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APR 29 2004

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

ER-028/04
April 29, 2004

Ms. Margaret L. Marks, Acting Director
Miamisburg Closure Project
U. S. Department of Energy
500 Capstone Circle
Miamisburg, OH 45342

SUBJECT: Contract No. DE-AC24-03OH20152
Contract Deliverable 039 – PRS Documents
CONTINGENT REMOVAL ACTIONS FOR CONTAMINATED SOILS - ADDENDUM 1: STRUCTURES, PUBLIC REVIEW DRAFT

Dear Ms. Marks:

The attached document replaces the version previously distributed. The attached document includes a copy of the original action memorandum.

My apologies for any inconvenience.

Sincerely,

David A. Rakel
CERCLA Process, GIS & Data

DAR/jdg

Enclosures

cc: David Seely, USEPA, (1) w/attachments
Mary C. Wojciechowski, Tetra Tech EM, Inc., (1) w/attachments
Brian Nickel, OEPA, (4) w/attachments
Ruth Vandegrift, ODH, (1) w/ attachments
Paul Lucas, DOE/MCP, (1) w/attachments
Sue Smiley, DOE/MCP, (1) w/attachments
Lisa Rawls, DOE/MCP, w/o attachments
Randy Tormey, DOE/OH, (1) w/attachments
Dann Bird, MMCIC, (3) w/attachments
Jim Bonfiglio, MESH, (1) w/attachments
John Fulton, CH2M HILL, w/o attachments
Jeff Bradford, CH2M HILL, w/o attachments
Dave Rakel, CH2M HILL, w/o attachments
Karen Arthur, CH2M HILL, w/o attachments
Monte Williams, CH2M HILL, w/o attachments
Public Reading Room, (4) w/attachments
DCC

Action Memo / EE/CA

for

Contingent Removal Actions for Contaminated Soils

Addendum 1: Structures

April 2004

Public Review Draft

Department of Energy

CH2MHILL

RECOMMENDATION

This decision document represents concurrence to incorporate Building 30, the Building 50 red drain line system, and similar structures that are simple removals, easily verified, with a small number of contaminants into the Contingent Removal Action. Plutonium-238 was observed on the floor of Building 30 by alpha spec at 294,197 dpm/sample. This exceeds the surface contamination guideline (100 dpm/100cm^2). A sediment sample from the Building 50 red Drain Line was analyzed and Th-232 was observed (13.84 pCi/g) in excess of the cleanup objective (2.1 pCi/g). Th-228 was also found in the same sample (12.16 pCi/g) in excess of the cleanup objective (2.6 pCi/g).

Presentation of the information in this addendum models the approved Contingent Action Memorandum that was prepared in accordance with CERCLA as amended by SARA, and not inconsistent with the NCP. This decision is based on the administrative record for the site.

Information provided in this Addendum 1 is consistent with actions already proposed for buildings and we recommend that they be initiated as described herein.

Paul Lucas 4/14/04

Paul Lucas, OSC
U.S. Department of Energy
Miamisburg, Ohio

David P. Seely 4/16/04

David Seely, RPM
USEPA
Chicago, Illinois

Brian Nickel 4/15/04

Brian Nickel
OEPA
Dayton, Ohio

PURPOSE:

The purpose of this addendum is to add applicable buildings and structures to the contingent removal action (CRA) process (AM, Reference 1). Justification for adding buildings and structures to the existing CRA process is as follows:

- demolition of contaminated buildings frequently exhibit the same characteristics for inclusion in the CRA process as PRSs,
  - simple removal action,
  - easily verified, and
  - small number of contaminants of concern (COCs).
- the contaminants for the specified buildings are the same as those for the soil removal/verification in the existing action memo,
- combining like work scopes increases efficiencies in budget and use of manpower and allows for a potential reduction in overall schedule duration, and
- combining similar activities into one Action Memo affords streamlining of sampling and reporting documentation.

The approach used to add buildings/structures into the Contingent Action Memo is to identify, for two examples (Building 30 and the Building 50 red drain line), sections in the Contingent Action Memo where additional information would be presented and provide the information as an attachment to this addendum for ease in comparison to the parent document. The additional information required includes updates to:

- Section 2, Site Conditions and Background,
- figure of structure locations,
- Section 5.1.1, Proposed Action Description, Phase II,
- Section 5.1.7 Project Schedule,
- Section 5.2 Estimated Costs, and
- Section 9 Recommendation (see new Recommendation Page for Addendum 1).

The Contingent Action Memo was generated to address contaminated soil Potential Release Sites (PRSs) at the Mound Closure Project (MCP) that meet certain criteria. This addendum incorporates into the Contingent Action Memo Building 30, Building 50 red drain line, and those buildings and structures that meet similar criteria. A flowchart that illustrates the CRA process for buildings (other than Building 30 and Building 50 red drain line) is included as Figure 2. Public review of this Addendum meets the public notification requirements for Building 30 and the Building 50 red Drain Line. For other buildings added to the CRA process, public notification will be via Factsheet and a notice published in a local newspaper. Included herein are text inserts as itemized above, one figure, and one table (cost estimate).

REFERENCES:

1) Action Memorandum, Engineering Evaluation/Cost Analysis, Contingent Removal Action for Contaminated Soil, June 2002, Final.

2) Work Plan for Environmental Restoration of the DOE Mound Site, The Mound 2000 Approach, February 1999, Final

PREPARED BY:

Karen M. Arthur, CH2MHill, ER QA

Attachments

2. SITE CONDITIONS AND BACKGROUND

2.1 SITE DESCRIPTION

This section describes the physical site location, site characteristics, and release of contaminants into the environment.

2.1.1 Physical Location

The MCP is a site on the southern border of the city of Miamisburg in Montgomery County, Ohio. The additional removal action is proposed for the Building 30 superstructure and the Building 50 red drain line system (Figure 1).

2.1.2 Site Characteristics

Building 30 is known as the Health Physics Count Lab/SM [Special Metallurgical] Storage Building, and is located as shown on Figure 1. Building 30 was constructed in 1965 and has served three main functions: the SM storage building (65 – late 70s), a gamma scanning facility for drums and boxes of radioactively contaminated materials (late 70s to mid 80s), and a counting laboratory for the analysis of radionuclides (mid 80s to recently). When Building 30 was used as a gamma scanning facility, soil in sealed dishes was screened in a gamma counter to determine the amount of plutonium or thorium present in the sample. The sealed dishes were not opened and were discarded in a Low Specific Activity (LSA) container outside of Building 30. As a radiological counting laboratory, Building 30 personnel used liquid scintillation counting to count paper smear samples for the detection of tritium and gross alpha/beta activity. The building is currently inactive and undergoing preparations for demolition.

Plutonium-238 is present on the building floor and possibly on the interior walls. The highest isotopic analysis result by alpha spec was 294,197 dpm/sample plutonium-238. This exceeds the surface contamination guideline (100 dpm/100cm^2 in Reference 2). Only plutonium-238 was observed by this analysis. Perimeter survey results found no contamination outside of the building. Since extensive remediation of the floor is not considered practical, the floor contamination will be encapsulated with the application of a paint fixative. Building 30 will be demolished in its entirety as a radiological facility and the debris disposed of as low level waste per Waste Management direction. The Contaminant of Concern for Building 30 is plutonium-238.

This Removal Action includes the demolition of the Building 30 superstructure. Soil under the Building 30 footprint is addressed in the Building 38 Soils Action Memorandum Addendum 1, SM/PP Hill Removal Plan, and Building 38 Area VSAP.

Building 50 Red Drain System: Building 50, the Alpha Fuels Environmental Test Facility was located as shown on Figure 1. Building 50 housed projects that only used encapsulated (sealed) radiological sources. All final radiological surveys of Building 50's interior and exterior superstructure surfaces met surface release criteria, and the building was demolished per the Building Data Package and Demolition Work Plan. During pre-demolition surveys of Building 50, elevated levels of thorium were discovered on a drain cover, drain line, and associated 1,100-gallon sump designed to hold wastewater from the Building 50 red drain system (lines that could potentially be radiologically contaminated). The sump is a steel tank in a secondary concrete containment pit. A sediment sample from the wastewater holding tank was analyzed and Th-232 was observed (13.84 pCi/g) in excess of the cleanup objective. Th-228 was also

found in the same sample (12.16 pCi/g). Accordingly, the Contaminants of Concern for the Building 50 Red Drain System are thorium-232 (cleanup objective 2.1 pCi/g) and thorium-228 (cleanup objective 2.6 pCi/g).

This Removal Action includes the removal of all drain lines in the Building 50 red drain system, the associated wastewater holding tank and concrete vault, and contaminated soil, if any, associated with the removal of the structures.

Buildings/structures utilizing the Contingent Action Memo will be closed out via an OSC Report.

5.1.1 Proposed Action Description, Phase II

The CRA process for buildings mirrors the CRA process for PRSs. Figure 2 is a flowchart illustration of the CRA process for buildings. The CRA process for buildings is applied when new information becomes available that indicates the industrial demolition path (Figure 4.4 in Reference 2) is inappropriate. This information is documented in the Factsheet. The current list of buildings expected to be industrial demolitions is 22, 24, 56, 57, 72, 104, 112, 113, 300, 301, 415, 432, 301A, DS, EG-1, EG-4, EG-6, EG-8, GP-8, P, PH, WH1, WH2, and WH3.

- Phase II: Remove Structures and Soil

Building 30 and the Building 50 red drain line system and tank will also be demolished and disposed of properly.

- Phase II: Verification

Confirmation sampling will be conducted within the additional areas to confirm COCs are below cleanup objectives. A DOE, USEPA, and OEPA-approved Verification Sampling and Analysis Plan (VSAP) will further define the verification sampling and analysis process. Since multiple contaminants may be present, the data may need to be reviewed to determine if cumulative risk is acceptable.

A VSAP will be developed for each building or structure included in the CRA process. Due to the number of structures and analytes, the COCs for a building will be specified within that building's VSAP. VSAPs will be submitted to the Core Team for review and approval. Each structure/building will be considered separately and will retain COCs identified above. If information is realized before or during the course of the removal action that could change the COCs verified, the information will be brought to the attention of the Core Team for evaluation.

5.1.7 Project Schedule

Building 30 and the Building 50 red drain line system are in queue for implementation in 2004.

5.2 ESTIMATED COSTS

The cost estimate to perform removal and sampling activities for Building 30 and the Building 50 red drain system are shown on the table below.

	Bldg 30	Bldg 50 Red Drain System
Work Planning	$6,550	$6,550
Characterization	$2,715	$10,725
Utilities	$4,430	$27,020
Safe Shutdown	$9,500	$38,680
Decontamination	$1,070	$5,840
Demolition	$7,190	$70,945
Slab & Piping Removal	$5,295	$48,710
VSAP	$2,000	$11,430
Hauling & Disposal	$5,000	$50,000
Site Restoration	$3,015	$5,950
Total	$46,765	$275,850

