (UG/L)	51-28-5			O	0/ 18	0.0			NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 16	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 16	0.0			NO
2-Benzyl-4-Chlorophenol (UG/L)	120-32-1			O	0/ 4	0.0			NO
2-Chloronaphthalene (UG/L)	91-58-7			O	0/ 18	0.0			NO
2-Chlorophenol (UG/L)	95-57-8			O	0/ 18	0.0			NO
2-Methylnaphthalene (UG/L)	91-57-6			O	0/ 18	0.0			NO
2-Methylphenol (UG/L)	95-48-7			O	0/ 18	0.0			NO
2-Nitroaniline (UG/L)	88-74-4			O	0/ 18	0.0			NO
2-Nitrophenol (UG/L)	88-75-5			O	0/ 18	0.0			NO
3,3'-Dichlorobenzidine (UG/L)	91-94-1			O	0/ 18	0.0			NO
3-Nitroaniline (UG/L)	99-09-2			O	0/ 18	0.0			NO
4,6-Dinitro-o-Cresol (UG/L)	534-52-1			O	0/ 18	0.0			NO
4-Bromophenyl-phenyl Ether (UG/L)	101-55-3			O	0/ 18	0.0			NO
4-Chloro-3-methylphenol (UG/L)	59-50-7			O	0/ 18	0.0			NO
4-Chloroaniline (UG/L)	106-47-8			O	0/ 18	0.0			NO
4-Methylphenol (UG/L)	106-44-5			O	0/ 18	0.0			NO
4-Nitroaniline (UG/L)	100-01-6			O	0/ 18	0.0			NO
4-Nitrophenol (UG/L)	100-02-7			O	0/ 18	0.0			NO
Acenaphthene (UG/L)	83-32-9			O	0/ 18	0.0			NO
Acenaphthylene (UG/L)	208-96-8			O	0/ 18	0.0			NO
Anthracene (UG/L)	120-12-7			O	0/ 18	0.0			NO
Benzo(a)anthracene (UG/L)	56-55-3			O	0/ 18	0.0			NO
Benzo(a)pyrene (UG/L)	50-32-8			O	0/ 18	0.0			NO
Benzo(b)fluoranthene (UG/L)	205-99-2			O	0/ 18	0.0			NO
Benzo(g,h,i)perylene (UG/L)	191-24-2			O	0/ 18	0.0			NO
Benzo(k)fluoranthene (UG/L)	207-08-9			O	0/ 18	0.0			NO
Benzoic Acid (UG/L)	65-85-0			O	0/ 13	0.0			NO
Benzyl Alcohol (UG/L)	100-51-6			O	0/ 13	0.0			NO
Bis(2-chloroethoxy)methane (UG/L)	111-91-1			O	0/ 18	0.0			NO
Bis(2-chloroethyl)ether (UG/L)	111-44-4			O	0/ 18	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/L)	117-81-7			O	0/ 21	0.0			NO
Butyl Benzyl Phthalate (UG/L)	85-68-7			O	0/ 18	0.0			NO
Carbazole (UG/L)	86-74-8			O	0/ 9	0.0			NO
Chrysene (UG/L)	218-01-9			O	0/ 18	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Di-n-butyl Phthalate (UG/L)	84-74-2			O	0/ 21	0.0			NO
Di-n-octyl Phthalate (UG/L)	117-84-0			O	0/ 18	0.0			NO
Dibenz(a,h)anthracene (UG/L)	53-70-3			O	0/ 18	0.0			NO
Dibenzofuran (UG/L)	132-64-9			O	0/ 18	0.0			NO
Diethyl Phthalate (UG/L)	84-66-2			O	0/ 18	0.0			NO
Dimethyl Phthalate (UG/L)	131-11-3			O	0/ 18	0.0			NO
Fluoranthene (UG/L)	206-44-0			O	0/ 18	0.0			NO
Fluorene (UG/L)	86-73-7			O	0/ 18	0.0			NO
Hexachlorobenzene (UG/L)	118-74-1			O	0/ 18	0.0			NO
Hexachlorobutadiene (UG/L)	87-68-3			O	0/ 18	0.0			NO
Hexachlorocyclopentadiene (UG/L)	77-47-4			O	0/ 18	0.0			NO
Hexachloroethane (UG/L)	67-72-1			O	0/ 18	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/L)	193-39-5			O	0/ 18	0.0			NO
Isophorone (UG/L)	78-59-1			O	0/ 18	0.0			NO
N-Nitroso-di-n-propylamine (UG/L)	621-64-7			O	0/ 18	0.0			NO
N-Nitrosodiphenylamine (UG/L)	86-30-6			O	0/ 18	0.0			NO
Naphthalene (UG/L)	91-20-3			O	0/ 18	0.0			NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 14	0.0			NO
Pentachlorophenol (UG/L)	87-86-5			O	0/ 21	0.0			NO
Phenanthrene (UG/L)	85-01-8			O	0/ 18	0.0			NO
Phenol (UG/L)	108-95-2			O	0/ 21	0.0			NO
Pyrene (UG/L)	129-00-0			O	0/ 18	0.0			NO
Volatile Organics									
1,1,1,2-Tetrachloroethane (UG/L)	630-20-6			O	0/ 202	0.0			NO
1,1,1-Trichloroethane (UG/L)	71-55-6	0.30	3.30	D	91/ 215	42.3	0.90	0.90	YES
1,1,2,2-Tetrachloroethane (UG/L)	79-34-5			O	0/ 213	0.0			NO
1,1,2-Trichloroethane (UG/L)	79-00-5			O	0/ 217	0.0			NO
1,1-Dichloroethane (UG/L)	75-34-3	3.50	3.50	D	1/ 213	0.5	0.34	0.34	NO
1,1-Dichloroethene (UG/L)	75-35-4	1.70	1.70	D	1/ 215	0.5	0.39	0.39	NO
1,1-Dichloropropene (UG/L)	563-58-6			O	0/ 167	0.0			NO
1,2,3-Trichlorobenzene (UG/L)	87-61-6			O	0/ 167	0.0			NO
1,2,3-Trichloropropane (UG/L)	96-18-4			O	0/ 192	0.0			NO
1,2,4-Trichlorobenzene (UG/L)	120-82-1			O	0/ 167	0.0			NO
1,2,4-Trimethylbenzene (UG/L)	95-63-6			O	0/ 167	0.0			NO
1,2-Dibromo-3-Chloropropane (UG/L)	96-12-8			O	0/ 2	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 177	0.0			NO
1,2-Dichloroethane (UG/L)	107-06-2			O	0/ 219	0.0			NO

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
1,2-Dichloroethene (UG/L)	540-59-0	1.30	7.20	L	10/ 13	76.9	5.57	7.20	YES
1,2-Dichloropropane (UG/L)	78-87-5			O	0/ 213	0.0			NO
1,2-Diethylbenzene (UG/L)	135-01-3			O	0/ 4	0.0			NO
1,2-cis-Dichloroethene (UG/L)	156-59-2	0.50	4.00	X	102/ 182	56.0	1.08	1.08	YES
1,2-trans-Dichloroethene (UG/L)	156-60-5	1.00	3.00	D	7/ 217	3.2	0.39	0.39	NO
1,3,5-Trimethylbenzene (UG/L)	108-67-8			O	0/ 167	0.0			NO
1,3-Dichlorobenzene (UG/L)	541-73-1			O	0/ 177	0.0			NO
1,3-Dichloropropane (UG/L)	142-28-9			O	0/ 167	0.0			NO
1,3-Dichloropropene (UG/L)	542-75-6			O	0/ 167	0.0			NO
1,3-Diethylbenzene (UG/L)	141-93-5			O	0/ 4	0.0			NO
1,3-cis-Dichloropropene (UG/L)	10061-01-5	0.50	1.20	D	2/ 215	0.9	0.55	0.55	NO
1,3-trans-Dichloropropene (UG/L)	10061-02-6			O	0/ 215	0.0			NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 177	0.0			NO
1,4-Diethylbenzene (UG/L)	105-05-5			O	0/ 4	0.0			NO
1-Chlorohexane (UG/L)	544-10-5			O	0/ 33	0.0			NO
2,2-Dichloropropane (UG/L)	594-20-7			O	0/ 167	0.0			NO
2-Butanone (UG/L)	78-93-3	7.00	41.00	D	3/ 13	23.1	16.80	41.00	YES
2-Chloroethylvinylether (UG/L)	110-75-8			O	0/ 40	0.0			NO
2-Chlorotoluene (UG/L)	95-49-8			O	0/ 183	0.0			NO
2-Hexanone (UG/L)	591-78-6			O	0/ 7	0.0			NO
4-Chlorotoluene (UG/L)	106-43-4			O	0/ 173	0.0			NO
4-Methyl-2-pentanone (UG/L)	108-10-1			O	0/ 11	0.0			NO
Acetone (UG/L)	67-64-1	2.00	12.00	D	6/ 11	54.5	11.90	12.00	YES
Acetonitrile (UG/L)	75-05-8			O	0/ 4	0.0			NO
Acrolein (UG/L)	107-02-8			O	0/ 3	0.0			NO
Acrylonitrile (UG/L)	107-13-1			O	0/ 7	0.0			NO
Benzene (UG/L)	71-43-2			O	0/ 215	0.0			NO
Benzyl Chloride (UG/L)	100-44-7			O	0/ 4	0.0			NO
Bromochloromethane (UG/L)	74-97-5			O	0/ 167	0.0			NO
Bromodichloromethane (UG/L)	75-27-4	0.50	3.70	D	3/ 215	1.4	0.38	0.38	NO
Bromoform (UG/L)	75-25-2			O	0/ 214	0.0			NO
Bromomethane (UG/L)	74-83-9			O	0/ 185	0.0			NO
Carbon Disulfide (UG/L)	75-15-0			O	0/ 11	0.0			NO
Carbon Tetrachloride (UG/L)	56-23-5			O	0/ 215	0.0			NO
Chlorobenzene (UG/L)	108-90-7			O	0/ 213	0.0			NO
Chloroethane (UG/L)	75-00-3			O	0/ 185	0.0			NO
Chloroform (Trichloromethane) (UG/L)	67-66-3	0.50	7.00	D	13/ 219	5.9	0.42	0.42	YES

Analytes Detected in Groundwater in the Mound Production Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Chloromethane (UG/L)	74-87-3			O	0/ 187	0.0			NO
Chlorotoluene (UG/L)	25168-05-2			O	0/ 19	0.0			NO
Dibromochloromethane (UG/L)	124-48-1			O	0/ 215	0.0			NO
Dibromomethane (UG/L)	74-95-3			O	0/ 204	0.0			NO
Dichlorodifluoromethane (UG/L)	75-71-8			O	0/ 175	0.0			NO
Dichloromethane (Methylene Chloride) (U	75-09-2	3.00	13.00	D	8/ 217	3.7	0.70	0.70	NO
Ethylbenzene (UG/L)	100-41-4	0.50	0.60	D	2/ 219	0.9	0.48	0.48	NO
Ethylene Dibromide (1,2-Dibromoethane)	106-93-4			O	0/ 2	0.0			NO
FREON-113 (UG/L)	76-13-1	2.00	34.00	X	12/ 19	63.2	29.60	34.00	YES
Hexachlorobutadiene (UG/L)	87-68-3			O	0/ 167	0.0			NO
Isopropyl Benzene (UG/L)	98-82-8			O	0/ 167	0.0			NO
Monobromobenzene (Phenyl bromide) (U	108-86-1			O	0/ 202	0.0			NO
Naphthalene (UG/L)	91-20-3			O	0/ 167	0.0			NO
Styrene (UG/L)	100-42-5			O	0/ 174	0.0			NO
Tert-butyl methyl ether (UG/L)	1634-04-4	1.20	2.40	D	4/ 24	16.7	0.61	0.61	YES
Tetrachloroethene (UG/L)	127-18-4	0.29	2.20	X	114/ 218	52.3	0.96	0.96	YES
Toluene (UG/L)	108-88-3	0.60	3.00	D	4/ 219	1.8	0.50	0.50	NO
Trichloroethylene (TCE) (UG/L)	79-01-6	0.50	5.90	X	189/ 219	86.3	2.31	2.31	YES
Trichlorofluoromethane (UG/L)	75-69-4	2.20	2.20	D	1/ 210	0.5	0.43	0.43	NO
Vinyl Acetate (UG/L)	108-05-4			O	0/ 11	0.0			NO
Vinyl Chloride (UG/L)	75-01-4			O	0/ 219	0.0			NO
Xylenes, Total (UG/L)	1330-20-7	0.50	3.60	D	9/ 212	4.2	0.56	0.56	NO
mp-Xylene (UG/L)	mp-Xylene	0.60	2.40	D	8/ 167	4.8	0.31	0.31	NO
n-Butylbenzene (UG/L)	104-51-8			O	0/ 167	0.0			NO
n-propylbenzene (UG/L)	103-65-1			O	0/ 167	0.0			NO
o-Xylene (UG/L)	95-47-6	0.40	1.30	D	5/ 167	3.0	0.27	0.27	NO
p-Isopropyltoluene (UG/L)	99-87-6			O	0/ 167	0.0			NO
sec-Butylbenzene (UG/L)	135-98-8			O	0/ 167	0.0			NO
tert-Butylbenzene (UG/L)	98-06-6			O	0/ 167	0.0			NO