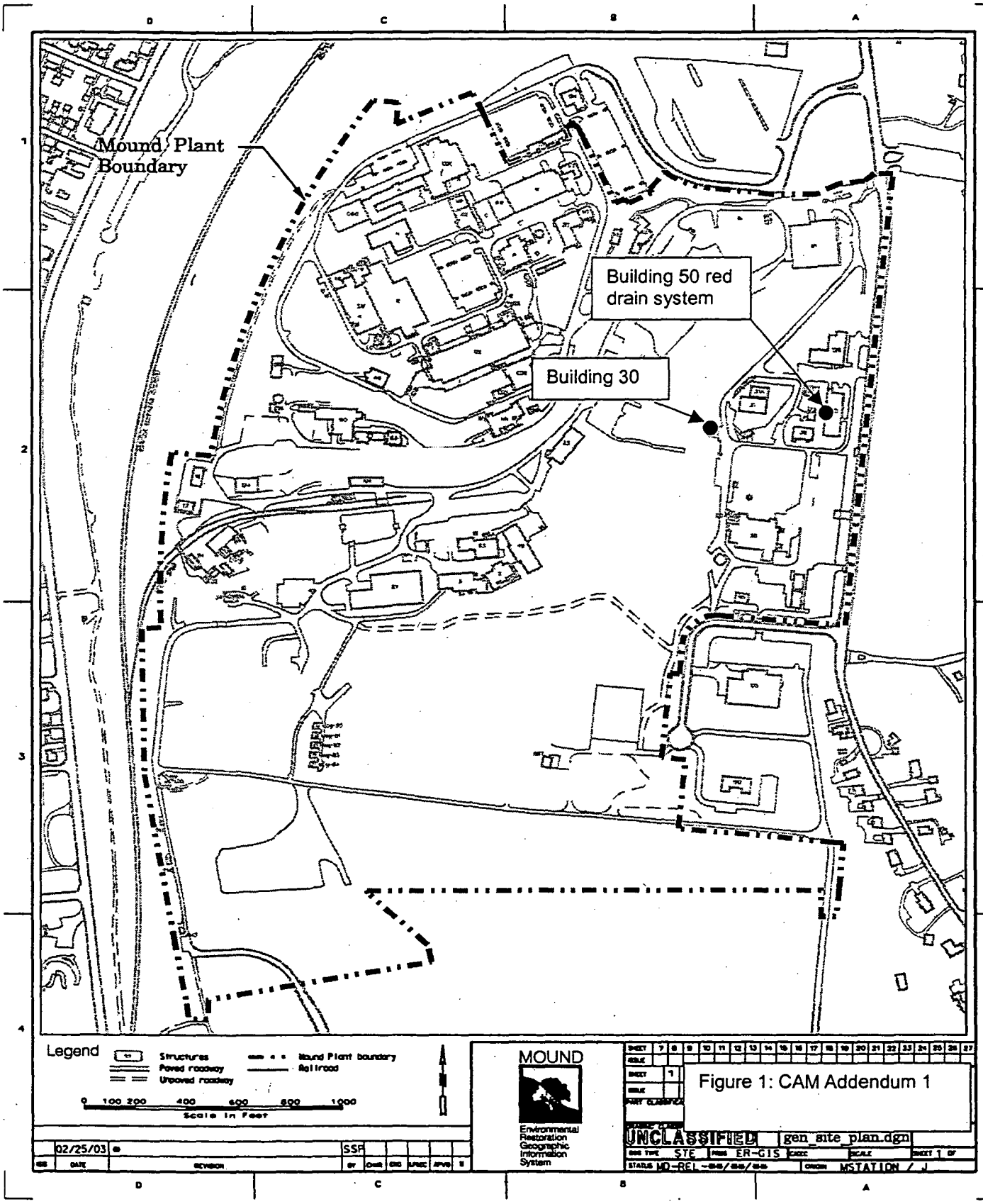
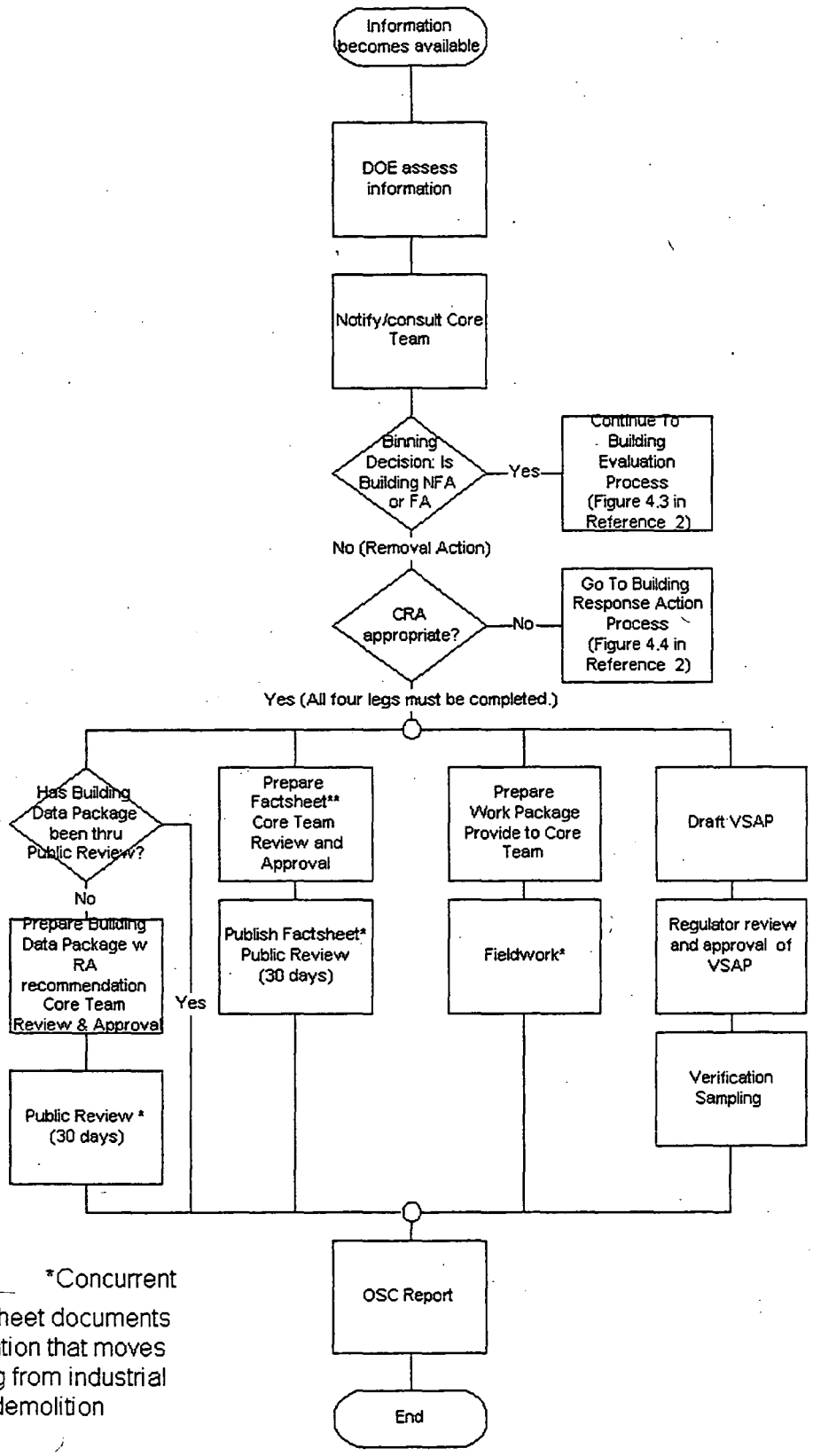


Figure 1: CAM Addendum 1

Contingent Removal Action
Process for Buildings Not Listed in this Addendum
(Buildings To Be Demolished)



*Concurrent

**Factsheet documents information that moves building from industrial demolition

Figure 2

ACTION MEMORANDUM
ENGINEERING EVALUATION/COST ANALYSIS

CONTINGENT REMOVAL ACTION FOR CONTAMINATED SOIL

MOUND PLANT
MIAMISBURG, OHIO

JUNE 2002

Final

Department of Energy

BWXT of Ohio, Inc.

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 Action Memorandum for the Contingent Removal Action for Contaminated Soil. Attached are our responses.

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

Sincerely,

DOE/MEMP: _____
Robert S. Rothman, Remedial Project Manager

USEPA: _____
Timothy J. Fischer, Remedial Project Manager

OEPA: _____
Brian K. Nickel, Project Manager

MMCIC Comments

Action Memorandum for Contingent Removal Action for Contaminated Soil

Public Review Draft, September 2001

Substantive Comments

1. MMCIC concurs that a removal action is warranted for the areas identified as PRS 153, 266, 273, 276, 412, and 421, and that the combined AM/EE/CA for these areas, described in the above-referenced document, is an efficient approach that still meets the requirements of the CERCLA/Mound 2000 process. However, MMCIC is unclear how newly discovered cleanup areas will be addressed in the future. Will any newly discovered areas first become a PRS and go through the binning process for removal, or will these designated sites go directly for removal action in accordance with the guidelines in this action memorandum? MMCIC intends to ask for a briefing with DOE and BWXTO, with Mr. Jim Bonfiglio of MESH in attendance, to clarify this process.

   Response
   When information that indicates possible contamination becomes available, it is assessed by the site and regulators. In the past, this has resulted in the identification of new PRSs. If the information indicated that this new PRS is similar to those identified in this AM/EE/CA, then removal action in accordance with the guidelines in this AM/EE/CA is warranted.

   The briefing mentioned above took place on November 7. As a result of that discussion, a flowchart of the process for newly discovered sites was developed and is included in these responses.

2. In Section 5.1.1, Proposed Action Description, the AM/EE/CA states that for other similar locations/PRSs that are addressed by this Contingent Removal Action, public notification will include a public notice (including location, nature of contaminant, and reference to this AM/EE/CA) in a local newspaper and the development and distribution of a fact sheet about the PRS. Section 5.1.1 indicates that the public notice may be published concurrent with the start of fieldwork, and that the opportunity for stakeholders/public to provide comments on the fact sheet may be concurrent with fieldwork. MMCIC believes it would be more appropriate to allow the pubic to review the fact sheet on new PRSs to be addressed by this Contingent Removal Action at least thirty days before the start of scheduled fieldwork.

Response
The AM/EE/CA also stipulated that the Verification Sampling would not proceed until the public had the opportunity to comment on the fact sheet. This was included in an attempt to address both the need to make progress in the field and provide the public an opportunity to participate in the process. This stipulation provides the opportunity to adjust in response to public comment. The approach proposed in this AM/EE/CA is consistent with *Expediting Cleanup Through Contingent Removal Actions* (DOE and USEPA, March 1997) which states "Thus, each time a situation is encountered which meets the trigger criteria, a response can be implemented immediately. Each time a response is initiated, the agencies should prepare an information brief to communicate to the public what remediation has been (or is being) conducted to keep them informed of the progress being made."

3. Once each removal action is complete, MMCIC requests that DOE/BWXTO return the PRS area to the standards or conditions of the intended use of the area as described in the *Mound Comprehensive Reuse Plan*.

Response
The plans for site restoration will be developed as the removal action proceeds. With continuing, timely communication between MMCIC and DOE, the Core Team expects that the PRS will be returned to a state consistent with the *Mound Comprehensive Reuse Plan* to the extent practicable.

4. In the Planning and Implementation Schedule in Figure 5.1, have specific PRSs of the six PRSs addressed in the AM/EE/CA been assigned to Project FY02-1, FY02-2, FY03-1, FY03-2, FY03-3, and FY03-4?

Response
The PRSs associated with the transfer of Phase I will be addressed first. The field work for PRS 276 is complete. The field work for PRS 421 is nearing completion. The PRSs associated with Phase II (PRS 266, 273, 412) are expected to be next. Then the Phase III PRS (153) is expected to be addressed. This progression may change as the project evolves. Additional PRSs may be addressed before all of these are complete.

5. A data summary table in the beginning of the document would increase reader understanding. This table would be appropriate under Section 2.1.2 and could include data summary comparing each PRS with cleanup standards.

Response
Cleanup objectives were established later in Table 5.1. A table could be presented early in the document that compares sampling results to risk-based guideline values. Such a table is included in the PRS package which is referenced in Section 2.2.

6. It would be helpful for the public reader who is not familiar with the site and Action Memorandum process to include in the Purpose; Section 1 a disclaimer or explanation stating that the Action Memorandum is not intended as a stand alone document and the reader must also rely on data packages for PRS 153, 266, 273, 276, 412, and 421 which were previously issued.

Response
The following sentence was added to the Purpose section. " The removal action presented in this document is based on information presented in previous documents. These documents are referenced in Section 2.2 and pertinent excerpts are presented in Appendix A. "

Errata

1. A typographical error is found at the top of Page 13: containerization was misspelled (the first "i" was left out).

Response
The text was corrected.