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Common Anions									
Nitrate (UG/L)	7697-37-2	1.7E+02	9.4E+03	D	5/ 10	50.0	1.1E+16	9.4E+03	YES
Nitrate/Nitrite (UG/L)	1497-55-8	6.3E+00	2.0E+04	X	76/ 113	67.3	3.1E+04	2.0E+04	YES
Nitrite (UG/L)	14797-65-0	1.0E+01	7.0E+01	D	2/ 21	9.5	1.4E+01	1.4E+01	YES
Explosives									
1,3,5-Trinitrobenzene (UG/L)	99-35-4	1.1E+00	1.1E+00	D	1/ 23	4.3	1.2E+00	1.1E+00	NO
1,3-Dinitrobenzene (UG/L)	99-65-0			O	0/ 43	0.0			NO
2,4,6-Trinitrotoluene (UG/L)	118-96-7	2.6E-01	2.6E-01	D	1/ 24	4.2	9.2E-01	2.6E-01	NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 23	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 34	0.0			NO
2-Amino-4,6-Dinitrotoluene (UG/L)	35572-78-2			O	0/ 43	0.0			NO
HMX (UG/L)	2691-41-0			O	0/ 43	0.0			NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 42	0.0			NO
PETN (UG/L)	78-11-5			O	0/ 40	0.0			NO
RDX (UG/L)	121-82-4			O	0/ 41	0.0			NO
Tetryl (UG/L)	479-45-8			O	0/ 43	0.0			NO
Metals									
Aluminum (UG/L)	7429-90-5	1.2E+01	3.2E+04	X	141/ 151	93.4	4.7E+03	4.7E+03	YES
Antimony (UG/L)	7440-36-0	3.5E-01	4.2E+01	D	47/ 158	29.7	3.2E+00	3.2E+00	YES
Arsenic (UG/L)	7440-38-2	3.0E-01	9.3E+02	D	35/ 150	23.3	7.3E+00	7.3E+00	YES
Barium (UG/L)	7440-39-3	1.8E+01	3.1E+03	X	148/ 150	98.7	1.4E+02	1.4E+02	YES
Beryllium (UG/L)	7440-41-7	3.0E-02	2.3E+00	D	56/ 151	37.1	3.8E-01	3.8E-01	YES
Bismuth (UG/L)	7440-69-9	8.2E-01	2.6E+02	D	29/ 139	20.9	2.1E+01	2.1E+01	YES
Boron (UG/L)	7440-42-8	5.7E+01	1.3E+02	D	7/ 8	87.5	1.1E+02	1.3E+02	YES
Cadmium (UG/L)	7440-43-9	1.4E-01	1.3E+01	D	17/ 161	10.6	7.0E-01	7.0E-01	YES
Calcium (UG/L)	7440-70-2	1.2E+02	1.5E+06	X	198/ 198	100.0	2.0E+05	2.0E+05	YES
Chromium (UG/L)	7440-47-3	2.0E-01	4.5E+04	X	106/ 155	68.4	1.6E+03	1.6E+03	YES
Cobalt (UG/L)	7440-48-4	3.1E-01	3.0E+02	D	63/ 151	41.7	1.7E+01	1.7E+01	YES
Copper (UG/L)	7440-50-8	3.8E-01	5.1E+02	X	118/ 153	77.1	1.8E+01	1.8E+01	YES
Cyanide (UG/L)	57-12-5	5.5E+00	1.4E+01	D	3/ 46	6.5	4.7E+00	4.7E+00	YES
Iron (UG/L)	7439-89-6	1.5E-01	1.9E+05	X	186/ 199	93.5	3.2E+04	3.2E+04	YES
Lead (UG/L)	7439-92-1	4.0E-01	4.0E+01	D	62/ 162	38.3	3.9E+00	3.9E+00	YES
Lithium (UG/L)	7439-93-2	1.2E+01	4.6E+03	X	123/ 138	89.1	1.4E+02	1.4E+02	YES
Magnesium (UG/L)	7439-95-4	2.7E+01	7.2E+05	X	199/ 199	100.0	7.7E+04	7.7E+04	YES
Manganese (UG/L)	7439-96-5	3.7E-02	3.0E+03	X	190/ 199	95.5	6.2E+02	6.2E+02	YES
Mercury (UG/L)	7439-97-6	1.0E-01	1.4E+00	D	3/ 151	2.0	6.1E-02	6.1E-02	NO
Molybdenum (UG/L)	7439-98-7	4.3E-01	4.7E+02	X	82/ 134	61.2	2.0E+01	2.0E+01	YES

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Nickel (UG/L)	7440-02-0	4.4E-01	1.2E+04	X	114/ 154	74.0	4.8E+02	4.8E+02	YES
Potassium (UG/L)	7440-09-7	2.1E+00	2.1E+05	X	186/ 200	93.0	1.6E+04	1.6E+04	YES
Selenium (UG/L)	7782-49-2	1.3E+00	9.1E+00	D	11/ 149	7.4	1.7E+00	1.7E+00	YES
Silicon (UG/L)	7440-21-3	2.2E+03	1.2E+04	D	6/ 6	100.0	1.7E+04	1.2E+04	YES
Silver (UG/L)	7440-22-4	1.8E-01	2.9E+01	D	13/ 153	8.5	1.1E+00	1.1E+00	YES
Sodium (UG/L)	7440-23-5	6.8E+01	7.3E+06	X	197/ 197	100.0	3.4E+05	3.4E+05	YES
Thallium (UG/L)	7440-28-0	1.1E+00	6.9E+00	D	10/ 147	6.8	3.4E+00	3.4E+00	YES
Tin (UG/L)	7440-31-5	1.4E+00	3.6E+02	D	29/ 136	21.3	7.5E+00	7.5E+00	YES
Vanadium (UG/L)	7440-62-2	1.5E-01	2.8E+02	D	72/ 151	47.7	2.3E+01	2.3E+01	YES
Zinc (UG/L)	7440-66-6	6.1E-01	4.0E+02	X	114/ 153	74.5	4.9E+01	4.9E+01	YES
Pesticides and/or PCBs									
4,4'-DDD (UG/L)	72-54-8			O	0/ 62	0.0			NO
4,4'-DDE (UG/L)	72-55-9			O	0/ 62	0.0			NO
4,4'-DDT (UG/L)	50-29-3			O	0/ 62	0.0			NO
Aldrin (UG/L)	309-00-2			O	0/ 62	0.0			NO
Alpha Chlordane (UG/L)	5103-71-9	3.2E-02	6.9E-02	D	3/ 62	4.8	1.1E-01	6.9E-02	NO
Alpha-BHC (UG/L)	319-84-6			O	0/ 62	0.0			NO
Aroclor-1016 (UG/L)	12674-11-2			O	0/ 62	0.0			NO
Aroclor-1221 (UG/L)	11104-28-2			O	0/ 62	0.0			NO
Aroclor-1232 (UG/L)	11141-16-5			O	0/ 62	0.0			NO
Aroclor-1242 (UG/L)	53469-21-9			O	0/ 62	0.0			NO
Aroclor-1248 (UG/L)	12672-29-6			O	0/ 62	0.0			NO
Aroclor-1254 (UG/L)	11097-69-1			O	0/ 62	0.0			NO
Aroclor-1260 (UG/L)	11096-82-5			O	0/ 62	0.0			NO
Beta-BHC (UG/L)	319-85-7			O	0/ 62	0.0			NO
Delta-BHC (UG/L)	319-86-8			O	0/ 62	0.0			NO
Dieldrin (UG/L)	60-57-1			O	0/ 62	0.0			NO
Endosulfan I (UG/L)	959-98-8			O	0/ 62	0.0			NO
Endosulfan II (UG/L)	33213-65-9			O	0/ 62	0.0			NO
Endosulfan Sulfate (UG/L)	1031-07-8			O	0/ 59	0.0			NO
Endrin (UG/L)	72-20-8			O	0/ 62	0.0			NO
Endrin Aldehyde (UG/L)	7421-93-4			O	0/ 48	0.0			NO
Endrin Ketone (UG/L)	53494-70-5			O	0/ 62	0.0			NO
Gamma Chlordane (UG/L)	5103-74-2			O	0/ 62	0.0			NO
Gamma-BHC (Lindane) (UG/L)	58-89-9			O	0/ 62	0.0			NO
Heptachlor (UG/L)	76-44-8			O	0/ 62	0.0			NO
Heptachlor Epoxide (UG/L)	1024-57-3			O	0/ 62	0.0			NO

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Methoxychlor (UG/L)	72-43-5			O	0/ 62	0.0			NO
Toxaphene (UG/L)	8001-35-2			O	0/ 62	0.0			NO
Radiological									
Americium-241 (PCI/L)	14596-10-2	6.8E-02	1.7E-01	D	6/ 43	14.0	2.9E+00	1.7E-01	YES
Bismuth-207 (PCI/L)	13982-38-2			O	0/ 50	0.0			NO
Bismuth-210 (PCI/L)	14331-79-4	1.2E-01	2.6E-01	D	2/ 55	3.6	8.0E+00	2.6E-01	NO
Bismuth-211 (PCI/L)	15229-37-5			O	0/ 4	0.0			NO
Bismuth-212 (PCI/L)	14913-49-6			O	0/ 4	0.0			NO
Bismuth-214 (PCI/L)	14733-03-0			O	0/ 4	0.0			NO
Cesium-134 (PCI/L)	13967-70-9			O	0/ 4	0.0			NO
Cesium-137 (PCI/L)	10045-97-3			O	0/ 56	0.0			NO
Cobalt-60 (PCI/L)	10198-40-0			O	0/ 56	0.0			NO
Europium-152 (PCI/L)	14683-23-9			O	0/ 4	0.0			NO
Europium-154 (PCI/L)	15585-10-1			O	0/ 4	0.0			NO
Europium-155 (PCI/L)	14391-16-3			O	0/ 4	0.0			NO
Lead-212 (PCI/L)	15092-94-1			O	0/ 4	0.0			NO
Lead-214 (PCI/L)	15067-28-4			O	0/ 4	0.0			NO
Neptunium-237 (PCI/L)	13994-20-2			O	0/ 4	0.0			NO
Plutonium-238 (PCI/L)	13981-16-3	9.0E-03	1.9E+00	D	8/ 62	12.9	2.4E-01	2.4E-01	YES
Plutonium-238/239 (PCI/L)	PU-238/239			O	0/ 2	0.0			NO
Plutonium-239 (PCI/L)	15117-48-3			O	0/ 5	0.0			NO
Plutonium-239/240 (PCI/L)	PU-239/240	3.0E-03	1.8E-01	D	12/ 52	23.1	5.4E-01	1.8E-01	YES
Plutonium-242 (PCI/L)	13982-10-0	1.1E-01	1.1E-01	D	1/ 2	50.0		1.1E-01	YES
Potassium-40 (PCI/L)	13966-00-2	1.3E+02	2.6E+02	D	5/ 54	9.3	1.4E+02	1.4E+02	YES
Protactinium-233 (PCI/L)	13981-14-1			O	0/ 4	0.0			NO
Protactinium-234 (PCI/L)	15100-28-4			O	0/ 4	0.0			NO
Radium-223 (PCI/L)	15623-45-7			O	0/ 4	0.0			NO
Radium-225 (PCI/L)	13981-53-8			O	0/ 4	0.0			NO
Radium-226 (PCI/L)	13982-63-3	1.3E-01	3.9E+01	X	50/ 66	75.8	2.4E+00	2.4E+00	YES
Radium-228 (PCI/L)	15262-20-1	5.7E-01	1.7E+01	L	8/ 8	100.0	4.5E+01	1.7E+01	YES
Strontium-89 (PCI/L)	14158-27-1			O	0/ 4	0.0			NO
Strontium-90 (PCI/L)	10098-97-2	7.5E-01	4.2E+01	D	8/ 57	14.0	2.2E+00	2.2E+00	YES
Thallium-208 (PCI/L)	14913-50-9			O	0/ 4	0.0			NO
Thorium-227 (PCI/L)	15623-47-9	5.8E-02	5.8E-02	D	1/ 5	20.0	2.4E+18	5.8E-02	YES
Thorium-228 (PCI/L)	14274-82-9	2.0E-02	8.5E+00	X	42/ 57	73.7	6.9E+01	8.5E+00	YES
Thorium-230 (PCI/L)	14269-63-7	4.4E-03	4.1E+00	L	45/ 59	76.3	5.4E-01	5.4E-01	YES
Thorium-232 (PCI/L)	7440-29-1	5.0E-04	2.1E+00	L	33/ 66	50.0	7.2E-01	7.2E-01	YES

Analytes Detected in Groundwater in the Bedrock Wells

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Thorium-234 (PCI/L)	15065-10-8			O	0/ 4	0.0			NO
Tritium (PCI/L)	10028-17-8	3.0E+00	2.8E+06	X	4473/4488	99.7	2.1E+05	2.1E+05	YES
Uranium-233 (PCI/L)	13968-55-3	2.7E-02	1.6E+01	D	3/ 3	100.0	1.6E+62	1.6E+01	YES
Uranium-233/234 (PCI/L)	U-233/234	1.5E-01	9.3E-01	D	5/ 5	100.0	2.7E+00	9.3E-01	YES
Uranium-234 (PCI/L)	13966-29-5	3.3E-02	6.7E+01	X	61/ 70	87.1	2.1E+00	2.1E+00	YES
Uranium-235 (PCI/L)	15117-96-1	7.8E-03	8.3E+00	D	20/ 43	46.5	6.9E+00	6.9E+00	YES
Uranium-235/236 (PCI/L)	U-235/236	3.7E-02	4.7E-02	D	2/ 26	7.7	9.6E-02	4.7E-02	YES
Uranium-238 (PCI/L)	7440-61-1	2.9E-02	6.6E+00	L	59/ 77	76.6	5.9E-01	5.9E-01	YES
Semi-Volatile Organics									
1,2,4-Trichlorobenzene (UG/L)	120-82-1			O	0/ 65	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 99	0.0			NO
1,3-Dichlorobenzene (UG/L)	541-73-1	3.0E+00	3.0E+00	D	1/ 98	1.0	2.7E+00	2.7E+00	NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 99	0.0			NO
1-chloro-4-phenoxybenzene (UG/L)	7005-72-3			O	0/ 65	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/L)	108-60-1			O	0/ 119	0.0			NO
2,4,5-Trichlorophenol (UG/L)	95-95-4			O	0/ 65	0.0			NO
2,4,6-Trichlorophenol (UG/L)	88-06-2			O	0/ 65	0.0			NO
2,4-Dichlorophenol (UG/L)	120-83-2			O	0/ 65	0.0			NO
2,4-Dimethylphenol (UG/L)	105-67-9			O	0/ 65	0.0			NO
2,4-Dinitrophenol (UG/L)	51-28-5			O	0/ 65	0.0			NO
2,4-Dinitrotoluene (UG/L)	121-14-2			O	0/ 42	0.0			NO
2,6-Dinitrotoluene (UG/L)	606-20-2			O	0/ 31	0.0			NO
2-Benzyl-4-Chlorophenol (UG/L)	120-32-1			O	0/ 44	0.0			NO
2-Chloronaphthalene (UG/L)	91-58-7			O	0/ 65	0.0			NO
2-Chlorophenol (UG/L)	95-57-8			O	0/ 65	0.0			NO
2-Methylnaphthalene (UG/L)	91-57-6	6.0E+00	6.0E+00	D	1/ 69	1.4	5.2E+00	5.2E+00	NO
2-Methylphenol (UG/L)	95-48-7			O	0/ 65	0.0			NO
2-Nitroaniline (UG/L)	88-74-4			O	0/ 65	0.0			NO
2-Nitrophenol (UG/L)	88-75-5			O	0/ 65	0.0			NO
3,3'-Dichlorobenzidine (UG/L)	91-94-1			O	0/ 66	0.0			NO
3-Nitroaniline (UG/L)	99-09-2			O	0/ 65	0.0			NO
4,6-Dinitro-o-Cresol (UG/L)	534-52-1			O	0/ 65	0.0			NO
4-Bromophenyl-phenyl Ether (UG/L)	101-55-3			O	0/ 65	0.0			NO
4-Chloro-3-methylphenol (UG/L)	59-50-7			O	0/ 65	0.0			NO
4-Chloroaniline (UG/L)	106-47-8			O	0/ 65	0.0			NO
4-Methylphenol (UG/L)	106-44-5	1.2E+01	6.1E+01	D	2/ 65	3.1	6.2E+00	6.2E+00	NO
4-Nitroaniline (UG/L)	100-01-6			O	0/ 64	0.0			NO

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
4-Nitrophenol (UG/L)	100-02-7			O	0/ 65	0.0			NO
Acenaphthene (UG/L)	83-32-9	1.0E+00	1.0E+00	D	1/ 72	1.4	5.6E+00	1.0E+00	NO
Acenaphthylene (UG/L)	208-96-8			O	0/ 72	0.0			NO
Anthracene (UG/L)	120-12-7			O	0/ 72	0.0			NO
Benzo(a)anthracene (UG/L)	56-55-3			O	0/ 73	0.0			NO
Benzo(a)pyrene (UG/L)	50-32-8			O	0/ 73	0.0			NO
Benzo(b)fluoranthene (UG/L)	205-99-2			O	0/ 73	0.0			NO
Benzo(g,h,i)perylene (UG/L)	191-24-2			O	0/ 73	0.0			NO
Benzo(k)fluoranthene (UG/L)	207-08-9			O	0/ 73	0.0			NO
Benzoic Acid (UG/L)	65-85-0	1.0E+00	8.9E+02	D	2/ 62	3.2	3.7E+01	3.7E+01	NO
Benzyl Alcohol (UG/L)	100-51-6			O	0/ 62	0.0			NO
Bis(2-chloroethoxy)methane (UG/L)	111-91-1			O	0/ 65	0.0			NO
Bis(2-chloroethyl)ether (UG/L)	111-44-4			O	0/ 65	0.0			NO
Bis(2-ethylhexyl)phthalate (UG/L)	117-81-7	1.0E+00	9.5E+02	D	12/ 66	18.2	1.8E+01	1.8E+01	YES
Butyl Benzyl Phthalate (UG/L)	85-68-7			O	0/ 66	0.0			NO
Carbazole (UG/L)	86-74-8			O	0/ 50	0.0			NO
Chrysene (UG/L)	218-01-9			O	0/ 73	0.0			NO
Di-n-butyl Phthalate (UG/L)	84-74-2	6.0E-01	3.0E+00	D	5/ 65	7.7	5.6E+00	3.0E+00	YES
Di-n-octyl Phthalate (UG/L)	117-84-0			O	0/ 66	0.0			NO
Dibenz(a,h)anthracene (UG/L)	53-70-3			O	0/ 73	0.0			NO
Dibenzofuran (UG/L)	132-64-9			O	0/ 69	0.0			NO
Diethyl Phthalate (UG/L)	84-66-2	5.0E-01	5.0E-01	D	1/ 65	1.5	5.6E+00	5.0E-01	NO
Dimethyl Phthalate (UG/L)	131-11-3			O	0/ 65	0.0			NO
Fluoranthene (UG/L)	206-44-0	9.0E-01	9.0E-01	D	1/ 72	1.4	5.5E+00	9.0E-01	NO
Fluorene (UG/L)	86-73-7	2.0E+00	2.0E+00	D	1/ 72	1.4	5.4E+00	2.0E+00	NO
Hexachlorobenzene (UG/L)	118-74-1			O	0/ 65	0.0			NO
Hexachlorobutadiene (UG/L)	87-68-3			O	0/ 65	0.0			NO
Hexachlorocyclopentadiene (UG/L)	77-47-4			O	0/ 65	0.0			NO
Hexachloroethane (UG/L)	67-72-1			O	0/ 65	0.0			NO
Indeno(1,2,3-cd)pyrene (UG/L)	193-39-5			O	0/ 73	0.0			NO
Isophorone (UG/L)	78-59-1			O	0/ 65	0.0			NO
N-Nitroso-di-n-propylamine (UG/L)	621-64-7			O	0/ 65	0.0			NO
N-Nitrosodiphenylamine (UG/L)	86-30-6			O	0/ 65	0.0			NO
Naphthalene (UG/L)	91-20-3	5.0E+00	5.0E+00	D	1/ 72	1.4	5.5E+00	5.0E+00	NO
Nitrobenzene (UG/L)	98-95-3			O	0/ 23	0.0			NO
Pentachlorophenol (UG/L)	87-86-5			O	0/ 65	0.0			NO
Phenanthrene (UG/L)	85-01-8	3.0E+00	3.0E+00	D	1/ 72	1.4	5.2E+00	3.0E+00	NO

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Phenol (UG/L)	108-95-2	1.0E+00	2.0E+00	D	2/ 65	3.1	5.4E+00	2.0E+00	NO
Pyrene (UG/L)	129-00-0	6.0E-01	6.0E-01	D	1/ 72	1.4	5.5E+00	6.0E-01	NO
Volatile Organics									
1,1,1,2-Tetrachloroethane (UG/L)	630-20-6			O	0/ 211	0.0			NO
1,1,1-Trichloroethane (UG/L)	71-55-6	4.0E-01	7.0E+00	D	20/ 264	7.6	5.3E-01	5.3E-01	YES
1,1,2,2-Tetrachloroethane (UG/L)	79-34-5			O	0/ 261	0.0			NO
1,1,2-Trichloroethane (UG/L)	79-00-5			O	0/ 264	0.0			NO
1,1-Dichloroethane (UG/L)	75-34-3	2.0E+00	2.0E+00	D	1/ 263	0.4	6.5E-01	6.5E-01	NO
1,1-Dichloroethene (UG/L)	75-35-4			O	0/ 264	0.0			NO
1,2,3-Trichloropropane (UG/L)	96-18-4			O	0/ 185	0.0			NO
1,2-Dichlorobenzene (UG/L)	95-50-1			O	0/ 154	0.0			NO
1,2-Dichloroethane (UG/L)	107-06-2			O	0/ 265	0.0			NO
1,2-Dichloroethene (UG/L)	540-59-0	1.8E+00	3.5E+01	D	10/ 33	30.3	7.4E+00	7.4E+00	YES
1,2-Dichloropropane (UG/L)	78-87-5			O	0/ 263	0.0			NO
1,2-Diethylbenzene (UG/L)	135-01-3			O	0/ 47	0.0			NO
1,2-cis-Dichloroethene (UG/L)	156-59-2	9.1E-01	1.7E+01	D	46/ 166	27.7	1.3E+00	1.3E+00	YES
1,2-trans-Dichloroethene (UG/L)	156-60-5	8.5E-01	1.0E+01	D	13/ 248	5.2	7.3E-01	7.3E-01	YES
1,3-Dichlorobenzene (UG/L)	541-73-1			O	0/ 154	0.0			NO
1,3-Diethylbenzene (UG/L)	141-93-5			O	0/ 43	0.0			NO
1,3-cis-Dichloropropene (UG/L)	10061-01-5			O	0/ 254	0.0			NO
1,3-trans-Dichloropropene (UG/L)	10061-02-6			O	0/ 264	0.0			NO
1,4-Dichlorobenzene (UG/L)	106-46-7			O	0/ 154	0.0			NO
1,4-Diethylbenzene (UG/L)	105-05-5			O	0/ 43	0.0			NO
1-Chlorohexane (UG/L)	544-10-5			O	0/ 160	0.0			NO
2,2'-oxybis(1-chloropropane) (UG/L)	108-60-1			O	0/ 4	0.0			NO
2-Butanone (UG/L)	78-93-3	6.0E+00	6.5E+01	D	12/ 130	9.2	5.1E+00	5.1E+00	YES
2-Chloroethylvinylether (UG/L)	110-75-8			O	0/ 187	0.0			NO
2-Chlorotoluene (UG/L)	95-49-8			O	0/ 161	0.0			NO
2-Hexanone (UG/L)	591-78-6	1.0E+00	1.0E+00	D	1/ 33	3.0	5.4E+00	1.0E+00	NO
4-Chlorotoluene (UG/L)	106-43-4			O	0/ 139	0.0			NO
4-Methyl-2-pentanone (UG/L)	108-10-1			O	0/ 76	0.0			NO
Acetone (UG/L)	67-64-1	1.0E+00	1.7E+01	D	23/ 75	30.7	9.2E+00	9.2E+00	YES
Acetonitrile (UG/L)	75-05-8			O	0/ 48	0.0			NO
Acrylonitrile (UG/L)	107-13-1			O	0/ 48	0.0			NO
Benzene (UG/L)	71-43-2	2.5E+00	2.5E+00	D	1/ 275	0.4	1.2E+00	1.2E+00	NO
Benzyl Chloride (UG/L)	100-44-7			O	0/ 11	0.0			NO
Bromochloromethane (UG/L)	74-97-5	2.6E+01	2.6E+01	D	1/ 1	100.0		2.6E+01	YES

Analytes Detected in Groundwater in the Bedrock Wells

Analyte (units)	CAS Number	Minimum Detect	Maximum Detect	Dist.	Results >Detection Limit	% Results >Detection Limit	95% UCL of Mean	Exposure Concentration	Detection in Greater than 5%
Bromodichloromethane (UG/L)	75-27-4			O	0/ 264	0.0			NO
Bromoform (UG/L)	75-25-2			O	0/ 264	0.0			NO
Bromomethane (UG/L)	74-83-9			O	0/ 65	0.0			NO
Carbon Disulfide (UG/L)	75-15-0			O	0/ 76	0.0			NO
Carbon Tetrachloride (UG/L)	56-23-5	1.5E+00	1.5E+00	D	1/ 264	0.4	8.6E-01	8.6E-01	NO
Chlorobenzene (UG/L)	108-90-7	1.0E+00	1.0E+00	D	1/ 266	0.4	1.2E+00	1.0E+00	NO
Chloroethane (UG/L)	75-00-3			O	0/ 81	0.0			NO
Chloroform (Trichloromethane) (UG/L)	67-66-3	5.8E-01	1.1E+00	D	4/ 265	1.5	5.5E-01	5.5E-01	NO
Chloromethane (UG/L)	74-87-3	3.4E+00	3.4E+00	D	1/ 80	1.3	3.7E+00	3.4E+00	NO
Chlorotoluene (UG/L)	25168-05-2			O	0/ 50	0.0			NO
Dibromochloromethane (UG/L)	124-48-1			O	0/ 259	0.0			NO
Dibromomethane (UG/L)	74-95-3	2.8E+00	2.8E+00	D	1/ 213	0.5	1.0E+00	1.0E+00	NO
Dichlorodifluoromethane (UG/L)	75-71-8			O	0/ 34	0.0			NO
Dichloromethane (Methylene Chloride)	75-09-2	1.0E+00	6.1E+02	D	46/ 264	17.4	3.3E+00	3.3E+00	YES
Ethylbenzene (UG/L)	100-41-4			O	0/ 276	0.0			NO
FREON-113 (UG/L)	76-13-1	2.2E+00	2.2E+00	D	1/ 149	0.7	1.1E+00	1.1E+00	NO
Fluorobenzene (UG/L)	462-06-6	3.9E+01	3.9E+01	D	1/ 1	100.0		3.9E+01	YES
Hexane (UG/L)	110-54-3			O	0/ 4	0.0			NO
Iodomethane (UG/L)	74-88-4			O	0/ 4	0.0			NO
Monobromobenzene (Phenyl bromide)	108-86-1			O	0/ 210	0.0			NO
O-Chloroflurobenzene (UG/L)	348-51-6	3.2E+01	3.2E+01	D	1/ 1	100.0		3.2E+01	YES
Styrene (UG/L)	100-42-5			O	0/ 33	0.0			NO
Tetrachloroethene (UG/L)	127-18-4	3.0E-01	2.5E+01	D	50/ 264	18.9	2.4E+00	2.4E+00	YES
Toluene (UG/L)	108-88-3	1.0E+00	8.0E+00	D	8/ 276	2.9	1.2E+00	1.2E+00	NO
Trichloroethylene (TCE) (UG/L)	79-01-6	6.0E-01	4.6E+01	X	139/ 273	50.9	4.7E+00	4.7E+00	YES
Trichlorofluoromethane (UG/L)	75-69-4			O	0/ 221	0.0			NO
Vinyl Acetate (UG/L)	108-05-4			O	0/ 76	0.0			NO
Vinyl Chloride (UG/L)	75-01-4			O	0/ 265	0.0			NO
Xylenes, Total (UG/L)	1330-20-7			O	0/ 270	0.0			NO

APPENDIX J

Data Review and Additional Field Work

Some of the historical analytical results from samples taken within the Phase I property area are elevated with respect to a risk-based comparison criterion. The specific comparison level used was three times the 10^{-5} RBGV plus background. Twenty-three sample locations were identified with results for Plutonium 238 (3 locations), Thorium 230 (1 location) and Thorium 232 (19 locations) above the comparison values. These results have been included in the Residual Risk Evaluation for this property and the report indicates that the risk remains within acceptable levels. However, in some cases the results are significantly elevated above guideline values and warrant additional evaluation. Table 1 lists the locations with the exceedance, the contaminant that exceeds the comparison value, the observed result, the Project Code, Date the Sample was collected, Method Code, and Method Description. Figure 1 illustrates the sample locations. The process followed to determine what locations warranted additional field activities and the results of those activities are summarized here.