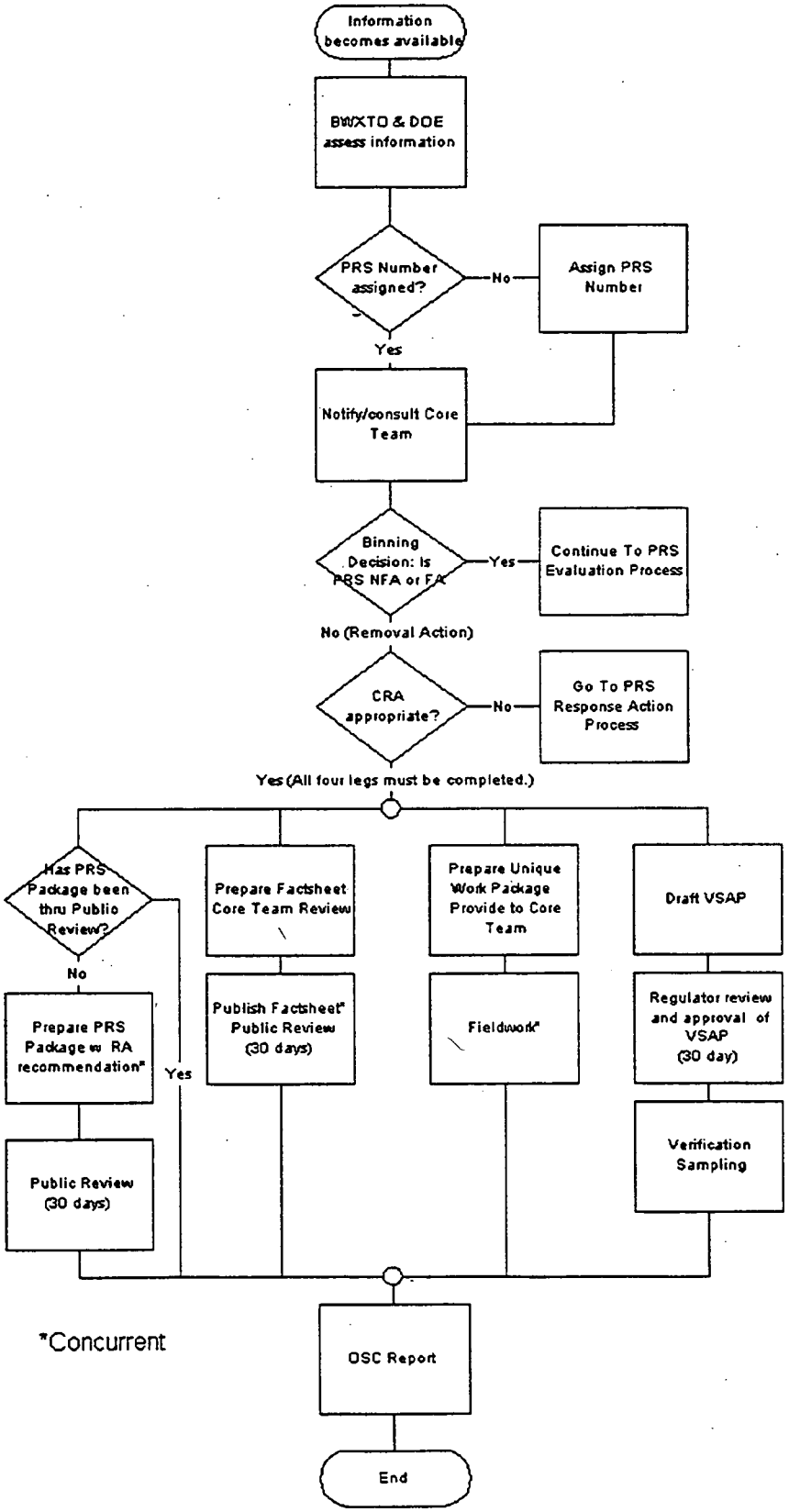
2. Page 10 of this Action Memorandum has no definition showing the acronym VSAP as Verification Sampling and Analysis Plan.

Response
The definition was added in the text and Table of Acronyms.

3. Appendix C of this document includes only two of the six recommendation pages for PRS 153, 266, 273, 276, 412, 421. All recommendations should be included for the benefit of the reader.

Response
The other recommendations were inadvertently omitted in printing the copies provided MESH and MMCIC. They were included in the Public Review Draft signed by the Core Team members. They will be included in the Final version of the document.

Contingent Removal Action - Process for Newly Discovered Sites or To Add Existing PRSs



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

Mr. J.D. Bonfiglio
MESH Advisor
Paragon Associates
8924 Evan Court
Suite 11
Springboro, Ohio 45066

Dear Mr. Bonfiglio:

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 Action Memorandum for the Contingent Removal Action for Contaminated Soil. Attached are our responses.

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

Sincerely,

DOE/MEMP: _____
Robert S. Rothman, Remedial Project Manager

USEPA: _____
Timothy J. Fischer, Remedial Project Manager

OEPA: _____
Brian K. Nickel, Project Manager

TO: Sharon Cowdrey –MESH

FROM: J. D. Bonfiglio – MESH Advisor

DATE: September 2001

SUBJECT: A) Action Memo – Engineering Evaluation/Cost Analysis "Contingent Removal Action for Contaminated Soil" September, 2001 Public Review Draft Listing PRS 421 and 5 Others

B) PRS 421 – Potential Release Site ~ 125 Page Package for Public Review and Comment

A) CONTINGENT REMOVAL ACTION FOR CONTAMINATED SOIL (E.G. PRS 421 +).

The stated purpose for this action memo is to "Document general site conditions that would justify application of a Contingent Removal Action (CRA) consistent with CERCLA, to propose the CRA described AND to allow public input. Six PRS's (153, 266, 273, 276, 412 and 421) are listed in this CRA. Table 2.1 on page 5 shows the Core Team Removal Action recommendations for the six PRS's beginning in July 1996 (153) and ending in July 2000 for PRS 421. Over this period please note that no removal action has been performed to date. On page 9 under the heading Public Notification, it states this "AM/EE/CA constitutes public notification for the PRS's specifically listed in Table 2.1 (see above 6 PRS's)." Eventually on Page 11 the Table 5.1 entitled "Cleanup Objectives (pCi/g)" shows contaminants and their levels vs. cleanup objectives. Following scrutiny of data, two materials, actinium 227+ and plutonium 238 show either incorrect math (AC 0.11 + 4.5 = 4.6 and not 4.7) and Pu 238 (0.13 + 61 does not equal 55). The table is supposed to equal the 10^{-5} g.v.+ the background value as the footnote claims. The other 8 contaminants shown in Table 5.1 have correct so called "cleanup objective" values.

Response
A footnote will be added to the Table in its final version indicating the Pu-238 cleanup objective was kept at 55pCi/g. The value for Ac-227 will be changed in the final version of the document to 4.6. The 4.7 value was a retained from a previous version of the document.

On page 12, the first paragraph states that "additional cleanup objectives for non-radioactive COC's (contaminant of concern) in soil will also take into consideration leaching to groundwater, as well as the risk from contaminated soil." Further "for PRS's with small areas of contamination (e.g. less than 1000 ft. ^{2}) hot spot criteria will not be applied." All samples must not exceed the agreed upon cleanup objectives. The complete list of COC's for each PRS will be documented in the VSAP approved by the Core Team. VSAP is not listed among the many acronyms shown on page IV. (Add please!)

Response
Verification Sampling and Analysis Plan (VSAP) will be added to the list of acronyms on page iv in the Final version of the document.

Thus this reviewer (and any others) has no clue as to which COC's and amounts are present in the six PRS's.

Response
Page 10 states "The most common COCs and accompanying cleanup objectives for the PRSs targeted by this document are listed in Table 5.1." The Removal Action recommendations compiled in Appendix A (referenced in Section 2.2 "Other Actions To Date" list the contaminants and levels that lead to Core Team to decide Removal Action was warranted. Appendix B lists additional information about the six PRSs (history, other contaminants and levels observed, and source (project) of information.

Page 13, Section "5.1.1.3 uncertainties" states, "The concentration levels of the contaminants and the extent of contamination (lateral and depth) is major! Who among us would disagree? Is there no data?

Response
Section 5.1.1.3 Uncertainties reads "The major uncertainties are the concentration levels of the contaminants and the extent of contamination (Lateral and depth). The minor uncertainties include location of utilities that may exist in the area of excavation."

The first sentence in Section 5.1.1.3 was included to acknowledge an uncertainty inherent in this type of work. Although the PRSs may not be completely characterized, there are sufficient data to conclude a Removal Action is warranted and develop a plan for performing the Removal Action.

For the six PRSs listed in this Action Memorandum, the contaminants that drove the decision for Removal Action are listed in the Recommendation Pages (included in Appendix A). Information about additional contaminants observed at these PRSs is included in Appendix B and the PRS Packages themselves. An information factsheet will be prepared for future removals.

On page 18 this project (six PRS's) shows action into fiscal year 2005 which is inconsistent with 5.1.7 on page 16 which leads one to believe 2003 is the conclusion.

Response
This removal action is different from previous removals at Mound in that it addresses six specific PRSs and PRSs that are determined at some future date to be similar to them. The six PRSs named in the action memorandum are expected to be completed by FY03. The schedule illustration extends to the anticipated end of the exit project to show there may be other, similar PRSs removed as part of this removal action.

Another item troubles the reader (with this and most other documents generated by the site) illustrated by table 5.2 on page 17 concerning RA cost estimates. 80% of the page is blank – I would like to see the various sub-components cost breakdowns for each of the 3 categories.

Response
The EPA guidance for action memo content includes cost information because there are restrictions on total and annual costs for EPA lead removals. The guidance does not specify the level of detail to provide. These restrictions do not apply to DOE lead Removal Actions. We have provided cost estimates in Action Memos for this site to provide the public with an idea of the financial impact of the removal action.

On page 19 it states, "There is the potential for the contaminants to migrate if action is delayed or not taken." For this reason, I object to the proposed schedule for action stretching into 2005 or beyond. Is this not action delayed?

Response
The proposed schedule extends to the end of the exit project to reflect the fact that this new tool, contingent removal action, may be used anytime up to the end of the project. The six PRSs identified in the action memorandum are expected to be removed by FY03. In fact, fieldwork for the removal of PRS 276 is complete and fieldwork for removal of PRS 421 is nearing

Without serious review, corrections and additions, I would not approve this document if I was a Core Team Member. (page 22)

The appendix A, B, and C pages following the report have separate issues. The following are examples and not intended to be all inclusive:

Appendix A

The Core Team recommendations for the PRS's list the contaminant levels which exceed the GV's (by many times) for which a response action is warranted. Why not establish a table prior to table 5.1 on page 11 showing action data compared to objectives? This would assist all readers to understand better! Why are only PRS 153 and 273 shown? Where are the others?

Response
The others were inadvertently omitted in printing the copies provided MESH and MMCIC. They were included in the Public Review Draft signed by the Core Team members. They will be included in the Final version of this document.

Appendix B

The six PRS's background data is buried within this appendix. The table suggested under Appendix A could be constructed from the data found here. I suggest this table be included within the main report. Since there are no page numbers given for the Appendix B (and C) Section(s) I don't know if pages are complete. See PRS 421 in Appendix B, then turn page – is the table (untitled? 5.3 or ?) referring to PRS 421? It should be clarified since this good data table is lost in obscurity in Appendix B. Note that all 8 contaminants" (I named column that) exceed the "10^{-6} g.v. (at the time of the sampling event) background level is not included." [See J & B section re PRS 421 data package,(page 5 and 6 of this report)]

Response
The table referenced in the comment does refer to PRS 421.

Appendix C – Calculation of Guideline Values

The ten pages (not numbered) report an overview of the calculation for the various contaminants and exposure method. Unfortunately, one can not repeat the calculations since as stated at the top of each page both the variables and equations are (only?) available on pages 92 and 93 of an RBGV report 3/97. Since 2 pages may assist – why not include them also. What's another two pages?

Response
Since the report " Mound Risk Based Guideline Values, March 1997" was reviewed by the public, is included in the Public Reading Room, and has been widely distributed it was included by reference. This is consistent with the presentation of calculations of RBGVs in other action memorandums and the Residual Risk Evaluations for Parcel 3 and 4.

CONCLUSION:

I believe this document can be greatly improved and made more concise, relevant, user friendly and then a blueprint for future Removal Action groupings of PRS's.

Response
The key feature of this Action Memorandum that is expected to facilitate progress is the fact that it applies to PRSs identified in the future that are similar in nature (type of contaminant, levels of contamination, removal approach) to the six PRSs identified in the Action Memo.

B) PRS 421 – POTENTIAL RELEASE SITE (~125 + PAGE) REPORT

This 7 section voluminous package concerns contaminated soil known as "the ridge". As noted earlier, PRS 421 is included in the action memo discussed in Part A of this report.

In the "PRS History and Narrative" section of the package, an excellent description of the problem, why it happened, a table showing contaminants of concern and additional "Reading Room References" was prepared by BWX's Dennis Gault and Joe Geneczko. This is what I have been urging DOE and BWX to do since March 2001.

Response
The fundamental building block for the Mound 2000 Process is the PRS Package. The content and format for the PRS 421 Package are essentially the same as the content and format of the first PRS Package (PRS 279) produced in July 1995. In that time, the Mound 2000 process has designated 178 PRSs No Further Assessment, 41 PRSs Removal Action, and 33 PRS Further Assessment.