Locations 288, I13831, S0788, S0986, S0985, SCR450
Based on evaluation of other nearby sample results or other known conditions, DOE and the regulators agreed that these locations did not warrant additional field investigation. Information considered for each sample location is summarized as follows:

- Location 288 was sampled in 1984. This is a borehole sample appearing in the excavation footprint of PRS 421. Multiple boring locations surrounding the spot are flagged as being removed. Original depth is unknown.
- Location I13831 was sampled in 1999. It is a borehole location at the edge of the soil removed for installation of the drain. According to information in MEIMS the depth was 0-.3 feet. This location is surrounded by sample locations that have been flagged as removed.
- Location S0788 was sampled in 1984. It is a surface location previously binned with the Salt Storage Building as requiring No Further Assessment.
- Location S0986 was sampled in1983. It is a surface sample surrounded by multiple sample locations.
- Location S0985 was sampled in 1984. It is a surface sample location apparently in the road with multiple sample locations surrounding the original spot.
- Location SCR450 was sampled in 1992 and is under a concrete pad that was investigated as part of the recent verification sample effort at PRS 276. The original contaminant concentrations were not found.

Locations S0777 & S0598
Sample results from the Rad Site Survey indicate low level Thorium 232 results (3.71 & 4.3 pCi/g respectively). These locations are separated from other PRS boundaries and were not likely considered for inclusion as a PRS due to the low levels indicated. Other single sample results from the Rad Site Survey were made PRSs early in the ER process at Mound due to results that were significantly higher. DOE and the regulators agreed that a FIDLER survey of the

area surrounding the above sample locations would be conducted out to a radius of 25'.

Locations S1044, S1006, S1007, S1043, SCR 394, & MND08-0023
These locations are all in the PRS 406 boundary. PRS 406 was binned NFA by the core team in March 1996. The binning was based on data collected from the OU-5 New Property Investigation. The historical information from the Rad Site Survey led to the Remedial Investigation effort on the OU-5 New Property. Sample location SCR 394 is reported to be a borehole at 0' depth. Only one interval is reported in the database. Sample location MND08-0023 is reported to be a borehole over the interval 0-0.8' in depth. Only one interval is reported in the database. DOE and the regulators agreed that a FIDLER survey of the area surrounding the above sample locations (S1044, S1006, S1007, MND08-0023) would be conducted out to a radius of 25'.

Locations SCR 342, SCR 366, 91CC, 185SW, 74-H
These locations are in the PRS 407 area. PRS 407 and 281 were closed with the approval of the Building 21 OSC Report. Remediation was performed at PRS 407 based on the results of characterization conducted in June 1995 and reported in the Building 21 and Surrounding Soils Data Report. The investigation also determined other areas within the sample grid did not require remediation. Sample location 185SW is reported to be a borehole from 0-1' in depth Sample locations SCR 342 & SCR 366 are boreholes with multiple reported intervals and no depth information in the database. These two locations are in the middle of the drainage ditch and have likely been disturbed by the installation of the concrete drainage controls. DOE and the regulators agreed that a FIDLER survey of the area surrounding the above sample location (74-H) would be conducted out to a radius of 25'.

Locations S0982, 74-K, 74-J, & 304-19
These locations are in the PRS 304 area. PRS 313 & 304 were binned NFA by the Core Team in February 1997. PRS 304 was later rebinned removal action and an OSC report was approved by the Core Team in December 1998 (PRS 313 remained NFA) Sample location 304-19 is a Thorium 230 result of 7.51 pCi/g with a detection limit of 5.8 pCi/g. It was collected in the 0-1 foot interval of the borehole in October 1998. This sample was also reported in the OSC report as sample id 004386. Sample location S0982 was specifically investigated in conjunction with PRS 313. A diamond pattern of boreholes was drilled around this location on a 10' radius to 4' in depth. The results of this investigation reported in the Other Soils Characterization Report in May 1996 indicate "no radiological, organic, or inorganic compounds in concentrations exceeding the action levels". Sample location S0982 is essentially coincident with location 74-K Sample locations 74-H, 74-J & 74-K are reported to be near surface locations in the Site Survey Sub-Report – Mound Sub-Section 4. DOE and the regulators agreed that a FIDLER survey of the area surrounding the above sample locations (74-J) would be conducted out to a radius of 25'.

FIDLER Survey Results

During the FIDLER survey for locations S0598 and S1006/S1007, an isolated spot within the 25' radius circle around the S1006/S1007 location (the only remaining location with historical elevated results for Plutonium 238) indicated a FIDLER reading slightly above background and a sample was sent for gamma spec analysis. The results indicated a level of 4.07 pCi/g of Thorium 232. DOE and the regulators agreed that the soil in the area would be scooped up and the area confirmed clean via FIDLER survey. The elevated result from the initial FIDLER survey within the 25' circle surrounding sample location S1006/S1007 was removed. Initially the area was hand dug. During this excavation a large bush was removed and FIDLER surveys of the area under the bush indicated additional areas of contamination. The FIDLER was used to continue surveying the surrounding vicinity and the resulting contamination area was on a T shaped line about 25' long and 2' wide. Contamination was not consistent along this area and the highest gamma spec result taken at the highest FIDLER location indicated about 7 pCi/g of Thorium 232. Due to the expanded size of the removal area, a track hoe excavator was brought in to complete the excavation of material. Figure 2 depicts the area in question along with other features including sample locations within the excavation that were analyzed via gamma spectrometry. The excavation boundary was surveyed in, however the majority of soil removed was from the central areas. The outer areas were disturbed by the excavator and therefore included within the boundary. The results of the gamma spectrometry surveys indicate no additional contamination above cleanup objectives and the data are included in Table 2.

The FIDLER surveys surrounding the remaining sample locations were conducted on July 11. There were no indications of additional areas of elevated contamination from this FIDLER survey.

Table 3 lists the twenty-three locations examined and their disposition.

Table 1: Sample Results Exceeding Guideline Values

Project Code	Sample Location	Contaminant	Result	Units	Method Code	Date Collected	Method Description
RSS	S1006	Plutonium-238	396.4	PCI/G	PD80030-1343	01-Mar-82	PD80030-1343, Pu, U, Th & Pb-210 in Solid Samples
RSS	S1007	Plutonium-238	216.3	PCI/G	PD80030-1343	01-Mar-82	PD80030-1343, Pu, U, Th & Pb-210 in Solid Samples
RSS	S0788	Plutonium-238	234	PCI/G	PD80030-1343	01-Sep-84	PD80030-1343, Pu, U, Th & Pb-210 in Solid Samples
SCRDATA	304-19	Thorium-230	7.51	PCI/G	GERMANIUM	22-Oct-98	Germanium Detector Screen, Radioisotopes
RSS	S0598	Thorium-232	4.3	PCI/G	PD80030-3605	01-Oct-83	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S0777	Thorium-232	3.71	PCI/G	PD80030-3605	01-Sep-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
BLDG21	185SW	Thorium-232	4.95	PCI/G	NDI1986	- -	NDI1986, Gamma Spectrometry
OU6RECON	MND08-0023	Thorium-232	11.3	PCI/G	BICRON	17-Aug-89	Bicron Detector Screening, Pu & Th
SCRDATA	SCR366	Thorium-232	7.3	PCI/G	BICRON	31-May-89	Bicron Detector Screening, Pu & Th
SCRDATA	SCR342	Thorium-232	9.3	PCI/G	BICRON	02-Jun-89	Bicron Detector Screening, Pu & Th
PRS407VERF	I13831	Thorium-232	5.24	PCI/G	NAS 1960	01-Jun-99	NAS 1960, Thorium Isotopes / Strontium-90
RSS	S0982	Thorium-232	14.94	PCI/G	PD80030-3605	01-Jul-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S0985	Thorium-232	7.73	PCI/G	PD80030-3605	01-Jul-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S0986	Thorium-232	7.13	PCI/G	PD80030-3605	01-Oct-83	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S1043	Thorium-232	5.8	PCI/G	PD80030-3605	01-Aug-85	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	S1044	Thorium-232	5.6	PCI/G	PD80030-3605	01-May-85	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	74-H	Thorium-232	80.1	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	74-J	Thorium-232	20.9	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	74-K	Thorium-232	15	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
RSS	288	Thorium-232	5.9	PCI/G	PD80030-3605	01-Apr-84	PD80030-3605, Pu in Sm Soil Sample, Acid-Leach
SCRDATA	SCR450	Thorium-232	4.8	PCI/G	BICRON	17-Jun-92	Bicron Detector Screening, Pu & Th
BLDG21	91CC	Thorium-232	6.16	PCI/G	NDI1986	12-Dec-94	NDI1986, Gamma Spectrometry
SCRDATA	SCR394	Thorium-232	24.4	PCI/G	BICRON	20-Oct-93	Bicron Detector Screening, Pu & Th

Table 2: Phase I Sampling from Area near S1006/S1007

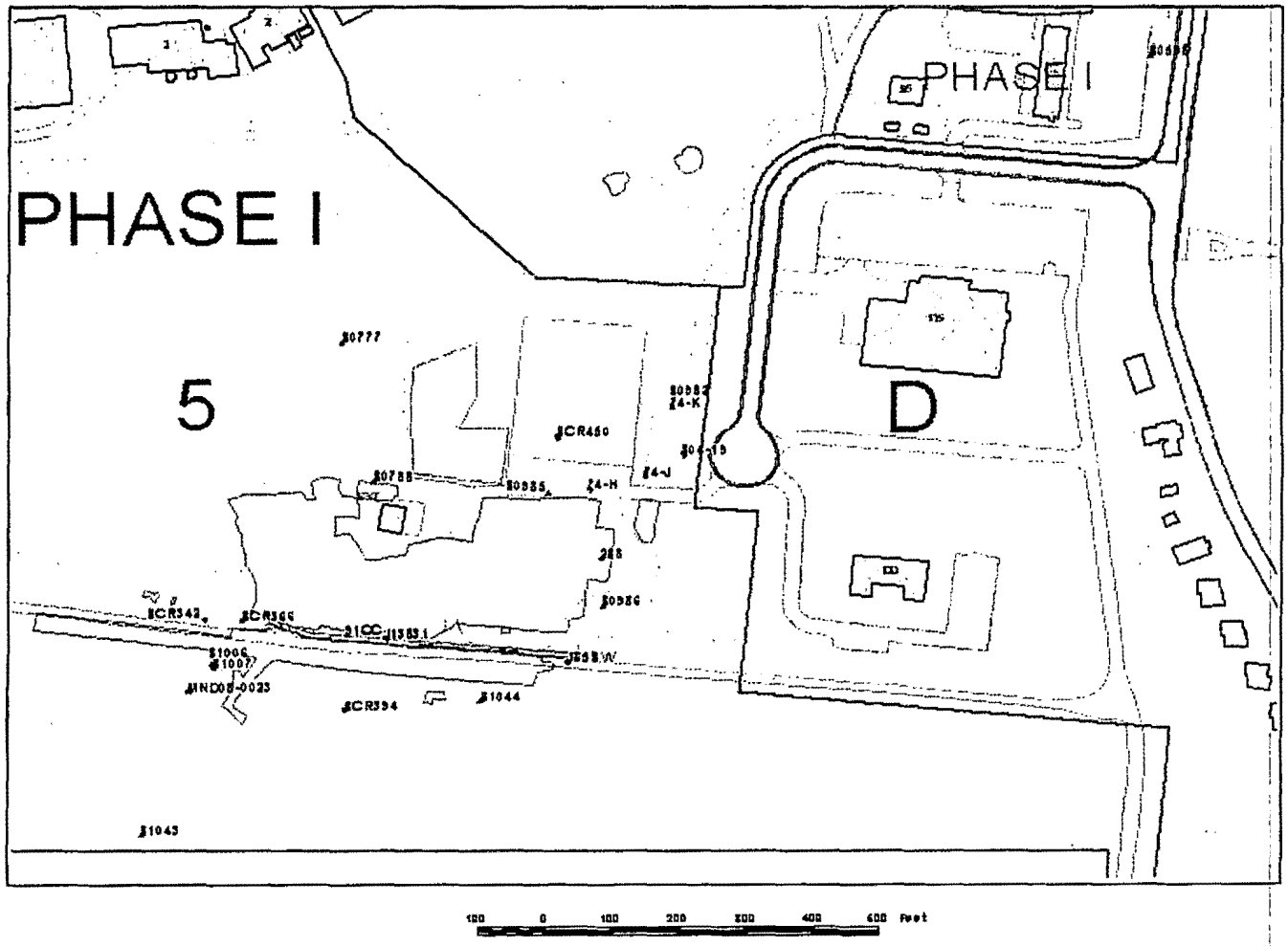
Results in pCi/g

Lab Sample ID	Sample Location	Co-60	Cs-137	Pb-210	Ra-226	Ac-227	Th-230	Th-230 MDA	Th-232	Pu-238	Pu-238 MDA	Am-241	U-235	U-238	Comments
ML14335	421-718-1	0	0.04	0.33	1.6	0	0	9.14	1.46	13.86	54.23	0			
ML14336	421-718-2	0	0.01	0.94	2.13	0	0	8.9	0.89	0	24.4	0			
ML14337	421-718-3	0.02	0.1	1.56	2.29	0	0	8.11	0.71	0	17.93	0.08			
ML14338	421-718-4	0	0	1.34	2.03	0	4.79	7.24	0.97	20.87	15.69	0.1			
ML14339	421-718-5	0.01	0	0.97	1.18	0	2.79	5.08	0.94	4.08	13.85	0			
ML14340	421-718-6	0	0.02	2.05	2.61	0.04	0	8.46	1	4.85	17.54	0			
ML14341	421-718-7	0	0.07	0.63	1.3	0	5.34	9.87	1.13	9.94	22.52	0			
ML14342	421-718-8	0	0.08	0.79	1.89	0	2.08	9.21	0.9	4.24	25.79	0.04			
ML14343	421-718-9	0	0.07	1.4	1.18	0.12	1.97	6.84	1.15	10.53	15.58	0.1			
ML14344	421-718-10	0.01	0.1	0.88	2.03	0.06	5.23	8.32	1.13	0	56.56	0.07			

Table 3: Sample Locations and Dispositions

Sample Location	Contaminant	Result	Units	Disposition
S1006	Plutonium-238	396.4	PCI/G	Fidler survey
S1007	Plutonium-238	216.3	PCI/G	Fidler survey
S0788	Plutonium-238	234	PCI/G	No field work, use nearby data
304-19	Thorium-230	7.51	PCI/G	No field work, use nearby data
S0598	Thorium-232	4.3	PCI/G	Fidler survey
S0777	Thorium-232	3.71	PCI/G	Fidler survey
185SW	Thorium-232	4.95	PCI/G	No field work, use nearby data
MND08-0023	Thorium-232	11.3	PCI/G	Fidler survey
SCR366	Thorium-232	7.3	PCI/G	No field work, use nearby data
SCR342	Thorium-232	9.3	PCI/G	No field work, use nearby data
I13831	Thorium-232	5.24	PCI/G	No field work, use nearby data
S0982	Thorium-232	14.94	PCI/G	No field work, use nearby data
S0985	Thorium-232	7.73	PCI/G	No field work, use nearby data
S0986	Thorium-232	7.13	PCI/G	No field work, use nearby data
S1043	Thorium-232	5.8	PCI/G	No field work, use nearby data
S1044	Thorium-232	5.6	PCI/G	Fidler survey
74-H	Thorium-232	80.1	PCI/G	Fidler survey
74-J	Thorium-232	20.9	PCI/G	Fidler survey
74-K	Thorium-232	15	PCI/G	No field work, use nearby data
288	Thorium-232	5.9	PCI/G	No field work, use nearby data
SCR450	Thorium-232	4.8	PCI/G	No field work, use nearby data
91CC	Thorium-232	6.16	PCI/G	No field work, use nearby data
SCR394	Thorium-232	24.4	PCI/G	No field work, use nearby data

Figure 1: Phase I Hot Spot Exceedances

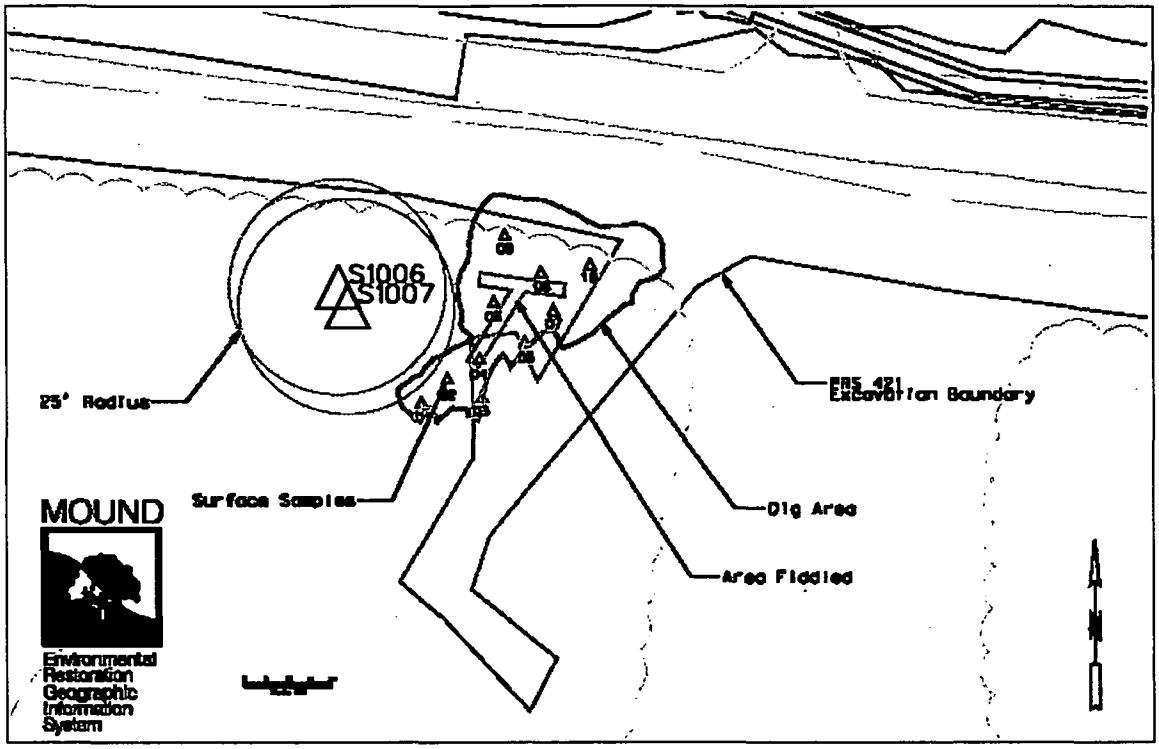


Phase 1 Exceedances
Excavated Boundaries
— Surveyed
-- Digitized
Parcel Boundary
— Outline

MOUND

08/01/03

Figure 2: Removal Area and Associated Sample Locations



APPENDIX K

Data Qualifiers

CLP Laboratory Data Qualifiers and their Used in the RRE

Inorganic Chemical Data	Definition	Included in RRE?
B	Reported value is <CRDL[a], but >IDL[b].	Yes
U	Compound was analyzed for but not detected.	Yes[c]
E	Value is estimated due to matrix interference.	Yes
N	Spiked sample not within control limits.	Yes
J	Value is an estimated quantity.	Yes
R	Quality control indicates that data is unusable.	No

Organic Chemical Data	Definition	Included in RRE?
U	Compound was analyzed for but not detected.	Yes[c]
J	Value is estimated, spectral identification criteria are met but the value is <CRDL.	Yes
B	Analyte found in associated blank as well as in sample.	Yes[e]
E	Concentration exceeds calibration range of GC/MS[d] instrument.	Yes
D	Compound identified in an analysis at a secondary dilution factor	Yes

a. CRDL means contract required detection limits
b. IDL means instrument detection limits
c. "U" qualified data, 1/2 result or 1/2 the detection limit is used in RRE calculations.
d. GC/MS means Gas Chromatograph/Mass Spectrometry
e. "B" qualified organic results. If blank sample contained a common lab contaminant, result considered positive only if concentration exceeded 10x the amount detected in the blank. If blank sample contained a constituent that is not a common lab contaminant, result considered positive only if concentration exceeded 5X the amount detected in the blank.

Response to Comments

on

Phase I
Residual Risk Evaluation
(Draft, July 2002)

September 2002

Response to Comments

from OEPA
on RRE Draft

Comment 1. A summary of the information and action associated with the review of the soil data in Phase I exceeding three times the 10^{-5} risk based guideline value plus any background value needs to be incorporated within this document.

Response 1. The following text was added to the end of Section 2.0: "Subsequent to the start of the Phase I risk evaluation process, several isolated locations were identified in Phase I with elevated radionuclide concentrations. Some of the historical analytical results from samples taken within the Phase I property area are elevated with respect to a risk-based comparison criterion. The specific comparison level used was three times the 10^{-5} RBGV plus background. Twenty-three sample locations were identified with results for Plutonium 238 (3 locations), Thorium 230 (1 location) and Thorium 232 (19 locations) above the comparison values. These results have been included in the Residual Risk Evaluation for this property and the report indicates that the risk remains within acceptable levels. However, in some cases the results are significantly elevated above guideline values and warrant additional evaluation. The process followed to determine what locations warranted additional field activities and the results of those activities are summarized in Appendix J." Appendix J was also added and provides a summary of the fieldwork performed.

Comment 2. As discussed, the sources for toxicity criteria used to calculate RBGV and risk should remain consistent with the hierarchy and sources listed in the RREM. The updated RBGVs include toxicity sources other than those listed in the RREM (IRIS, HEAST and NCEA). Please revised the RBGVs and calculated risk using only the values from the toxicity criteria sources listed in the RREM. Toxicity criteria for 1,1,1 – Trichloroethene and Trichloroethylene provided directly by NCEA should replace any NCEA value obtained through another source.

Response 2. The toxicity values used to recalculate RBGVs and risk were selected in a manner consistent with comment 2.

Comment 3. While reviewing the data CD, there are some records for <u>inorganics</u> in ground water that are lab qualified as a "B" meaning the reported value is greater than the instrument detection limit but less than the contract required detection limit. There are also data qualifiers associated with some of this data flagged with a "U" meaning undetected. Half the detection limit was used to calculate the EPC. The U data qualifier is questionable. Further discussion is needed on this data.

Response 3. The meaning of the lab qualifiers is correctly indicated in the comment. The data validator applied the U qualification during the validation process. This qualifier may have been assigned for reasons different from the assignment of the B qualifier. This was discussed at the August 8 comment resolution meeting.

The groundwater data subset with lab qualifier = B and data qualifier = U was reviewed. It was noted that this combination of qualifiers occurs for 18 inorganics, reported by three different labs in 1993-1994, and five different project codes. The impact on risk

was judged to be minimal so no changes in the text or tables are needed. There was agreement that this situation could be examined further as a potential lesson learned and may identify an additional data review tool or step in the assembly/review of the RRE data set.

Comment 4. Create a new sub-section in section 4.0 Toxicity Assessment to qualitatively discuss adverse effects associated with any COPC that does not have a slope factor or reference dose listed on Table 15.

Response 4. The following text was added to the end of the last full paragraph on page 33:

"The following constituents in Phase I do not have toxicity criteria accepted by HEAST or IRIS: VOCs (bromochloromethane, fluorobenzene, O-chloroflurobenzene), pesticides (chlordane), SVOCs (benzo(g,h,i)perylene, phenanthrene), and inorganics (bismuth, lead, and lithium).

"Although the USEPA has developed toxicity values for the oral and inhalation routes of exposure for many chemicals, they have not developed toxicity criterion for all chemicals and all exposure routes that were evaluated for Phase I. For this reason, acceptable literature databases (ATSDR, Sax's Dangerous Properties of Industrial Materials, Chemfinder.com, Risk Assessment Information System Website) were reviewed to determine if toxicological information on other COPCs is available. Information obtained in this fashion is discussed qualitatively.

"Bromochloromethane is a poison—it is mildly toxic by ingestion and inhalation (Reference 17). Fluorobenzene is also mildly toxic by ingestion and inhalation (Reference 17).

"Benzo(g,h,i)perylene is a polycyclic aromatic hydrocarbon (PAH). PAHs generally occur as complex mixtures (for example, as part of combustion products such as soot). The USEPA and International Agency for Research on Cancer have determined that benzo(g,h,i)perylene is not classifiable as to human carcinogenicity (Reference 18). Bismuth has been reported as poisonous to humans (Reference 17).

"Unlike most other chemicals, the hazard posed by inorganic lead is based on levels of lead in blood rather than on toxicity values. The USEPA has developed mathematical models for predicting concentrations of lead in the blood of children and adults resulting from exposure to soil, air, drinking water, food, and other sources. The USEPA compares the predicted blood-lead concentrations with a concentration of 10 micrograms of lead per deciliter of blood to decide whether lead presents a health risk. The USEPA has estimated that the concentration of lead in blood could exceed 10 ug/dL if the concentration of lead in soil at residences exceeds 400 mg of lead per kg of soil. In work areas, USEPA has estimated that the concentration of lead in soil should not exceed 750 to 1,750 mg/kg. In Phase I, the concentration of lead in soil was 16.7

mg/kg for the Construction Worker and 0.013 mg/kg for the Site Employee. Although certain lead compounds have been shown to cause cancer in animals, the risk of cancer is not typically evaluated for lead because people are more sensitive to lead's non-cancer effects than to its cancer effects. For radioactive isotopes of lead, the cancer risks were included in the risks from the appropriate long-lived decay chains in Phase I (Reference 19)."

Comment 5. Page vii, Executive Summary- First paragraph, second sentence – Revise sentence to incorporate the bold text. The revised sentence should state "A residual risk evaluation (RRE) quantifies human health risks **and non-cancer health effects** associated with residual levels of contamination remaining within an area to ensure that **current** and future users of the land will not be exposed to contaminant levels that are unacceptable. **In the National Oil & Hazardous Substances Pollution Contingency Plan (NCP, EPA 1990), EPA defines the** acceptable **risk range as 10^{-4} to 10^{-6} with a departure at 10^{-6}, and a hazard index of one is defined as the acceptable threshold for non-cancer health effects."** An explanation of the meaning of the risk range and HI should be placed in this section as they are introduced (presently found in Section 2.4.3). Please spell out HI.

Response 5. The text was changed to read as follows:
"A Residual Risk Evaluation (RRE) quantifies human health risks and non-cancer health effects associated with residual levels of contamination remaining within an area to ensure that current and future users of the land will not be exposed to contaminant levels that are unacceptable. In the future, Phase I may be used for commercial or industrial land use. In the National Oil and Hazardous Substances Pollution Contingency Plan (NCP, USEPA 1990), the United States Environmental Protection Agency (USEPA) defines the acceptable risk range as 10^{-4} (increased cancer incidence of 1 in 10,000) to 10^{-6} (increased cancer incidence of 1 in 1,000,000) with a departure at 10^{-6}, and a Hazard Index (HI) of one is defined as the acceptable threshold for non-cancer health effects. The acceptable threshold for non-cancer constituents is a HI of less than or equal to one."

Comment 6. Page vii, Executive Summary - Third paragraph - Add the bold text to last sentence of the paragraph therefore the sentence should read "Overall, cancer and non-cancer risks associated with exposure to soil and air **in both the current and future use scenarios** fall within the acceptable risk range....."

Response 6. The text was changed as requested.

Comment 7. Page vii, Executive Summary - Last paragraph - This paragraph is difficult to follow since the text discussion keeps switching between the current construction worker and current and future site employee (first sentence, for example). Revise this paragraph to discuss the risk and non-cancer hazard results for the construction worker separate from the site employee. Specifically, one paragraph will summarize the results for the construction worker (summarize risk estimates and non-cancer HI's for current use in a few sentences and then

summarize the risk and HI results for the future scenario). A separate paragraph will discuss the risk and HI results (current scenario and then future scenario) for the site employee.