In summary, this is the situation with PRS 421:

- PRS 421 was created following the Removal Action for Bldg. 21 (PRS 284) and associated soils PRS 407 and PRS 281.
- Five storm drains from the PRS 407 and 284 areas discharged into the area of PRS 421, PRS 407 contains 4 acres of land.
- PRS 407 was once part of PRS 283 a bulk transfer of thorium drums (plutonium recoverable waste storage).
- PRS 284 (Building 21) was evaluated in 1995 as part of a program to clean and transfer property to Miamisburg.
- In sequence PRS 284/Building 21 was demolished from 10/96 – 3/97; PRS 407 soil removed 6/97 – 3/98 with added excavation ~ 10/99.
- The work near the roadway separated the new from the old Mound property line thus removing PRS 407 from PRS 406 and the newly created PRS 421.
- Successful response actions for PRS 281, 284 and 407 was "declared" resulting in a no <u>further assessment required</u>.
- PRS 421, now isolated, does have 8 contaminants which exceed the guideline (10^{-6} criteria). These are:

	CONTAMINANT	MAXIMUM LEVEL	GUIDELINE VALUE
1	Benzo (a) Pyrene	1.0 mg/Kg	0.41 mg/Kg
2	Beryllium	1.4 mg/Kg	0.70 mg/Kg
3	Cesium 137 (+D)	1.15 pCi/g	0.46 pCi/g
4	Thorium 228 (+D)	15.6 pCi/g	0.11 pCi/g
5	Thorium 230 (+D)	2.59 pCi/g	0.13 pCi/g
6	Thorium 232 (+D)	32.6 pCi/g	0.11 pCi/g
7	Plutonium 238	396.4 pCi/g	55 pC/g
8	Uranium 234 (+D)	6.6 pC/g	0.13 pCi/g

Summary

Thorium and plutonium levels are especially high but all eight require a prompt removal action. (not 2-4 years!) Remember migration via storm drains et al were indicated earlier and no reason to expect that migration has ceased. The longer an RA the chance for creating additional PRS's is increased.

The "Core Team" recommended a Removal Action 10/2000. It's time for action! (Removal that is!)

JDB
9/27/2001

Response
The fieldwork associated with removal of PRS 421 is nearly complete.

Table 4.1.3

Construction/Mound Employee - Soil/Sediment Exposure Pathway (Radionuclides)

$$CS_{ING} = \frac{(TR)}{(ED_1)\ (EF)\ (SF_o)\ (CF_1)\ (IR_{soil})}$$

$$CS_{INH} = \frac{(TR)}{(ED_1)\ (EF)\ (SF_i)\ (CF_2)\ (IR_{air})\ (\frac{1}{VF} + \frac{1}{PEF})}$$

$$CS_{EX} = \frac{(TR)}{(ED_2)\ (SF_e)\ (1-S_e)\ (T_e)}$$

$$CS_{TOTAL} = \frac{(TR)}{(ED_1)\ (EF)\ [(SF_o)\ (CF_1)\ (IR_{soil}) + (SF_i)\ (CF_2)\ (IR_{air})\ (\frac{1}{VF} + \frac{1}{PEF})] + (ED_2)\ (SF_e)\ (1-S_e)\ (T_e)}$$

Table 4.1.3 Construction/Mound Employee (Radionuclides)
Exposure variable explanations for the soil/sediment exposure pathway

Variable	Definition	Value Used	Explanation/Source
CS_{ING}	Radionuclide Concentration in Soil (Ingestion)	pCi/g	Calculated Guideline Values (GVs) [1]
CS_{INH}	Radionuclide Concentration in Soil (Inhalation)	pCi/g	Calculated Guideline Values (GVs) [1]
CS_{EX}	Radionuclide Concentration in Soil (External Exposure)	pCi/g	Calculated Guideline Values (GVs) [1]
CS_{TOTAL}	Total Radionuclide Concentration in Soil for all Exposure Pathways	pCi/g	Calculated Guideline Values (GVs) [1]
TR	Target Excess Individual Lifetime Cancer Risk	1×10^{-6} 1×10^{-5} 1×10^{-4} (Unitless)	OSWER Directive 9285.7-01B
ED_1	Exposure Duration 1	5 yrs	OSWER Directive 9285.6-03
ED_2	Exposure Duration 2	5 yrs x 0.685	OSWER Directive 9285.6-03 (250 days/yr ÷ 365 days/yr)
SF_o	Oral Cancer Slope Factor	Radionuclide-specific (risk/pCi)	HEAST
SF_i	Inhalation Cancer Slope Factor	Radionuclide-specific (risk/pCi)	HEAST

Table 4.1.3 Construction/Mound Employee (Radionuclides)
Exposure variable explanations for the soil/sediment exposure pathway

Variable	Definition	Value Used	Explanation/Source
CF_2	Conversion Factor 2	10^3 g/kg	OSWER Directive 9285.7-01B
EF	Exposure Frequency	250 days/yr	OSWER Directive 9285.6-03
IR_{soil}	Ingestion Rate - Soil	480 mg/day	OSWER Directive 9285.6-03
IR_{air}	Inhalation Rate	20 m^3/day	OSWER Directive 9285.6-03
VF	Soil-to-Air Volatilization Factor	Radionuclide-specific (m^3/kg)	OSWER Directive 9285.7-01B, revisions
PEF	Particulate Emission Factor	4.28×10^9 m^3/kg	OSWER Directive 9285.7-01B, revisions
S_e	Gamma Shielding Factor	0.1 (Unitless)	OSWER Directive 9285.7-01B (open area), revisions
T_e	Gamma Exposure Time Factor	1/3 (Unitless)	OSWER Directive 9285.7-01B (8/24 hr exposure), revisions

[1] The calculated guideline values (GVs) are presented in Appendix B of this report.

ACTION MEMORANDUM
ENGINEERING EVALUATION/COST ANALYSIS

CONTINGENT REMOVAL ACTION FOR CONTAMINATED SOIL

MOUND PLANT
MIAMISBURG, OHIO

JUNE 2002

PREPARED FOR:
U.S. DEPARTMENT OF ENERGY
MIAMISBURG ENVIRONMENTAL MANAGEMENT PROJECT
MIAMISBURG, OHIO 45343

BY:
BWXT of Ohio, Inc.
P.O. BOX 3030
MIAMISBURG, OHIO 45343-3000
UNDER CONTRACT #DE-AC24-97OH20044

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

APPENDICES

ACRONYMS

AM	Action Memorandum
AM/EE/CA	Action Memorandum/Engineering Evaluation/Cost Analysis
ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CRA	Contingent Removal Action
DOE	Department of Energy
DOT	Department of Transportation
EE/CA	Engineering Evaluation/Cost Analysis
ER	Environmental Restoration
FFA	Federal Facilities Agreement
MEMP	Miamisburg Environmental Management Project
MMCIC	Miamisburg Mound Community Improvement Corporation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
OSC	On-Scene Coordinator
OSHA	Occupational Safety and Health Administration
pCi/g	picoCuries per gram
PRS	Potential Release Site
RA	Removal Action
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RSE	Removal Site Evaluation
SARA	Superfund Amendments and Reauthorization Act
USEPA	United States Environmental Protection Agency
VSAP	Verification Sampling and Analysis Plan

1. PURPOSE

The U.S. Department of Energy (DOE) is the designated lead agency under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and removal actions at the Mound Plant are implemented as non-Superfund, federal-lead actions. DOE provides the On-Scene Coordinator (OSC). Non-Superfund, federal-lead removal actions are not subject to United States Environmental Protection Agency (USEPA) limitations on the OSC ($50,000 authority) and are not subject to National Oil and Hazardous Substances Pollution Contingency Plan (NCP) limitations on removal actions (i.e., $2,000,000 in cost and 12 months in duration).

This Action Memorandum (AM) Engineering Evaluation/Cost Analysis (EE/CA) has been generated to document the general site conditions that would justify application of a Contingent Removal Action (CRA) consistent with CERCLA, to propose the CRA described herein, and to allow public input (USEPA 1990).

The removal action presented in this document is based on information presented in previous documents. These documents are referenced in Section 2.2 and pertinent excerpts are presented in Appendix A.

2. SITE CONDITIONS AND BACKGROUND

2.1 SITE DESCRIPTION

This section describes the physical site location, site characteristics, release of contaminants into the environment, and the site's National Priorities List (NPL) status.

2.1.1 Physical Location

The Mound Plant is located on the southern border of the city of Miamisburg in Montgomery County, Ohio. The site is located approximately 10 miles south-southwest of Dayton and 45 miles north of Cincinnati. This CRA is proposed for the Potential Release Sites (PRSs) identified in Table 2.1 and shown in Figure 2.1. This CRA is also proposed for similar PRSs designated for Removal Action (RA) by the Core Team as well as similar sites not yet discovered.

2.1.2 Site Characteristics

The PRSs to be addressed under this Action Memorandum have the following characteristics:

- simple removal action,
- easily verified, and
- small number of contaminants of concern.

PRSs that meet the above criteria and have been designated for RA are identified in Table 2.1.

2.1.3 Release or Threatened Release into the Environment

The potential release of radionuclides and/or hazardous chemicals (including petroleum hydrocarbons) prompted this removal action.

2.1.4 National Priorities List Status

The USEPA placed the Mound Plant in Miamisburg, Ohio on the NPL by publication in the Federal Register on November 21, 1989.

2.2 OTHER ACTIONS TO DATE

The Mound Plant initiated a CERCLA program in 1989, now guided by the agreement among, the DOE, Ohio Environmental Protection Agency (OEPA), and USEPA. A Federal Facilities Agreement (FFA) under CERCLA Section 120 was executed between DOE and USEPA Region V on October 12, 1990. It was revised on July 15, 1993 (EPA Administrative Docket No. OH 890-008984)

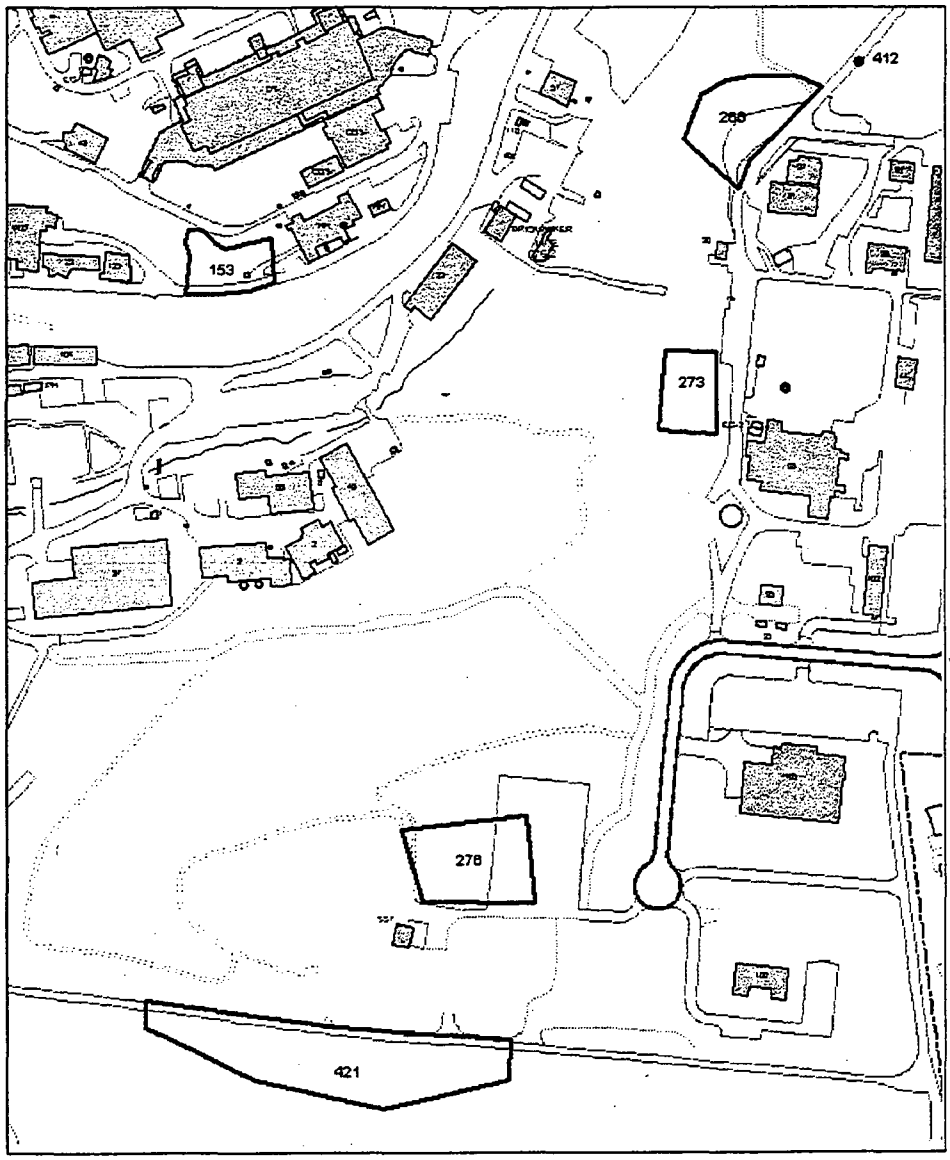

Figure 2.1 Location of Identified PRSs for this Contingent Removal Action
(PRS 153, 266, 273, 276, 412, and 421 - Outlined in Red)

to include OEPA as a signatory. The general purposes of the FFA are to:

- ensure that the environmental impacts associated with past and present activities at the site are thoroughly investigated and appropriate remedial actions taken as necessary to protect the public health, welfare, and the environment,

- establish a procedural framework and schedule for developing, implementing, maintaining, and monitoring appropriate response actions at the site in accordance with CERCLA, Superfund Amendments and Reauthorization Act (SARA), the NCP, Superfund guidance and policy, and Resource Conservation and Recovery Act (RCRA) guidance and policy, and

- facilitate cooperation, exchange of information, and participation of the parties in such actions.

On the dates indicated in Table 2.1, the Core Team (consisting of representatives of DOE/Miamisburg Environmental Management Project (MEMP), USEPA, and OEPA) recommended these PRSs be addressed as Removal Actions. These recommendations (included in Appendix A) were available for public review and comment during the dates indicated in Table 2.1.

2.2.1 Previous Removal Actions

No previous removal actions have been performed at the PRSs identified in Table 2.1.

2.2.2 Current Actions

Currently, no action is underway at the PRSs in Table 2.1.

2.3 STATE AND LOCAL AUTHORITIES' ROLES

2.3.1 State and Local Action to Date

In 1990, as a result of Mound Plant's placement onto the NPL, DOE and USEPA entered into an FFA that specified the manner in which Mound CERCLA-based Environmental Restoration (ER) was to be implemented. In 1993, the FFA was amended to include the OEPA as a signatory. DOE remains the lead agency.

Table 2.1 Initial PRSs Identified for this Contingent Removal Action

PRS	Date of Core Team Removal Action Recommendation	Dates of Public Review
153	July 17, 1996	January 9, 1997 - February 13, 1997
266	August 28, 1996	October 2, 1996 - February 15, 1996
273	April 17, 1996	January 30, 1997 - March 6, 1997
276	July 22, 1999	October 13, 1999 - November 13, 1999
412	March 17, 1998	April 15, 1998 - May 15, 1998
421	July 12, 2000	May 10, 2001 - June 10, 2001

2.3.2 Potential for Continued State and Local Response

Eventual release of the Mound Plant for industrial/commercial use is planned. Periodic environmental monitoring of the area may be required until a final Record of Decision (ROD) is implemented for the entire Mound site. This monitoring would require coordination with local, state, and federal authorities. Current plant-wide environmental monitoring programs will continue until such time as remediation is completed. OEPA will continue its oversight role until all terms of the FFA have been completed.

3. THREAT TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT

3.1 THREATS TO PUBLIC HEALTH OR WELFARE

The potential release of radionuclides and/or hazardous chemicals (including petroleum hydrocarbons) may create a potential threat to the public health or welfare.

3.2 THREATS TO THE ENVIRONMENT

The potential release of radionuclides and/or hazardous chemicals (including petroleum hydrocarbons) may create a potential threat to the environment.

3.2.1 Removal Site Evaluation

The Removal Site Evaluation (RSE) requirements, as outlined under EPA's NCP regulations in 40 Code of Federal Regulations (CFR) 300.415, are presented throughout this AM/EE/CA. The source and nature of the potential release are described in the PRS Data Packages for the PRSs listed in Table 2.1. On the basis of this information, the Core Team recommended Removal Actions for these PRSs. An evaluation by public health agencies has not been performed for these PRSs, and, therefore, is not included in this AM/EE/CA. The determination of the need for a removal action is outlined in this section in Table 3.1.

The NCP identifies eight factors that must be considered in determining the appropriateness of a removal action [40 CFR 300.415(b)(2)]. These criteria are evaluated in Table 3.1.

Table 3.1 Evaluation of Removal Action Appropriateness Criteria [40 CFR 300.415(b)(2)]

Criteria		Evaluation
(I)	"...potential exposure to nearby human populations, animals, or the food chain..."	There is potential exposure to nearby human populations, animals, or the food chain from the radionuclides and/or hazardous chemicals (including petroleum hydrocarbons) when present institutional controls are relaxed.
(ii)	"Actual or potential contamination of drinking water supplies..."	There is potential for contamination of onsite drinking water supplies from the radionuclides and/or hazardous chemicals (including petroleum hydrocarbons). The contaminants could migrate to the groundwater that is the source for the plant drinking water.
(iii)	"Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;"	This CRA does not address hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage. However, remnants of drums, barrels, tanks, or other bulk storage may be encountered during this CRA.
(iv)	"High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;"	There is the potential to encounter high levels of hazardous substances, pollutants, or contaminants in soils largely at or near the surface that may migrate.
(v)	"Weather conditions that may cause hazardous substances to migrate or be released;"	These sites are exposed to weather conditions. The effects of stormwater runoff might cause the associated hazardous substances to migrate.
(vi)	"Threat of fire or explosion;"	N/A.
(vii)	"The availability of other appropriate federal or state response mechanisms to respond to the release;" and	There are no other state or federal mechanisms to respond. The FFA established a combined state and federal mechanism to respond under CERCLA. DOE is the designated lead agency at Mound under CERCLA.
(viii)	"Other situations or factors that may pose threats to public health or welfare or the environment."	N/A.

N/A - Not applicable

4. ENDANGERMENT DETERMINATION

As these locations are currently configured and access controlled, actual or threatened releases of pollutants and contaminants from this site do not pose an endangerment to public health or welfare or to the environment. However, to eliminate the possibility of endangerment, as the site transfers from DOE ownership and control, DOE has determined that removal of the contaminants is appropriate.

5. PROPOSED ACTION AND ESTIMATED COSTS

5.1 PROPOSED ACTION

The proposed action is the excavation and disposal of contaminated soil and associated material/debris that meet the criteria in Section 2.1.2. This CRA is proposed for PRSs identified in Table 2.1. This proposed action also includes locations/PRSs that exhibit properties similar to those of the PRSs in Table 2.1 (i.e., type of contaminant, contaminant concentration, isolated areas of contamination).

Since the proposed action is within the site boundaries, it is not expected to have a disproportionate impact on low income or minority populations.

5.1.1 Proposed Action Description

The proposed action is expected to result in multiple fieldwork efforts during the remainder of the Mound Exit Project. Components of the proposed action include the following:

- Project Planning

  This step includes among other objectives: identifying/confirming the limits of excavation, identifying disposal site(s) and methods for containerization of contaminated soil, identifying real or near-real time monitoring techniques for contaminant(s) of concern, developing and gaining approval of an appropriate Removal Action Work Plan, and training personnel as appropriate.

- Public Notification

  The public review of the AM/EE/CA constitutes the public notification for the PRSs specifically listed in Table 2.1. For other, similar locations/PRSs that are addressed by this CRA, public notification will have several elements. First, a public notice will be published in a local newspaper. The public notice will indicate the location, nature of the contaminant, and refer to this AM/EE/CA. The notice may be published concurrent with the start of fieldwork.

  A fact sheet will be developed. The fact sheet will include a brief description/history of the PRS, contaminants of concern (COCs), risk criteria, background levels, cleanup objectives, dust controls, surface water controls, environmental surveillance measures, verification sampling, and schedule of key activities (public review period, excavation, shipping, On-Scene Coordinator Report publication), estimated cost, where to find additional information, etc. The fact sheet will be provided to the regulators

for review with the Verification Sampling and Analysis Plan (VSAP) and work plan. The facts sheet will be available in the public reading room and referenced in the newspaper notification discussed above. Stakeholders / public can provide comments for thirty days; this opportunity for comment is concurrent with field work. The VSAP will not be implemented until stakeholders have had an opportunity to comment on the fact sheet. The fact sheet will also be provided to the members of the MAC and MRC.

- Site Preparation

  This step includes among other activities: review activities and safety issues with workforce, obtain appropriate permits, establish control of access and egress to construction site, locate and clearly mark underground utilities, establish soil erosion controls, make provisions for excavation equipment, make provisions for containment (as needed) for contaminated material, and make provisions for monitoring equipment.

- Excavation

  This step may include among other activities: removal of trees or shrubs that interfere with work activities, establishing a staging area for waste and contaminated material, removal of small structures, and excavation of soil and debris. Progression and extent of excavation will be determined in the field.

- Verification

  This step includes among other activities, sampling and analysis of soil in and at the edges of excavation to determine the residual contaminant concentration and verifying that the residual contaminant concentration is within acceptable limits. An Ohio EPA and USEPA approved VSAP, as detailed in the approved work plan, will further define the verification sampling and analysis process, which will include COCs and cleanup objectives. The most common COCs and accompanying cleanup objectives for the PRSs targeted by this document are listed in Table 5.1 (Calculations of the Risk-Based Guideline Values listed in Table 5.1 are included in Appendix C). The list of COCs may be expanded for each PRS and added PRSs, based upon additional information and characterization. The cleanup objectives will be based upon the established background levels and the most recent 10^{-5} risk-based guideline value for the more conservative scenario (construction or office worker). New or modified toxicological factors will also be taken into account for any PRSs that have not been cleaned up. Dependent on the contaminants, leaching to groundwater may need to be addressed.

Table 5.1 Cleanup Objectives (pCi/g)

Contaminant	Background Level	10-5 Risk Level [2]	Cleanup Objective*
Actinium-227+ decay products in secular equilibrium to Lead-207	0.11	4.5	4.7
Americium-241		63	63
Cesium-137+D	0.42	3.4	3.8
Cobalt-60		0.7	0.7
Lead-210+ decay products in secular equilibrium to Lead-206	1.2 [1]	6.2	7.4
Protactinium-231+ decay products in secular equilibrium to Lead-207	0.11 [1]	3.9	4
Plutonium-238	0.13	61	55
Radium-226+ decay products in secular equilibrium to Lead-210	2.0	0.9	2.9
Thorium-230+ decay products in secular equilibrium to Lead-206	1.9	0.9	2.8
Thorium-232+ decay products in secular equilibrium to Lead-208	1.4	0.7	2.1

*Objective is sum of 10^{-5} Risk-Based Guideline Value and background.

[1] These radionuclides have comparatively short half-lives and are deduced to be in secular equilibrium with the parent nuclide. Thus the background value measured for the parent is considered to be the appropriate value for these as well. The validity of using this method for background determination for other radionuclides will be assessed on a case by case basis if not available.

[2] More conservative scenario (construction or office worker)

Additional cleanup objectives for non-radioactive COCs in soil will also take into consideration leaching to groundwater, as well as the risk from contaminated soil. Additional characterization could identify additional COCs or could indicate that one or more of the primary COCs are not present. This will be addressed and documented in the VSAP. The VSAP may also include isolated hot spot criteria; i.e., a verification result that exceeds the cleanup objective by a factor of three indicates a hot spot and the need for further excavation at that location. For PRSs with small areas of contamination (for example less than 1000 ft^2), hot spot criteria will not be applied. In that case, all samples shall not exceed the agreed upon cleanup objective. If exceedances occur, additional cleanup will occur. Exceptions to the above would require review and approval by the Core Team.

The complete list of COCs for each PRS and any additional PRSs addressed under this action memorandum EE/CA will be documented in the VSAP and approved by the Core Team. To avoid the potential for elevated risk (greater than 1×10^{-4}) due to multiple contaminants, cumulative risk within a parcel will be considered by the Core Team in establishing the list of COCs and associated cleanup objectives. Additional information to be used in developing the VSAP may become available through additional data, historical review, PRS characterization before or during excavation, etc. Any changes will be presented to the public at the monthly Mound Action Committee and Mound Reuse Committee meetings by DOE/MEMP and BWXTO.

- Site Restoration

  Equipment, materials, waste containers, and barricades will be removed. The site will be backfilled and compacted to original contours and elevation unless otherwise specified. The area will be seeded as needed.

- Documentation of Completion

  Completion of the CRA will be documented by either a PRS-specific OSC Report or a series of annual OSC Reports. Each annual OSC Report will address the previous fiscal year's efforts. The draft OSC Report for each year is due to USEPA and OEPA three months after the end of the fiscal year. If this CRA is not applied to a location/PRS during a fiscal year, USEPA and OEPA will be notified in the monthly project managers meeting. In addition, this will be documented by letter.

5.1.1.1 Rationale, Technical Feasibility, and Effectiveness

The removal action chosen is necessary for the removal of known contamination to ensure that migration of the contamination does not occur.