Response 7. The discussion of construction worker and site employee was separated into two paragraphs:

"Cumulative incremental cancer risks are within the acceptable risk range for the current and future Construction Worker Scenario. Cumulative incremental non-cancer hazards for the current Construction Worker Scenario meet the acceptable level. Cumulative incremental non-cancer hazards exceed the acceptable HI of one for the future Construction Worker.

Cumulative incremental cancer risks are within the acceptable risk range for the current Site Employee Scenario. The cumulative incremental risk for the future Site Employee is at the limit of the acceptable risk range. Cumulative incremental non-cancer hazards for the current Site Employee Scenario meet the acceptable level. Cumulative incremental non-cancer hazards exceed the acceptable HI of one for the future Site Employee."

Comment 8. Page viii, Executive Summary - Last paragraph - Remove the first three full sentences in this paragraph (i.e. The groundwater model does not take into account.....). Revise the paragraph, beginning with the first partial sentence at the top of the page, to state "groundwater and are **most likely** due to the conservative assumptions used in the **flow tube model to assess future groundwater.** These assumptions are likely to result in an overestimation of **future** groundwater risk. Details of the uncertainties associated with the assessment of future exposure to groundwater are provided in Section 6.0, Uncertainties. Given the conservative nature of the RRE and the associated uncertainties, the risks presented in the table below represent the upper-bound plausible limit of risks (worst case scenario) **for Phase I.** Remove the last sentence of this paragraph (i.e. based on the protective measures presented in the Proposed Plan.....). Risk Management decisions should be made in the Rod and Proposed Plan.

Response 8. The text was changed as requested.

Comment 9. Page ix, Executive Summary – As discussed, the Overall Summary of Risks table will be removed. Move Tables 34-36 up to replace the removed table.

Response 9. The text was changed as requested. References in Executive Summary to Summary Table were changed to Tables 34-36.

Comment 10. Page 1, Section 1.0 Introduction - Second paragraph - Revise last sentence to include bold text "In this report residual risk at Phase I is evaluated for **both current and future** commercial/industrial use of the parcel."

Response 10. The text was changed as requested.

Comment 11. Page 1, Section 1.0 Introduction - Last paragraph - Revise the second to last sentence to include bold text "A Residual risk evaluation assesses human health risks associated with residual levels of contamination remaining within an area to ensure that future users of the land will not be exposed to contaminant levels that would pose unacceptable risks **and/or adverse health effects.**

Response 11. The text was changed as requested.

Comment 12. Page 1, Section 1.0 Introduction - Last paragraph - Revise the last sentence to include bold text "The Phase I RRE results will be used **by risk managers**, together with Applicable....."

Response 12. The text was changed as requested.

Comment 13. Page 2, Section 1.1 Purpose of Residual Risk Evaluation - Revise the first sentence to include bold text "The **purpose** of the Phase I RRE .....remaining after all necessary **remedial** actions within Phase I have been taken.

Response 13. The text was changed as requested.

Comment 14. Page 2, Section 1.2, Scope of Phase I RRE - First paragraph - Revise third sentence to include bold text "Residual contaminants in Phase I were evaluated for two potential receptor groups: construction workers.....and **air for an exposure duration of** 5 years, and site employees.....**for an exposure duration of** 25 years."

Response 14. The text was changed as requested.

Comment 15. Page 2, Section 1.2, Scope of Phase I RRE - First paragraph - Replace the second to the last sentence of this paragraph with "The assumptions used in this evaluation are presented in Table 14.

Response 15. The text was changed as requested.

Comment 16. Page 2, Section 1.2, Scope of Phase I RRE - First paragraph - Move the last sentence of this paragraph to the beginning of the paragraph after the second sentence, which defines RME.

Response 16. The text was changed as requested.

Comment 17. Page 2, Section 1.2 Scope of the Phase I RRE – Second to last sentence – Identify the "EPA" mentioned as USEPA. Please complete this consistency throughout the document.

Response 17. The text was changed as requested.

Comment 18. Page 2, Section 1.2 Scope of the Phase I RRE – Last sentence on page – Change the term "Incremental risk can" to "Incremental risk is".

Response 18. The text was changed as requested.

Comment 19. Page 3, Section 2.0 Data Compilation and Evaluation - Change the fourth sentence to state **"All available information and results were reviewed to ensure that only analytical data of the highest quality and confidence were used in the quantitative portion of the risk assessment. Data determined to be of insufficient quality for use in the risk assessment were removed from the data set and segregated based on the following criteria. "**

Response 19. The text was changed as requested, with "highest" replaced by "sufficient."

Comment 20. Page 4, Section 2.0 Data Compilation and Evaluation - Paragraph at top of page - Remove the last sentence (i.e. The measurements of antimony.....) and replace with "Historical data that is no longer representative of current conditions, based on trends of subsequent analytical results, were segregated from the data set."

Response 20. The text was changed as requested.

Comment 21. Page 4, Section 2.0 Data Compilation and Evaluation - Remove the last sentence of this section and replace with the following **"Analytical results not segregated were determined to be of sufficient quality for use in the risk assessment. This data was the basis for the risk calculations and can be found on the attached CD-Rom. Data that was segregated (based on the criteria discussed above) and was not used in the risk calculations can also be found on the CD-Rom."**

Response 21. The text was changed as requested.

Comment 22. Page 4, Section 2.1 Data Quality Assessment - Add the following to the end of the last sentence of this section ".....were separated from the data set **and not used in the risk calculations.**

Response 22. The text was changed as requested.

Comment 23. Page 4, Section 2.2 Environmental Media Considered and Data Availability – Add explosives to the list of analyses.

Response 23. The text was changed as requested.

Comment 24. Page 5, Section 2.2 Environmental Media Considered and Data Availability - Revise the last sentence of the first paragraph to include the bold text "Phase I does not contain surface water **bodies or sediment**"

Response 24. The text was changed as requested.

Comment 25. Page 6, Section 2.32 Data Analysis - Revise the first sentence to state **"If the data follows a lognormal distribution, the data must first be transformed using the natural log function. The 95% UCL is then calculated using the H-Statistic**. The 95% UCL equation of the arithmetic mean **for lognormal distributions** was calculated as follows:"

Response 25. The text was changed as requested.

Comment 26. Page 5, Section 2.3 Data Analysis – In the 95% UCL equation, the t statistic table is in Reference 9, not Reference 4 as indicated in the text. Please correct.

Response 26. The text was corrected.

Comment 27. Page 6, Section 2.32 Data Analysis - Equation - If it is possible in the word processing software used to generate this report, please use the superscript function instead of the "^" in any equations presented in this report.

Response 27. Not possible as text is presently entered.

Comment 28. Page 6, Section 2.32 Data Analysis - Add the following to the text after the presentation of the 95% UCL equation for lognormal distribution, **"The 95% UCL for data sets in which the distribution is not normal or lognormal, was determined by assuming a lognormal distribution. EPA guidance states that most environmental data sets are log normally distributed, rather than normally distributed, therefore it is reasonable to assume a lognormal distribution (EPA, 1992 = Reference 10).**

Response 28. The text was added as requested.

Comment 29. Page 6, Section 2.3 Data Analysis – The 95% UCL equation is incomplete. Add after "e = constant", "(base of the natural log)" and add "mean = mean of the transformed data".

Response 29. The text was changed as requested.

Comment 30. Page 6, Section 2.3 Data Analysis – Last sentence – Appendix F is referenced as the source for data and lab qualifiers. The qualifiers are missing from this document. Please add them as an appendix.

Response 30. The explanation of data qualifiers was added as Appendix K.

Comment 31. Page 6, Section 2.4 Data Screening Process - Revise the title of this section to **"Screening Process for the Selection of Contaminants of Potential Concern."** This title is clearer and does not confuse the reader with the data quality screening that was discussed in previous sections of this report.

Response 31. The text was changed as requested. Table of Contents was also changed.

Comment 32. Page 6, Section 2.4 Data Screening Process - Second paragraph - Revise first sentence to include bold "To make the COPC selection....**separate tables are provided for each receptor and the respective exposure scenario** (i.e. Current and Future Construction Worker vs. Current and Future Site Employee)."

Response 32. The text was revised as requested. The original sentence was replaced with the following: "To make the COPC selection process easier to follow, separate tables are provided for each receptor and the respective exposure scenario (construction worker and site employee) for current/future soil, current groundwater, and future groundwater."

Comment 33. Page 7, Section 2.4 Data Screening Process - Second full sentence on the page – Change the sentence to read "The second table identifies final COPCs to be carried through the RRE by comparing the EPCs for the COPCS carried through from the first screening table to background values.

Response 33. The text was changed as requested.

Comment 34. Page 7, Section 2.4.2, Screening Constituents Based on Background - First sentence - Electronically paste the tables summarizing the background levels as an appendix in this RRE Report.

Response 34. Table 37 and 38 were added. Table 37 lists Mound background values for soil contaminants. Table 38 lists Mound background values for groundwater contaminants.

Comment 35. Page 8, Section 2.4.2 Screening Constituents Based on Background – First sentence in the first full paragraph – Remove the word "initial" from in front of COPCs and replace with ..."COPCs carried through from the first screening table, the 95% UCL ..."

Response 35. The text was changed as requested.

Comment 36. Page 8, Section 2.4.3 Screening Constituents Based on Guideline Values - Move the last paragraph of this section (begins on page 9 "A Hazard Quotient....") before the preceding paragraph (begins on page 8 "Some of the radionuclides....").

Response 36. The paragraph was moved as requested.

Comment 37. Page 10, Section 3.1 Characterization of Exposure Setting - This section must include a brief and general overview summarizing the "atmosphere" or "setting" of Phase I for current/future industrial use. This is necessary information which "sets the stage" for the reader to get a feel for the site and potential exposure pathways. For example, information presented in the first four paragraphs of Appendix F Building Information can be summarized to address this comment.

Response 37. The information in the first four paragraphs of Appendix F was summarized and added here:
"Phase 1 includes 13 existing buildings and explosives magazines and 25 former production-era building sites including buildings, explosives storage magazines and an electrical generator. The properties in Phase I have supported a number of operations; explosives testing and production-related activities, administrative activities (i.e., offices and site security operations), utilities operations, waste processing operations (the Burn Area), and cleanup waste storage operations .

"Phase I also includes building sites for around nine buildings constructed in 1947, in order to support the construction of the original site buildings. An additional building location includes the site of a building that was transferred from Dayton Unit III, to the Mound site in 1949. This building was later moved to another location on the Mound site, and is known as "Building 19." The building sites dating from the construction era include a storage warehouse, an explosives and detonator storage operation for construction related explosives, as well as a quonset-type building, and some other temporary buildings.

"Phase I lands have also been used for various waste and non-waste storage activities including waste container management, equipment management, and for other general plant uses."

Comment 38. Page 11, Section 3.3 Identifying Exposure Scenarios - Include the rationale for evaluating only two receptors (construction worker and site employee) in the text. Also state that the future use of the site is restricted to industrial use.

Response 38. The following text was inserted at the beginning of Section 3.3 :

"DOE, its regulators, and its stakeholders have agreed that the future use of the Mound Plant property will be commercial/industrial. Receptor scenarios were selected that

represent reasonable exposures in a commercial/industrial setting. Consistent with the RREM, two scenarios are presented in this RRE: the construction worker scenario and the site employee scenario."

Comment 39. Page 12, Section 3.3.1 Construction Worker Scenario - Top of page. Reference 14 is incorrect and should be revised to Reference 16, if appropriate.

Response 39. In response to comment 40, this paragraph was omitted.

Comment 40. Section 3.3.1 Construction Worker Scenario, page 12: First paragraph. The sentence that states "*The exclusion of this pathway is expected to have a minimal impact on the final risk based calculations.*" is confusing and implies that exposure via the dermal pathway was not quantified in this RRE. Please clarify text stating that exposure via the dermal pathway was assessed since results for the dermal route are presented in this report.

Response 40. The paragraph referenced was omitted.

Comment 41. Page 12, Section 3.3.1 Construction Worker Scenario – Add to the exposure pathways the following " dermal contact with contaminated soil".

Response 41. The text was changed as requested.

Comment 42. Page 12, Section 3.3.1 Construction Worker Scenario - Bullets - If perched groundwater is present in Phase I, then the construction worker receptor could potentially be exposed to groundwater during activities such as excavation, utility repair/installation, remediation. Therefore, dermal contact, inhalation and incidental ingestion of groundwater could occur. Provide rationale supporting those exposure pathways that are not complete.

Response 42. By definition of the scenario, the construction worker receptor is not potentially exposed during remediation activities. These activities are complete prior to the introduction of the construction worker/site employee to the site.

The following will be added to the final paragraph of Section 3.3.1 after the current bullet list:

"The following are potential exposure pathways that were judged to be not as significant as those above and are therefore not quantitatively addressed:

- incidental ingestion of groundwater,
- inhalation of volatile emissions from groundwater, and
- dermal contact with groundwater.

If these exposure pathways were found to be significant, the risks would be managed."

Comment 43. Page 13, Section 3.3.2 Site Employee - Bullets - Dermal contact with surface soil is potentially complete considering that incidental ingestion may involve hand/mouth interaction. All complete pathways must be evaluated in the RRE or the exclusion justified within the text.

Response 43. The following text was added:

"The site employee scenario assumes that a worker will be employed in an office or commercial setting, with the majority of working hours spent indoors. Such occupations are not expected to involve direct work with surrounding soils, as would be expected with the construction worker scenario. As a result, potential dermal exposure to soils would be minimal or non-existent. Hence, it can reasonably be assumed that dermal contact is not a viable pathway for the site employee scenario."

Comment 44. Page 13, Section 3.4 Exposure Point Concentration - This section is repetitive with the discussion on page 5. Consider combining these sections into one.

Response 44. Section 3.4 was omitted and subsequent sections were renumbered.

Comment 45. Page 14, Section 3.5.1 Soil Exposure Pathways –Add to this section the equation for calculating absorbed dose from dermal exposure to soil (Pg. 38 RREM). Discuss application of this pathway.

Response 45. The following text was added :

The absorbed dose from dermal exposure to soil was estimated using the following equation:

$$\text{Dermally absorbed dose (mg/kg-day)} = \frac{DA_{event} \times EF \times SA \times ED}{BW \times AT}$$

$$DA_{event} = C_{soil} \times AF \times ABS \times CF$$

Where:

C_{soil} = contaminant concentration in soil (mg/kg)
AF = adherence factor of soil to skin (mg/m^2 – event)
SA = skin surface area available for contact (m^2)
ABS = chemical-specific absorption factor (dimensionless)
EF = exposure frequency (events/yr)
ED = exposure duration (yr)
BW = body weight (kg)
AT = averaging time (yrx365day/yr)
CF = conversion factor (10^{-6} kg/mg)

This pathway applies only to the current and future construction worker. The dermally absorbed dose was calculated for those chemicals with an ABS available.

Comment 46. Page 17, Section 3.5.2 Groundwater Exposure Pathways – Add to this section the equation for calculating intake from ingestion of radionuclides in groundwater (Pg. 39 RREM).

Response 46. The following text was added prior to "The following equation.....of radionuclides from dermal contact with water"

The following equation was used to calculate the intake of radionuclides from ingestion of water:

$$\text{Intake (pCi)} = C_w \times IR \times ED \times EF$$

Where:

C_w = radionuclides concentration in water (pCI/L)
IR = ingestion rate (L/d)
ED = exposure duration (yr)
EF = exposure frequency (d/yr)

Comment 47. Page 17, Section 3.5.2 Groundwater Exposure Pathways – In the equation on this page, the units for the "Constituent Intake" should be mg/kg-day.

Response 47. The text was changed as requested.

Comment 48. Page 18, Section 3.5.2 Groundwater Exposure Pathways – In the first equation on this page, please remove the extra line under the denominator of the equation.

Response 48. Not possible as presently entered.

Comment 49. Page 20, Section 4.0 Toxicity Assessment – First paragraph, last sentence – Add "air" to the list of exposures summed in the tables.

Response 49. The text was changed as requested.

Comment 50. Page 20, Section 4.0 Toxicity Assessment – In the last sentence please spell out RfDs.

Response 50. The text was changed as requested.

Comment 51. Page 25, Section 5.2.1 Construction Worker Risk Results – Please list the Hazard Index values for soil.

Response 51. The values have been added.

Comment 52. Page 25, Section 5.2.1 Construction Worker Risk Results - First Paragraph, second to the last sentence – Change the reference to radium from 226 to radium-228.

Response 52. After revisions to calculations, uranium-238 is the appropriate reference.

Comment 53. Page 25, Section 5.2.1 Construction Worker Risk Results – Current Groundwater – List the background residual risks and hazard as was done in the soil and future groundwater sections.

Response 53. The information was added as requested.

Comment 54. Page 25, Section 5.2.1 Construction Worker Risk Results – Future Groundwater, second to the last sentence – This sentence will change due to the recalculation of the dermal pathway for tritium (see comment on Appendix C, Table 28).

Response 54. The paragraph was rewritten to be consistent with the revised calculations.

Comment 55. Page 26, Section 5.2.2 Site Employee Risk Results – Soil – List the values for total, incremental and background Hazard Index.

Response 55. The values were listed as requested.

Comment 56. Page 26, Section 5.2.2 Site Employee Risk Results – Soil, fourth sentence – Change the reference from plutonium as a basis for the background risk to arsenic.

Response 56. With revised values, the reference is to thorium-232.

Comment 57. Page 27, Overall Summary of Risk Results – First sentence - If the summary table in the Executive Summary is removed as discussed, please change this sentence to reflect the action.

Response 57. The text, "...on a table included with the executive Summary and..." was removed.

Comment 58. Page 27, Section 6.0 Uncertainties - Uncertainties associated with the methods used to assess future groundwater exposure should be discussed here. Also, include a discussion regarding why the flow tube model was designed utilizing conservative assumptions (potential data gaps and limited characterization).

Response 58. The last two paragraphs of Section 6.1 Uncertainty in Data Analysis discuss these topics. To emphasize the information in parentheses above, the following was added after "characterization of the bedrock aquifer" in the last paragraph of section 6.1:

"(data gaps over time, changing analytical techniques, limited samples locations, limited flow)".

Comment 59. Page 29, Section 6.2 Uncertainty in Exposure Assessment - Last paragraph, third sentence – Please change the sentence to read "Chromium VI is highly reactive and as a result has a very short holding time." Chromium VI is not difficult to measure, as long as it is present.

Response 59. The text was changed as requested.

Comment 60. Page 29, Section 6.2 Uncertainty in Exposure Assessment – Last paragraph, fourth sentence – The text references 2228 measurements of chromium contributing to this risk, four with results of 0.01 mg/l and an EPC of 960 mg/l. The Tables in Appendix I sum to 180 measurements with four for chromium VI, all at a detection level of 0.02 mg/l. The EPC, according to Table 30 for chromium is 0.958 mg/l. Please reconcile.

Response 60. The text was changed to read as follows:

"Of the 180 measurements of chromium in groundwater that contribute to this risk evaluation, four are measurements of chromium VI. All four results are reported at the detection limit of 0.02mg/l. The EPC for chromium is 0.958mg/l. All chromium was assumed to be chromium VI (RfDo – 0.003 mg/kg-day). The resulting future groundwater hazard index for the construction worker was 3.6. If the chromium is assumed to be chromium III (RfDo = 1.5 mg/kg-day), the resultant HI for the same scenario is 0.007. "

Comment 61. Page 31, Section 6.3 Uncertainty Related to Toxicity Information – Last paragraph, second sentence – Please provide the reader with a brief explanation of the classification (class A, B, C) in terms of weight of evidence.

Response 61. The following text was added after the first sentence in the last paragraph on page 31.

"USEPA classifies carcinogens according to the weight of evidence from epidemiologic and animal studies as follows:

Class A – Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Class B – Probable Human Carcinogen (limited evidence of carcinogenicity in humans or sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)

Class C – Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

Comment 62. Appendix A: Should state that trends in air COPCs have not increased since this evaluation was conducted, therefore estimates are representative of current/future exposure.

Response 62. The text was changed to reflect this information.

Comment 63. Appendix B – Please update the information in the example used, Antimony. According to the tables in Appendix I, there are 158 analyses for antimony.

Response 63. The text was revised to reflect 47 detections in 158 analyses.

Comment 64. Appendix B – Table B-1 – As discussed, the values in Table B-1 are incorrect. Please provide the correct future groundwater modeled results.

Response 64. Table B-1 was replaced.

Comment 65. Appendix C - Tables 2-15 - These tables should be in the main portion of the report. This information is key to the risk assessment process and will likely "get lost" and not reviewed by reader if presented in appendix.

Response 65. Per agreement reached on August 8, Tables 34, 35, and 36 will be presented in the Executive Summary. All tables (including 34, 35, and 36) will presented together in a separate, tabbed section in the back of the RRE.

Comment 66. Appendix C – Table 1 lists PRS 274/275 as a source for the data. Please indicate that this in one borehole (B103) on the edge of the PRS.

Response 66. The table was revised to indicate this.

Comment 67. Appendix C – All initial screening tables – For analytes screened out due to the human nutrient option, change the "Yes" in the COPC column to "No:4" with a corresponding footnote description.

Response 67. Initial screening tables were revised as requested.

Comment 68. Appendix C – All screening tables – Indicate in the footnote for RBGV that the level corresponds to a 10^{-6} risk level or 0.1 hazard index.

Response 68. Footnote was added to Soil Screening Table. Groundwater screening already had footnote added and also involves MCLs.

Comment 69. Appendix C – All soil and groundwater final screening tables – For the analytes affected by the "secular equilibrium" agreement, please place "Yes:1" (if applicable) in the daughter's COPC column. The Yes:1 footnote should indicate that the risk from this analyte is incorporated into the long-lived decay parent radionuclide's risk calculation. The reader should be referred to Appendix H for an explanation. Please place, in the parent's COPC column, "Yes:2 or 3 or n" (if applicable). The associated footnotes should indicate that this analyte is the parent of those daughters screened through on the final screening table. For example, Th232 on Table 3 would have a footnote indicating that this is the parent of Ac228, Ra224, Ra228 and Th208 among other anayltes and to see Appendix H for a complete list.
Response 69. The following was implemented :

"COPC=YES indicates the analyte is retained as a COPC; however, it will not be evaluated individually because it is included in the risk assessment as part of the long-lived decay chain of Ac-227 (Reference 1), U-238 (Reference 2), or Th-232 (Reference 3). See Appendix H for details. For Reference 4, Th-232 screens out but the Th-232 long-lived decay chain was retained for risk evaluation. For Reference 5, U-238 screens out but the U-238 long-lived decay chain was retained for risk evaluation. The analyte is retained as a COPC; however, it will not be evaluated individually because it is included in the risk evaluation as part of the long-lived decay chain of U-233 (Reference 6) and U-235 (Reference 7)."

Comment 70. Appendix C – Tables 4 and 5 –As discussed, the data pulled for the site employee soil risk assumed all units were in feet. Some soil units in the data were in inches. This created a slightly different data set than what should have been used. I understand that this problem will be corrected in the rerun of the RRE.

Response 70. This was corrected and the risks were recalculated.

Comment 71. Appendix C – Table 4 and 5 – Lead 210+D and Lead 210 long lived decay have different frequency of detects than Lead 210. Please correct.

Response 71. This has been corrected.

Comment 72. Appendix C – Tables 6, 8, 10, 12 and future ground water risk calculations - IRIS provides RfDo values for nitrate and nitrite. A hazard index (RBGV) should be calculated for these analytes and listed on the screening tables. The more conservative of the nitrate or nitrite RfDo should be used to calculate a hazard index (RBGV) for the combined nitrate/nitrite. These RfDo values should be used to calculate risk using the EPCs for nitrate, nitrite and nitrate/nitrite.

Response 72. Changes were made as requested.

Comment 73. Appendix C – All ground water tables – Change the footnote description on "No:3" to read "screened out based on comparison of the lower of RBGV or MCL"

Response 73. Footnote changed as requested.

Comment 74. Appendix C - Tables 6, 8, 10 and 12– Add the value 0.005, footnoted as a "c" in the RBGV column for cadmium.

Response 74. Added the value 0.005; it is footnoted as "c" in the RBGV column of tables 6, 8, 10, and 12.

Comment 75. Appendix C – Table 6 – Change the footnote from "c" to "b" on the RBGV for chromium VI.

Response 75. The text was changed as requested.

Comment 76. Appendix C – Table 6 – Add the RBGV value of 0.479 footnoted as "b" to manganese.

Response 76. The RBGV was added as requested.

Comment 77. Appendix C – Table 6 and 8 – When checking the frequency of detect column compared to the data on the provided CD, I consistently found fewer number of analyses for the inorganics in ground water. The numbers do not vary much, but please double check the number of analyses in the current ground water (production wells) data.

Response 77. We counted the number of analyses for vanadium (22), zinc (25), and chromium (25) at the production wells (0076 and 0271) presented in the data set for the Draft RRE and the Public Review Draft RRE. The results were the same for each data set (the numbers are in parentheses above) and agree with the values reported in Table 6.

Comment 78. Appendix C – Table 6 - Please duplicate Ra226 background concentration in the Ra226+d and Ra226 LLD rows.

Response 78. The information was added as requested.

Comment 79. Appendix C - All initial ground water screening tables – The RBGVs for ground water radionuclides were incorrectly calculated using the soil ingestion slope factor instead of the water ingestion slope factor. Please rerun the RBGV and incorporate the correct RBGVs into the RRE.

Response 79. RBGVs were recalculated and used in the recalculation of risk.

Comment 80. Appendix C – Table 7 and 22 – The EPC should be the lower of the maximum detect or 95% UCL (if applicable). Please rerun the tables and show the correct EPCs. Remove the calculated 95% UCL from the analytes with fewer than 20 samples (1,2-Dichlorothene).

Response 80. Tables 7 and 22 were revised.

Comment 81. Appendix C – Table 8 – Add the value 0.48 footnoted as "b" to the RBGV column for manganese.

Response 81. Added as requested.

Comment 82. Appendix C – Table 8 – Add the value 0.314 to the Background Concentration column for thorium 232 LLD.

Response 82. Added as requested.

Comment 83. Appendix C – Table 8 – Once radionuclide ground water RBGV are recalculated, ensure Ra226+D and Ra226 LLD has a value in the RBGV column.

Response 83. RBGVs added as requested.

Comment 84. Appendix C – Table 9 – Add the value 1485 to the Background Concentration column for tritium.

Response 84. Tritium background value was added as requested.

Comment 85. Appendix C - Table 10 - As indicated, while comparing the Frequency of Detect column to the data CD, I had difficulty in matching the number of analyses for zinc and vanadium. I found 151 analyses for vanadium and 153 for zinc. Please look into this discrepancy. This may affect more than the two analytes listed.

Response 85. Table 10 now indicates 151 analyses for vanadium and 153 for zinc.

Comment 86. Appendix C - Table 10 - Add the value 0.139 to the Background Concentration column for americium 241 and 0.975 to the Background Concentration column for strontium 90.

Response 86. The background values for americium-241 and strontium-90 were added.

Comment 87. Appendix C – Table 10 – The • footnote indicates that cis-1,2 – Dichloroethene values were used for screening values of 1,2 – Dichloroethene. Please

be consistent in the use of these values between current and future ground water screening tables.

Response 87. Current and future tables are now consistent.

Comment 88. Appendix C – Table 11 – Add units to this table.

Response 88. Units were added to the table.

Comment 89. Appendix C – Table 11 – Add to this table, the current ground water COPCs 1,2 – Dichloroethene and Tert-butyl methyl ether.

Response 89. MTBE was added (not to Table 10). 1,2 – Dichloroethene was screened out in Table 10.

Comment 90. Appendix C – Table 11 and 13– Add the current concentration contribution for cadmium to the future concentration for both receptors. Tables 28 and 31 are also affected for cadmium.

Response 90. This has been corrected.

Comment 91. Appendix C – Table 11 and 13 – Add the value 0.975 to the Background Concentration columns for strontium 90.