The situations addressed by this CRA involve straightforward tasks including excavation of soil/debris, containerization and disposal of soil/debris, followed

by verification sampling. Typical methods used to accomplish these tasks are described in the work plan.

Verification sampling detailed in the work plan will be employed to confirm the effectiveness of the CRA. Verification sampling results will be documented in the OSC Report.

5.1.1.2 Monitoring

Health and safety monitoring will be performed throughout the removal action according to standard Mound procedures.

5.1.1.3 Uncertainties

The major uncertainties are the concentration levels of the contaminants and the extent of contamination (lateral and depth). The minor uncertainties include location of utilities that may exist in the area of excavation.

5.1.1.4 Institutional Controls

DOE will remain in control of the locations/PRSs addressed by this CRA until transfer of ownership of the parcel(s) they are in. If necessary, enforceable deed restrictions will be in place at the time of transfer in order to ensure future protection of human health and the environment.

5.1.1.5 Post-Removal Site Control

Post-removal site control will be provided by DOE/MEMP. See Institutional Controls above.

5.1.1.6 Cross-Media Relationships and Potential Adverse Impacts

The potential cross-media impact associated with the removal action is the potential for unintended release of contaminated materials into the atmosphere or surface water. Careful monitoring and control will be implemented during the removal action.

No potential adverse impacts of the removal action have been identified.

5.1.2 Contribution to Future Remedial Actions

To facilitate further assessments and removal actions in or near the site of this removal action, the exact dimensions of the excavation and the levels of contamination remaining at the base of excavation will be documented. The excavation will be documented by utilizing photographs, record drawings, the OSC Report, and other information collected during the removal action.

The Mound Plant is anticipated to be cleaned up by removal actions. This removal action is planned to be the final clean-up for the locations at which it is applied. The information obtained, as a result of this removal, will be used in determining the availability for the final disposition of the Mound site and will be subject to review in the subsequent risk evaluation.

5.1.3 Description of Alternative Technologies

Alternative technologies frequently evaluated for CERCLA remediation include institutional controls, containment, collection, treatment, and disposal. Based on the prevailing conditions, the following alternatives (in addition to the proposed alternative of excavation and offsite disposal) were developed.

1. No Action
2. Institutional Controls

The performance capabilities of each alternative with respect to the specific criteria is discussed below.

5.1.3.1 No Action

The "No Action" approach was eliminated. The Core Team determined that a Removal Action is warranted for the PRSs in Table 2.1.

5.1.3.2 Institutional Controls

Implementing institutional controls for these PRSs was eliminated from further consideration. This option was not feasible for future site plans. Removal Action is warranted for these locations/PRSs.

5.1.4 Engineering Evaluation/Cost Analysis

This document serves as the action memo and the EE/CA.

5.1.5 Applicable or Relevant and Appropriate Requirements (ARARs)

Mound ARARs for the ER Program have been identified (DOE 1993). CERCLA regulations require that removal actions comply with ARARs.

The following have been identified as applicable, or relevant and appropriate to this removal action:

- 49 CFR 172, 173: Department of Transportation (DOT) hazardous material transportation and employee training requirements.

5.1.5.1 Air Quality

- 40 CFR Part 61 Subpart H: National Emissions Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities.
- Ohio Administrative Code (OAC) 3745-15-07(A): Air Pollution Nuisances Prohibited.
- OAC 3745-17-02 (A,B,C): Particulate Ambient Air Quality Standards.
- OAC 3745-17-05: Particulate Non-Degradation Policy.
- OAC 3745-17-08: (A)(1), (A)(2), (B),(D): Emission Restrictions for Fugitive Dust.

5.1.5.2 To Be Considered

- EPA/230/02-89/042: Methods for Evaluating the Attainment of Cleanup Standards.

5.1.5.3 Worker Safety

- 29 CFR Part 1910: Occupational Safety and Health Act (OSHA) - General Industry Standards.
- 29 CFR Part 1926: OSHA - Safety and Health Standards.
- 29 CFR Part 1904: OSHA - Record Keeping, Reporting, and Related Regulations.

5.1.5.4 Storm Water Runoff

- National Pollutant Discharge Elimination System (NPDES) Permit No. 1IO00005*HD, June1998.

5.1.6 Other Standards and Requirements

Other standards or requirements related to the actual implementation of the removal action may be identified subsequently during the design phase and will be incorporated into the Work Plan and/or its revisions.

5.1.7 Project Schedule

The schedule established for planning and implementing the removal action is illustrated in Figure 5.1. It is expected (but not required) that the PRSs

identified in Table 2.1 will be addressed in the first field applications of this removal action. The schedule illustration indicates four fieldwork campaigns for these PRSs (FY02-1, FY03-1, FY03-2, and FY03-3). The actual numbers and duration of these campaigns may differ from the schedule illustration. When this CRA is applied to a PRS not listed in Table 2.1, there will be a public notice in the local newspaper concurrent with the start of fieldwork. This is shown in the schedule illustration for the remaining fieldwork campaigns. Because of the flexible nature of this CRA, the numbers, duration, and timing of these fieldwork campaigns may differ from Figure 5.1.

5.2 ESTIMATED COSTS

The cost estimate to perform the removal action is shown in Table 5.2. Costs include the construction activities; all engineering and construction management, waste disposal, and site restoration. The estimate is based on the average of the estimates for the PRSs in Table 2.1; additional locations are expected to have similar costs.

Table 5.2 Removal Action Cost Estimate

ESTIMATE TOTALS	
Planning	35,000
Fieldwork	315,000
Report	28,000
TOTAL	$378,000

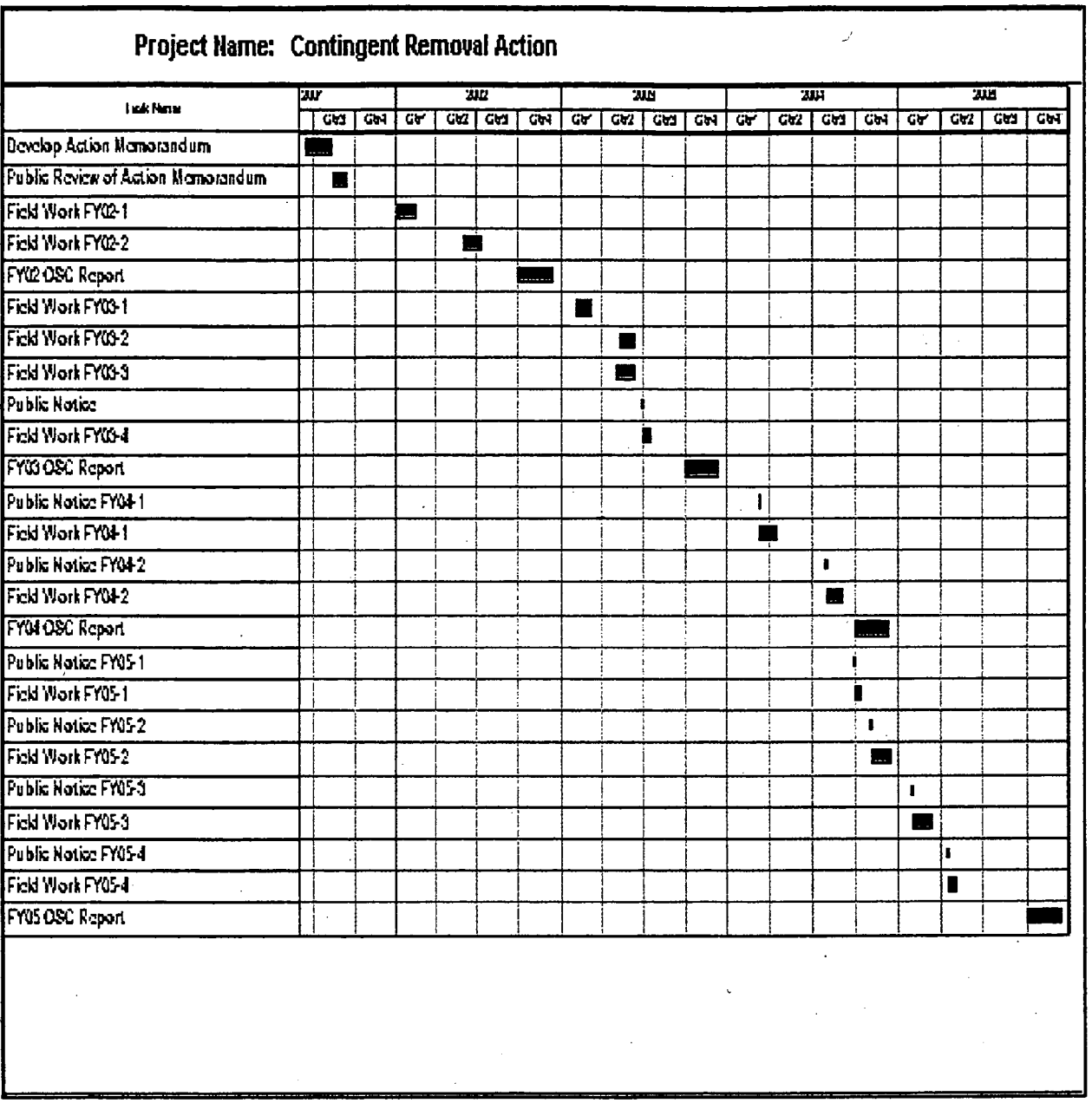

Figure 5.1 Planning and Implementation Schedule

6. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

There is the potential for the contaminants to migrate if action is delayed or not taken.

7. OUTSTANDING POLICY ISSUES

There are currently no outstanding policy issues affecting performance of this removal action.

8. ENFORCEMENT

The Core Team consisting of DOE, USEPA, and OEPA has agreed on the need to perform the removal. The work described in this document does not create a waiver of any rights under the FFA, nor is it intended to create a waiver of any rights under the FFA. The DOE is the sole party responsible for implementing this cleanup. Therefore, DOE is undertaking the role of lead agency, per CERCLA and the NCP, for the performance of this removal action. The funding for this removal action will be through DOE budget authorization and no Superfund monies will be required.

9. RECOMMENDATION

This decision document represents the selected removal action for the specific PRSs listed in Table 2.1 and similar locations/PRSs developed in accordance with CERCLA as amended by SARA, and consistent with the NCP. This decision is based on the administrative record for the site.

Conditions at the site meet the NCP Section 300.415 (b)(2) criteria for a removal and we recommend initiation of the removal action(s).

Approved:

Robert S. Rothman, Remedial Project Manager	DOE/MEMP	9/26/01 Date
Brian K. Nickel, Project Manager	OEPA	9/26/01 Date
Timothy J. Fischer, Remedial Project Manager	USEPA	9/26/01 Date

10. REFERENCES

USEPA 1990. Superfund Removal Procedures Action Memorandum Guidance. Office of Emergency and Remedial Response. US Environmental Protection Agency. December 1990.

DOE 1993. Draft Comprehensive Listing of State of Ohio ARARs, Letter from Hatcher to Kleinrath, May, 1993.

APPENDIX A
Core Team Recommendations for PRSs 153, 266, 273, 276, 412, and 421

MOUND PLANT
PRS 153
RADIOACTIVE WASTEWATER SEWER PIPELINE BREAK
AREA 20

RECOMMENDATION:

Potential Release Site (PRS) 153 is a soil area on the hillside west of the Hydrolysis House (HH) Building and bounded on the south by a roadway. This soil area, also known as Area 20, was designated a PRS because of contamination by leaks of wastewater from the 3-inch underground pipeline that transversed the northern boundary of this soil area. During the removal of the underground pipeline and surrounding soils in 1994, a localized area of contamination in the northwest corner of PRS 153 was discovered. The remediated soil had maximum concentrations of 678 pCi/g Th-232 (5 pCi/g Th-232 guideline level) and 7,694 pCi/g Pu-238 (25 pCi/g Pu-238 guideline level).

Therefore, a RESPONSE ACTION is recommended for the remainder of the contamination.

CONCURRENCE:

DOE/MB: Arthur W. Kleinrath, Remedial Project Manager — 11/26/96 (date)

USEPA: Timothy J. Fischer, Remedial Project Manager — 12/3/96 (date)

OEPA: Brian K. Nickel, Project Manager — 12/17/96 (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 1/9/97 to 2/13/97

☒ No comments were received during the comment period.

☐ Comment responses can be found on page _____ of this package.

MOUND PLANT
PRS 273
SOIL CONTAMINATION - AREA 12 (SM/PP HILLSIDE)

RECOMMENDATION:

This soils area was identified as a PRS due to historic use as a disposal site for radiologically contaminated soil.

Plutonium exists at 12 times the Mound ALARA goal of 25 pCi/g and thorium exists at 40 times the regulatory standard of 5 pCi/g. No other contaminants have been identified at levels of concern. Because this area is heavily vegetated, there is no immediate threat for migration of the contamination. However, there would be unacceptable exposure to a construction worker.

Therefore, since plutonium and thorium exist in the soil of PRS 273 at levels which present an unacceptable risk to potential future construction activities a RESPONSE ACTION is recommended.

CONCURRENCE:

DOE/MB: Arthur W Kleinrath 11/26/96
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: Timothy J Fisher 12/3/96
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: Brian K Nickel 11/27/96
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 1/30/97 to 3/6/97

☒ No comments were received during the comment period.

☐ Comment responses can be found on page _____ of this package.

MOUND PLANT
PRS 266/395
SOIL CONTAMINATION
Supersedes October 18, 1995 Recommendation

RECOMMENDATION:

PRS 266 was identified as a potential release site as a result of historical information and the Radiological Site Survey performed in October 1983. The 25,000 square foot area has three sets of data indicating high levels of thorium-232 (greater than 200 pCi/g). Therefore, a RESPONSE ACTION is recommended for PRS 266, as previously recommended on October 18, 1995.

PRS 395 was identified as a potential release site in June 1994 due to qualitative PETREX soil gas results during the Operable Unit 5, Operational Area Phase I Investigation. On October 18, 1995 further assessment for halogenated hydrocarbons was recommended for PRS 395. A subsequent quantitative *Soil Gas Confirmation Investigation* sample taken within 50 feet of PRS 395 showed that all concentrations of volatile (including halogenated hydrocarbons), semivolatile, PCBs, pesticides, metals, radionuclides, and explosives in the soils were below their respective ALARA, regulatory or 10^{-6} Risk Based Guideline Criteria. Therefore, NO FURTHER ASSESSMENT is recommended for PRS 395.

CONCURRENCE:

DOE/MEMP: _____ 12/19/96
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____ 12/18/96
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____ 12/18/96
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 4/3/97 to 5/8/97

☒ No comments were received during the comment period.

☐ Comment responses can be found on page _____ of this package.

Page 6

MOUND PLANT
DRS 200305

REMOVAL ACTION: Complete removal of radioactive soil in the area contaminated with Thorium-232 greater than 200 pCi/g. Upon completion of the Thorium-232 removal, the verification sampling plan, associated with DRS 305, will involve sampling the field-posted boundaries. This will ensure that DRS 305 will be adequately characterized or cleaned for unrestricted use.

CONCURRENCE:

DOE: _____ 10/29/02

USEPA: _____ 10/29/02

OEPA: _____ 10/29/02

SUMMARY OF COMMENTS AND RESPONSES.

Comment period from 8/15/02 to 9/16/02

☒ No comments were received during the comment period

☐ Comment responses can be found on page _____ of this package.

Page 8

MOUND PLANT
PRS 276
Contaminated Soil

RECOMMENDATION:

PRS 276 is a soils location approximately 300 feet northeast of Building 21 (since demolished) and is also known as Area 22. PRS 276 is located on the south part of the SM/PP Hill and has the approximate dimensions of 75 ft by 150 ft. This area consists of many piles of soil excavated from other areas at Mound Plant, including Area 20 (PRS 155). It is also called the "orphan soils" area because it was created when construction projects did not have funding for disposal of unexpected contaminated soil. The soil was placed at PRS 276 while waiting for funding. PRS 276 was not part of the original compilation of radioactively contaminated areas but was identified by the initial gamma surveys conducted when the Site Survey Project began.

The Core Team originally recommended Further Assessment for PRS 276. Subsequently, the cost of further investigation versus the cost of removing the potentially contaminated soils was evaluated. Cost estimates indicate that the cost of removal is not significantly greater than the cost of further assessment at PRS 276. Additionally Further Assessment findings may indicate the need for a Response (removal) Action, resulting in costs associated with both: Further Assessment and Response Action. Therefore, the Core Team recommends a RESPONSE ACTION as a more cost-effective course of action for PRS 276.

CONCURRENCE:

DOE/MEMP:	Arthur W. Kleinrath, Remedial Project Manager	7/28/99 (date)
USEPA:	Timothy J. Fischer, Remedial Project Manager	7/28/99 (date)
OEPA	Brian K. Nickel, Project Manager	7/28/99 (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 10/13/99 to 11/13/99

[ ] No comments were received during the comment period

[X] Comment responses can be found ~~on page~~ at front of this package

MOUND PLANT
PRS 412
Contaminated Soil

RECOMMENDATION:

PRS 412 (hot spot C0033) was identified as a result of the Radiological Site Survey Project. Thorium was found at 42 pCi/g at this location.

The Core Team originally recommended Further Assessment for PRS 412. Subsequently, the cost of further investigation versus the cost of removing the potentially contaminated soils was evaluated. Cost estimates indicate that the cost of removal is not significantly greater than the cost of further assessment at PRS 412. Additionally Further Assessment findings may indicate the need for a Response (removal) Action, resulting in costs associated with both Further Assessment and Response Action. Therefore, the Core Team recommends a RESPONSE ACTION as a more cost-effective course of action for PRS 412.

CONCURRENCE:

DOE/MEMP: _____ 3/19/98
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____ 3/19/98
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____ 3/19/98
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from 4/15/98 to 5/15/98

☐ No comments were received during the comment period.

☒ Comment responses can be found on page C1 - C8 of this package.

MOUND PLANT
PRS 421
"The Ridge"
Contaminated Soil

RECOMMENDATION:

Potential Release Site (PRS) 421was identified as a PRS when historical sampling data indicated the presence of contaminated soil in the "Ridge" area. This was confirmed during the verification sampling for PRS 402. Elevated readings were also observed during a 1995 Health Physics survey to support locating power line poles for DP&L. This PRS is a subpart of PRS 206.

The magnitude of contamination for PRS 421 as indicated by historical sampling data revealed levels of Plutonium-238 up to 5964 pCi/g (5.5 pCi/g 10^{-4} risk based guideline value), Thorium-230 up to 32.6 pCi/g (0.11 pCi/g 10^{-4} risk based guideline value), and Thorium-228 up to 15.6 pCi/g (0.11 pCi/g 10^{-4} risk based guideline value).

Therefore, since PRS 421 contains unacceptable levels of contaminants above guideline values, a REMOVAL ACTION is recommended.

CONCURRENCE:

DOE/MMP: _____ October 18 2002
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____ 11/15/02
Timothy J. Fischer, Remedial Project Manager (date)

OEPA: _____ 10/28/02
Brian K. Nickel, Project Manager (date)

SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____

☐ No comments were received during the comment period.

☐ Comment responses can be found on page _____ of this package.

Appendix B
Background information for PRSs 153, 266, 273, 276, 412, and 421

PRS 153

Background Information: PRS 153 is a soil area on the hillside west of the Hydrolysis House (HH) Building and bounded on the south by the roadway. This soil area, also known as Area 20, was contaminated by leaks of wastewater from the 3-inch underground pipeline that transverses the northern boundary of this soil area. HH to WD underground line was removed in 1994 along with soil in the immediate area of the waste line. Surveys were conducted in mid-1980's, 1985, 1992 (Soil Gas Survey), 1994 and 1995.

Information from previous investigations:

(a). Mid-1980s: Radiological Site Survey study of PRS 153 found; Plutonium-238 (1.9 pCi/g), Cesium-137 (1.0 pCi/g), Radium-226 (0.9 pCi/g), Americium-241 (>0.5 pCi/g) and Thorium-232 (4.0 pCi/g) (All were less than guideline criteria).

(b). 1985 (During installation of a sanitary sewer line, routine surface soil sampling found)
- (1). Cobalt-60 (800 pCi/g), Bismuth-207 (70 pCi/g), Cesium-137 (200 pCi/g).
- (2). The above contamination was reportedly removed from PRS 153 (Area 20) to PRS 276 (Area 22) but no verification sampling was provided.

(c). 1992 (Soil Gas Survey was Performed)
- (1). Toluene (213 ppb/Guideline Criteria: 414,600 ppb)

(d). 1994 (In 1994, the HH to WD underground radiological waste line (transverses PRS 153) was removed)
- (1). Contaminated soil was discovered. Some of this area was excavated, but the remediation was discontinued because of utility interference and the depth of excavation. Area was backfilled.
- (2). Thorium-232 (678 pCi/g) and Plutonium-238 (7,694 pCi/g).

(e). 1995: Further assessment of PRS 153 area was performed in 1995. This investigation, Other Soils Characterization, divided up PRS 153 into 15 foot by 15 foot grids and analyzed soil samples for organics (by organic vapor analyzer and organic vapor meter), metals radionuclides. Samples were collected every four feet until a depth of 12 feet or refusal was reached. However, the presence of utilities prevented sampling the extent of the contamination.
- (1). Thorium-232 (>5pCi/g) and Plutonium-238 (38 pCi/g).

* All metal detection were below the 10^{-6} Risk Base Guideline Criteria for soil.

• Volatile Organic Compounds (VOCs) were detected in twenty-nine samples (no quantitative data is available).

PRS 266/395

Background Information: Radiological data from the Site Survey in 1983 identified thorium-232 contamination at a maximum value of 254.3 pCi/g in the subsurface sample at a depth of 80 inches. Plutonium-238 levels were slightly elevated in the same area. PRS 395, which is at the western edge of PRS 266, indicated elevated levels of "Total Halogenated Hydrocarbons."

Information from previous sampling:

(a). Thorium-232 and Total Halogenated Hydrocarbons.

(b). December 18, 1996 Core Team Recommendation : *Response Action* for PRS 266, *NO Further Assessment* is recommend for PRS 395. Verbal communication with John Price, BWXT and earlier with Felix Spitler, BWXT indicates organic contamination may be present.

PRS 273

Background Information:
An area of soil located west of Building 38 and the Special Metallurgical Building on the SM/PP (special Metallurgical Building/Plutonium Processing Building) hillside. In 1965, thorium-232 contaminated soil was scraped from Area 1 and placed in PRS 273. Also in 1965, plutonium-238 and thorium-232 contaminated soil from the SM Building was placed in PRS 273. The Waste Transfer System pipeline (now removed) which carried radioactive waste from Building 38 to the Waste Disposal Building (WD) passed through the west side of PRS 273.

Information from previous sampling:
(a). 1983 Radiological Site Survey: Plutonium 238 (313 pCi/g) and Thorium-232 (190 pCi/g).
(b). 1995 Other Soil Characterization: Plutonium 238 (301 pCi/g) and Thorium-232 (212 pCi/g (subsurface)).

Special Notes:
- All metal detection were below the 10^{-6} Risk Base Guideline Criteria for soils.
- Volatile Organic Compounds (VOCs) were detected in twenty-nine samples (no quantitative data is available).

PRS 276

Background Information: PRS 276 is a soils location approximately 300 feet northeast of Building 21 and is also known as Area 22. This area consists of many piles of soil excavated from other areas at the Mound Plant, including Area 20 (PRS 153). It is also called the "Orphan Soils" area because it was created when construction projects did not have funding for disposal of unexpected contaminated soil.

Information from previous sampling:
(a). 1988 Radiological Site Survey: Plutonium 238 (8.33 pCi/g), Thorium-232 (7.73 pCi/g), Cobalt-60 (143 pCi/g), Cesium-137 (7 pCi/g), Radium-226 (0.7 pCi/g), Americium-241 (not detected), Tritium (990 pCi/l (soil distillate)).

~~Special~~ Note: Neither Bismuth-207 nor Bismuth-210m were analyzed for even though they may be expected in association with Cobalt-60 & Since Cesium-137 was identified, it is possible that Strontium-90 may also be present.

(b). COCs 1994 Screening Investigation at Area 22: 72 soil samples were collected and analyzed from area 22 at the Mound Soil Screening Facility for plutonium-238 and thorium-232. Soil screening detected plutonium-238 above the Mound Plant ALARA goal of 25 pCi/g in 21 samples. Thorium-232 was detected in one sample.
**Plutonium-238 (81 pCi/g)
**Thorium-232 (3.1 pCi/g)

PRS 412

Background Information: PRS 412 previously known as PRS 393, is identified as a radiological hot spot located near the eastern boundary of the Mound plant on the SM hill.