Response 91. Added as requested.

Comment 92. Appendix C – Table 11 and 13 – According to the table provided by SAIC, the future modeled screening concentration for tritium is 66797.9 not the 73198.957 listed in those columns on both tables. The erroneous EPCs appears on Tables 28 and 31.

Response 92. Tritium concentration is now 667987.9 pCi/L in Tables 11, 13, 28, and 31.

Comment 93. Appendix C – Table 12 - Add the value 0.480 to the RBGV column for manganese.

Response 93. Added as requested.

Comment 94. Appendix C – Table 12 - Add the value 0.700 footnoted as "c" to the RBGV column for 1,2 cis-Dichloroethene.

Response 94. The value 0.07 was added (1/10 HI) with "c" footnote.

Comment 95. Appendix C – Table 14 – Add ground water exposure assumptions and all dermal exposure assumptions to this table.

Response 95. The missing assumptions were added to the table.

Comment 96. Appendix C – Table 14 – Do not round the averaging time values (carcinogen or noncarcinogen). The carcinogen averaging time should be 25,550 days or 70 years, not 26,000 days or 71.2 years.

Response 96. The averaging time is listed as 25,550 days.

Comment 97. Appendix C – Table 15 – Provide source information for all columns/rows. For example, indicate the Dermal Absorption Factors are defaults from guidance.

Response 97. The references were added as requested.

Comment 98. Appendix C – Table 15 – Remove the adjusted Oral CSF values for the all non-applicable radionuclides.

Response 98. The table was adjusted as requested.

Comment 99. Appendix C – Table 15 – Given the secular equilibrium parent comment, thorium 232 toxicity criteria will need to be added to this table and perhaps other analytes.

Response 99. Toxicity criteria are included for Th-232, U-238, and U-235 long-lived decay.

Comment 100. Appendix C – Table 15 – Add a footnote to identify those analytes that do not have toxicity criteria.

Response 100. Unavailable toxicity criteria were labeled N/A.

Comment 101. Appendix C – All applicable risk tables – On the last column, the heading is Total Non-C Hazard. Please spell out cancer.

Response 101. The change was made as requested on all risk tables.

Comment 102. Appendix C – Table 19 – Add the word "Soil" to the heading of this table.

Response 102. The word "soil" was added as requested.

Comment 103. Appendix C – Table 28 – The risk calculated for the dermal pathway for tritium is incorrect. Please recalculate using the correct conversion factor.

Response 103. The dermal risk from tritium was recalculated.

Comment 104. Appendix C – Table 29 – The total column for cancer, dermal and inhalation needs to be filled in with the tritium values.

Response 104. The values have been added as requested.

Comment 105. Appendix C – Table 34 -36 - These tables should be presented in main portion of text.

Response 105. Per the agreement reached pursuant to the August 8th summit, these tables are included in the Executive Summary and the Tables section of the report.

Comment 106. Appendix C – Table 34 – To remain consistent with terminology, add the word "oral" to the row in the pathway column indicating "ingestion" pathway.

Response 106. Ingestion was replaced with oral.

Comment 107. Appendix C – Table 34 – Change the last column to read "Total Cancer Risk" Remove the ELCR footnote from all summary tables.

Response 107. Column heading in Tables 34, 35, and 36 was changed; ELCR was removed from all tables.

Comment 108. Appendix C – All summary tables – Increase the width of the pathway column so that the word "showering" is not "showerin".

Response 108. The change was made as requested.

Comment 109. Appendix C – Table 35 – The "Cumulative Background Future Risk" total column is incorrect and only has the Future Groundwater Total Risk value listed. Please correct.

Response 109. This situation was corrected.

Comment 110. Appendix D – Figure 3 – The Conceptual Site Model should be presented in the main text of the report.

Response 110. This was discussed at the August 3 comment resolution summit. The agreement reached was to leave the figures together in a separate section.

Comment 111. Appendix F – Page 8 0f 10 – Third paragraph from the bottom, first sentence discusses three locations in the Phase I. The second sentence indicates five locations summarized below. Please reconcile.

Response 111. At this time, three is correct. "Five" has been removed from the second sentence. This section was drafted before the boundary was changed and PRS 274/275 were removed. The original draft included the "Construction Era Explosives Bunkers."

Comment 112. Appendix F – Page 8 0f 10 – Third paragraph from the bottom, first sentence discusses three locations in the Phase I. The second sentence indicates five locations summarized below. Please reconcile.

Response 112. See Response 111.

Comment 113. Appendix G – Page 3 of 4 – Add PRS 352 and a brief summary.

Response 113. PRS 352 and a brief summary were added.

Comment 114. Appendix G – Page 4 of 4 – In the PRS 406 summary, first sentence, a number is referenced (283). What is this number?

Response 114. That refers to PRS 283. The text has been changed.

Comment 115. Appendix H - The text of this section dealing with secular equilibrium needs to be revised. We are presently working on some suggestions, but request a group discuss to finalize the wording.

Response 115. The edited text provided on 8/13 was included in Appendix H.

Comment 116. Appendix H - Ground water data and text will need to be incorporated in this section.

Response 116. The edited text provided on 8/13 was included in Appendix H.

Comment 117. Appendix H – Add the "Super Daughter Table" found in the June 7, 2002 draft of the RBGV Update. This table will illustrate the summing of the slope factors for the radionuclides assumed to be in secular equilibrium. Note HEAST as the source on the table.

Response 117. That table was added to Appendix H as Table 2.

from OEPA
on RRE Draft

On August 27, representatives of OEPA and BWXTO met and informally reviewed the above responses and a revised RRE. The following new comments were introduced. Note the page and Section references are to the informally reviewed Regulator Preview Copy of the Public Review Draft (August 2002).

New Comment 1. Page 29, Section 5.2.3 Overall Summary of Risk Results– Last Paragraph – Change the second sentence to "The cumulative incremental future risk for the Site Employee ($1.1x10^{-4}$) is at the limit of the acceptable risk range (10^{-4} to 10^{-6})."

Response 1. The text was changed as requested.

New Comment 2. Page 35 Section 6.5 Conclusions– Add the conclusions for the non-cancer results. If this section is discussing incremental risk, please indicate.

Response 2. This section does address incremental risk and the term, incremental, has been added to the existing text in several places. In addition the following paragraph was added:
"The current incremental HI for the Site Employee is within the acceptable range (less than 1). The current incremental HI for the Construction Worker Scenario is at the limit of the acceptable range (1). The future incremental HI for the Construction Worker and Site Employee Scenarios exceeds the acceptable level (1) and is driven by the conservative groundwater analysis (see Section 6.1). Incremental HI due to soil and air contaminants is within the acceptable range for industrial/commercial use."

New Comment 3. Ground Water Exposure Appendix– Update table B-2 to include the new wells added to the flow model resulting from the MCL exceedance effort.

Response 3. Table B-2 was updated to include the new wells.

New Comment 4. Tables Appendix– The guideline values for strontium 90 for the construction worker and site employee in ground water differ from Ohio EPA calculated values. The values are first presented on Tables 6 and 8. It appears that the difference is in assuming risk from daughters. Given the minimal impact on the risk, this reconciliation can be completed outside of the revision of this document.

Response 4. Reconciliation will be completed outside of the revision of the document.

New Comment 5. Tables Appendix– Tables 10 and 12- As was done on Tables 6 and 8, the MCL values should be used to screen against nitrate, nitrite and nitrate/nitrite concentrations.

Response 5. The values listed in the RBGV column were changed to MCL values and the reference changed to "c". This has no impact on the screening results.

New Comment 6. Appendix C– Table 15 – Replace radium 228 long lived decay values with thorium 232 long lived decay values in the soil radionulcide section.

Response 6. Radium-228 values were replaced with thorium-232 values.

New Comment 7. Appendix C– Table 19 – The "*Toxicity criteria used to calculate risk include radionuclide daughters" statement should footnote the long lived decay radionuclides. Please include this statement on tables 16-33 and footnote the appropriate radionuclides.

Response 7. The statement "Toxicity criteria used to calculate risk include radionuclide daughters. " is present for all risk calculation tables (Tables 16 – 33). The asterisk was removed since the radionuclides to which this statement applies are labeled with an "L" or the phrase "long lived decay" in the tables.

New Comment 8. Appendix J - Please spell check this section.

Response 8. The section was spell checked.

Response to Comments

from USEPA
on RRE Draft

Comment 1. As a general comment, I think we have all agreed that an explanation for the "elevated historical sampling locations" should be included somewhere in the report.

Response 1. The following text was added to the end of Section 2.0: "Subsequent to the start of the Phase I risk evaluation process, several isolated locations were identified in Phase I with elevated radionuclide concentrations. Some of the historical analytical results from samples taken within the Phase I property area are elevated with respect to a risk-based comparison criterion. The specific comparison level used was three times the 10^{-5} RBGV plus background. Twenty-three sample locations were identified with results for Plutonium 238 (3 locations), Thorium 230 (1 location) and Thorium 232 (19 locations) above the comparison values. These results have been included in the Residual Risk Evaluation for this property and the report indicates that the risk remains within acceptable levels. However, in some cases the results are significantly elevated above guideline values and warrant additional evaluation. The process followed to determine what locations warranted additional field activities and the results of those activities are summarized in Appendix J." Appendix J was also added and provides a summary of the fieldwork performed.

Comment 2. Page vii of ix - Put all of the risk number in the next to last line on the same line of text.

Response 2. With recalculation of risk, this sentence was no longer necessary and was removed.

Comment 3. Page viii of ix - Please delete the last sentence of the Executive Summary. Although it is true that we will manage the risks presented in this RRE, that should be left to the Proposed Plan and ROD. The RRE should just present the results of the risk calculation and show how the results relate to the acceptable risks levels identified in CERCLA.

Response 3. Text changed as requested.

Comment 4. Page 1 of 33 - Place all of "Phase I" in the third line of the last paragraph on this page on the same line of text.

Response 4. Text changed as requested.

Comment 5. Page 3 of 33 - Please insert the phrase "from the site during remedial action" between "removed" and "were segregated" in the 3rd from last line on this page.

Response 5. Text changed as requested.

Comment 6. Page 4 of 33 - Change "purpose" to "purposes" in the 7th line on the page.

Response 6. Text changed as requested.

Comment 7. Page 9 of 33 - Should "GVs" in the 1st line of the page be in parentheses or deleted?? Or should "estimates" be deleted?

Response 7. Text changed to read, " The GVs for these radionuclides include..."

Comment 8. Page 15 of 33 - Change "was" to "were" in the sentence that begins "Radionuclide intake estimates....."

Response 8. Text changed as requested.

Comment 9. Page 15 of 33 - Change "were" to "was" in the 5th line of the first full paragraph.

Response 9. Text changed as requested.

Comment 10. Page 25 of 33 - I think it would be appropriate to describe how much of the HI of 4.7 for future groundwater for the construction worker is due to chromium, as is done on page 26 for the site employee. Because the assumption that all of the chromium is hexavalent chromium is a very conservative assumption, this helps to show that the HI of 4.7 would be a very conservative estimate of the possibility for noncancer effects.

Response 10. The following sentence was added: "Chromium contributes 64% of the incremental HI."

Comment 11. Page 26 of 33 - Add the word "of" between "Both" and "these" in the 5th line of the last paragraph on this page.

Response 11. Text changed as requested.

Comment 12. Page 27 of 33 - In the second paragraph of Section 5.2.3, combine the two middle sentences together, so the text will read... "The cumulative future risk for the site employee is also acceptable, but the cumulative future non-cancer hazard for the site employee exceeds the acceptable level."

Response 12. The text was revised based on revised risk calculations and a commment received from OEPA on September 5.

Comment 13. In Tables 2 through 13, check the numbered notes in the "COPC" column which explain why a potential COPC was screened out. In many cases, it appears that either the 2s and 3s are reversed, or the note at the end of table is reversed.

Response 13. The 2s and 3s were reversed. The footnote was changed.

Comment 14. Table 5 - Lithium is included in this table even though it was already screened out in Table 4.

Response 14. Lithium should not have screened out in Table 4. This has been corrected.

Comment 15. Table 7 - The EPC for TCE should be .002, EPC for U-235 should be 0.466, EPC for U-238 should be 0.409. Also, as we have discussed in other emails.... we need to be consistent between Tables 7 and 9 in how we determine the EPC for COPCs with less than 20 detects (Cadmium, Copper, Lead, Tert-Butyl methyl ether, Th-230, U-234).

Response 15. The EPCs listed in Table 7 have been corrected. The EPC for contaminants with fewer than 20 analyses defaults to the maximum detected value.

Comment 16. Table 33 - This table is included in the report twice with a different number for total risk in each table.

Response 16. Only one Table 33 is now in the report.

Comment 17. Appendix F - Building Information - Page 1 of 10 - The text in the first line of the 5th paragraph refers to a Figure 5. I was not able to locate this figure in the document. I think a map showing the building locations should be included however.

Response 17. A map of Phase I showing locations of existing buildings and PRSs was added. This is now Figure 4.

Comment 18. Appendix G - PRS Information - Page 3 of 4 - There is a typo in PRS 369, referring to PRS 469.

Response 18. Text was corrected.

Comment 19. Appendix G - PRS Information - Page 3 of 4 - Add space after the end of first sentence in PRS 371.

Response 19. Text changed as requested.

Comment 20. Appendix G - PRS Information - Page 4 of 4 - Add more information on PRS 421. At least there should be some description of the fact that sampling was conducted and a removal action occurred.

Response 20. The PRS 421 information now reads: "PRS 421 is "The Ridge" across the road south of the location of the former Building 21. It was identified as a PRS when historical sampling data indicated the presence of contaminated soil. Contamination was confirmed during the verification sampling for PRS 407. The source of the contamination was surface runoff from the PRS 407 cleanup that followed preferential and intermediate drainage pathways south to the PRS 421 area. The removal action resulted in the excavation and containerization for disposal of approximately 105,133 cubic feet of soil, concrete, and asphalt. The cleanup objectives were 55 pCi/g for plutonium-238, 2.1 pCi/g for thorium-232, and 2.6 pCi/g for thorium-228. The OSC report documented that all verification sample results were below cleanup objectives. "