Information from previous sampling:
(a). 1983 Radiological Site Survey: Plutonium-238 (0.97 pCi/g) and Thorium-232 (42.4 pCi/g at 3 feet (C0033)). (Note: Four samples were taken: 2-Surface & 2- Subsurface)
(b). 1994 OU5 Operational Area Phase I Investigation: Plutonium 238 (9 pCi/g) and Thorium-232 (0.5 pCi/g).
(c). No detection of VOCs or SVOCs (Further Assessment : Soil Gas Confirmation Sampling).
(d). PRS 308 Further Assessment, July 2000. Based on a radiological survey conducted during the PRS 308 investigation, two samples were collected in the vicinity of PRS 412. Thorium 232 was detected at 4.43 pCi/g for sample #004618 and 20.21 pCi/g for sample #004619. It was agreed that these elevated areas would be addressed with the PRS 412 removal.

PRS 421

Background Information: PRS 421 was identified after the completion of the Building 21 (PRS 284) & Associated Soils (PRS 407 and PRS 281) Decontamination & Decommissioning (D&D) Project. It is felt that PRS 421 contamination is the result of contaminant migration from PRS 407 and PRS 284. Five storm drains from the PRS 407 and PRS 284 areas discharged into the area of PRS 421. There is no process history associated with PRS 421; no incidents, spills, or leaks are noted to have occurred here.

Information from previous sampling:

	Maximum Level	10^{-6} Guideline Value (at the time of the sampling event). Background level is not included.
Benzo(a)pyrene	1.0 mg/kg	0.41 mg/kg
Beryllium	1.4 mg/kg	0.70 mg/kg
Cesium-137+D	1.15 pCi/g	0.46 pCi/g
Thorium-228+D	15.6 pCi/g	0.41 pCi/g
Thorium-230+D	2.59 pCi/g	0.13 pCi/g
Thorium-232+D	32.6 pCi/g	0.11 pCi/g
Plutonium-238	396.4 pCi/g	55.0 pCi/g (10^{-5})
Uranium-234+D	6.6 pCi/g	0.13 pCi/g

APPENDIX C
Calculation of Risk-Based Guideline Values

Construction Worker - Soil/Sediment Exposure Pathway

Variables defined in Table 4.1.3 p93 RBGV Report 3/97
Equations listed in Table 4.1.3 p92 RBGV Report 3/97

Enter the following:

Series Ac-227 to Pb-207

Target Risk		1.00E-05
Oral Cancer Slope Factor		1.16E-09 risk/pCi
Inhalation Cancer Slope Factor		2.09E-07 risk/pCi
External Cancer Slope Factor		1.47E-06 risk/pCi

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series Segment		Ingestion	Inhalation	External Exp
Ac-227	Pb-207	1.16E-09	2.09E-07	1.47E-06
	Total	1.16E-09	2.09E-07	1.47E-06

Ingestion			
Target Risk	TR	1.00E-05	
Exposure Duration 1	ED_1	5	yrs
Exposure Frequency	EF	250	days/yr
Oral Cancer Slope factor	SF_0	1.16E-09	risk/pCi
Conversion Factor 1	CF_1	0.001	g/mg
Ingestion rate - Soil	IR_{soil}	480	mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	14.37	pCi/g
Inhalation			
Inhalation Cancer Slope factor	SF_i	2.09E-07	risk/pCi
Conversion Factor 2	CF_2	1000	g/kg
Inhalation Rate	IR_{air}	20	m^3/day
Soil to Air Volatilization Factor	VF	1	m^3/kg
Particulate Emission Factor	PEF	4.28E+09	m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	8.19E+03	pCi/g
External			
External Cancer Slope Factor	SF_e	1.47E-06	risk/pCi
Exposure Duration 2	ED_2	3.425	yrs
Gamma Shielding Factor	S_e	0.1	
Gamma Exposure Time factor	T_e	0.33	
Radionuclide Concentration in Soil (External Exposure)		6.63	pCi/g
Total			
	CS_{TOTAL}	4.54E+00	pCi/g

Construction Worker - Soil/Sediment Exposure Pathway

Variables defined in Table 4.1.3 p93 RBGV Report 3/97
Equations listed in Table 4.1.3 p92 RBGV Report 3/97

Enter the following:

Series		Am-241
Target Risk		1.00E-05
Oral Cancer Slope Factor		2.17E-10 risk/pCi
Inhalation Cancer Slope Factor		2.81E-08 risk/pCi
External Cancer Slope Factor		2.76E-08 risk/pCi
Ingestion		
Target Risk	TR	1.00E-05
Exposure Duration 1	ED_1	5 yrs
Exposure Frequency	EF	250 days/yr
Oral Cancer Slope factor	SF_0	2.17E-10 risk/pCi
Conversion Factor 1	CF_1	0.001 g/mg
Ingestion rate - Soil	IR_{soil}	480 mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	76.80 pCi/g
Inhalation		
Inhalation Cancer Slope factor	SF_I	2.81E-08 risk/pCi
Conversion Factor 2	CF_2	1000 g/kg
Inhalation Rate	IR_{air}	20 m^3/day
Soil to Air Volatilization Factor	VF	1 m^3/kg
Particulate Emission Factor	PEF	4.28E+09 m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	6.09E+04 pCi/g
External		
External Cancer Slope Factor	SF_e	2.76E-08 risk/pCi
Exposure Duration 2	ED_2	3.425 yrs
Gamma Shielding Factor	S_e	0.1
Gamma Exposure Time factor	T_e	0.33
Radionuclide Concentration in Soil (External Exposure)		352.97 pCi/g
Total		
	CS_{TOTAL}	6.31E+01 pCi/g

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series Segment	Ingestion	Inhalation	External Exp
Am-241	2.17E-10	2.81E-08	2.76E-08
Total	2.17E-10	2.81E-08	2.76E-08

Commercial/Office Worker - Soil/Sediment Exposure Pathway (Radionuclides)

Variables defined in Table 5.1.3 p110-111 RBGV Report 3/97

Equations listed in Table 5.1.3 p109 RBGV Report 3/97

Enter the following:

Series		Cs-137+D	
Target Risk		1.00E-05	
Oral Cancer Slope Factor		4.33E-11	risk/pCi
Inhalation Cancer Slope Factor		1.19E-11	risk/pCi
External Cancer Slope Factor		2.55E-06	risk/pCi
Ingestion			
Target Risk	TR	1.00E-05	
Exposure Duration 1	ED_1	25	yrs
Exposure Frequency	EF	250	days/yr
Oral Cancer Slope factor	SF_0	4.33E-11	risk/pCi
Conversion Factor 1	CF_1	0.001	g/mg
Ingestion rate - Soil	IR_{soil}	50	mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	739.03	pCi/g
Inhalation			
Inhalation Cancer Slope factor	SF_I	1.19E-11	risk/pCi
Conversion Factor 2	CF_2	1000	g/kg
Inhalation Rate	IR_{air}	20	m^3/day
Soil to Air Volatilization Factor	VF	1	m^3/kg
Particulate Emission Factor	PEF	4.28E+09	m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	2.88E+07	pCi/g
External			
External Cancer Slope Factor	SF_e	2.55E-06	risk/pCi
Exposure Duration 2	ED_2	17.125	yrs
Gamma Shielding Factor	S_e	0.2	
Gamma Exposure Time factor	T_e	0.08	
Radionuclide Concentration in Soil (External Exposure)		3.43	pCi/g
Total			
	CS_{TOTAL}	3.42E+00	pCi/g

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series Segment	Ingestion	Inhalation	External Exp
Cs-137+D	4.33E-11	1.19E-11	2.55E-06
Total	4.33E-11	1.19E-11	2.55E-06

Commercial/Office Worker - Soil/Sediment Exposure Pathway (Radionuclides)

Variables defined in Table 5.1.3 p110-111 RBGV Report 3/97
Equations listed in Table 5.1.3 p109 RBGV Report 3/97

Enter the following:

Series		Co-60
Target Risk		1.00E-05
Oral Cancer Slope Factor		4.03E-11 risk/pCi
Inhalation Cancer Slope Factor		3.58E-11 risk/pCi
External Cancer Slope Factor		1.24E-05 risk/pCi
Ingestion		
Target Risk	TR	1.00E-05
Exposure Duration 1	ED_1	25 yrs
Exposure Frequency	EF	250 days/yr
Oral Cancer Slope factor	SF_o	4.03E-11 risk/pCi
Conversion Factor 1	CF_1	0.001 g/mg
Ingestion rate - Soil	IR_{soil}	50 mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	794.04 pCi/g
Inhalation		
Inhalation Cancer Slope factor	SF_i	3.58E-11 risk/pCi
Conversion Factor 2	CF_2	1000 g/kg
Inhalation Rate	IR_{air}	20 m^3/day
Soil to Air Volatilization Factor	VF	1 m^3/kg
Particulate Emission Factor	PEF	4.28E+09 m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	9.56E+06 pCi/g
External		
External Cancer Slope Factor	SF_e	1.24E-05 risk/pCi
Exposure Duration 2	ED_2	17.125 yrs
Gamma Shielding Factor	S_e	0.2
Gamma Exposure Time factor	T_e	0.08
Radionuclide Concentration in Soil (External Exposure)		0.71 pCi/g
Total		
	CS_{TOTAL}	7.06E-01 pCi/g

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series Segment	Ingestion	Inhalation	External Exp
Co-60	4.03E-11	3.58E-11	1.24E-05
Total	4.03E-11	3.58E-11	1.24E-05

Construction Worker - Soil/Sediment Exposure Pathway

Variables defined in Table 4.1.3 p93 RBGV Report 3/97
Equations listed in Table 4.1.3 p92 RBGV Report 3/97

Enter the following:

Series	Pb-210+D	
Target Risk		1.00E-05
Oral Cancer Slope Factor		2.66E-09 risk/pCi
Inhalation Cancer Slope Factor		1.39E-08 risk/pCi
External Cancer Slope Factor		4.21E-09 risk/pCi

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series	Segment	Ingestion	Inhalation	External Exp
Pb-210	Pb-206	2.66E-09	1.39E-08	4.21E-09
	Total	2.66E-09	1.39E-08	4.21E-09

Ingestion			
Target Risk	TR	1.00E-05	
Exposure Duration 1	ED_1	5	yrs
Exposure Frequency	EF	250	days/yr
Oral Cancer Slope factor	SF_0	2.66E-09	risk/pCi
Conversion Factor 1	CF_1	0.001	g/mg
Ingestion rate - Soil	IR_{soil}	480	mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{Ing}	6.27	pCi/g
Inhalation			
Inhalation Cancer Slope factor	SF_I	1.39E-08	risk/pCi
Conversion Factor 2	CF_2	1000	g/kg
Inhalation Rate	IR_{air}	20	m^3/day
Soil to Air Volatilization Factor	VF	1	m^3/kg
Particulate Emission Factor	PEF	4.28E+09	m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{Inh}	1.23E+05	pCi/g
External			
External Cancer Slope Factor	SF_e	4.21E-09	risk/pCi
Exposure Duration 2	ED_2	3.425	yrs
Gamma Shielding Factor	S_e	0.1	
Gamma Exposure Time factor	T_e	0.33	
Radionuclide Concentration in Soil (External Exposure)		2314.04	pCi/g
Total			
	CS_{TOTAL}	6.25E+00	pCi/g

Construction Worker - Soil/Sediment Exposure Pathway

Variables defined in Table 4.1.3 p93 RBGV Report 3/97
Equations listed in Table 4.1.3 p92 RBGV Report 3/97

Enter the following:

Series Pa-231 to Pb-207

Target Risk		1.00E-05
Oral Cancer Slope Factor		1.53E-09 risk/pCi
Inhalation Cancer Slope Factor		2.55E-07 risk/pCi
External Cancer Slope Factor		1.61E-06 risk/pCi

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series Segment		Ingestion	Inhalation	External Exp
Pa-231	Ac-227	3.74E-10	4.55E-08	1.39E-07
Ac-227	Pb-207	1.16E-09	2.09E-07	1.47E-06
	Total	1.53E-09	2.55E-07	1.61E-06

Ingestion

Target Risk	TR	1.00E-05
Exposure Duration 1	ED_1	5 yrs
Exposure Frequency	EF	250 days/yr
Oral Cancer Slope factor	SF_0	1.53E-09 risk/pCi
Conversion Factor 1	CF_1	0.001 g/mg
Ingestion rate - Soil	IR_{soil}	480 mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	10.86 pCi/g

Inhalation

Inhalation Cancer Slope factor	SF_I	2.55E-07 risk/pCi
Conversion Factor 2	CF_2	1000 g/kg
Inhalation Rate	IR_{air}	20 m^3/day
Soil to Air Volatilization Factor	VF	1 m^3/kg
Particulate Emission Factor	PEF	4.28E+09 m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	6.73E+03 pCi/g

External

External Cancer Slope Factor	SF_e	1.61E-06 risk/pCi
Exposure Duration 2	ED_2	3.425 yrs
Gamma Shielding Factor	S_e	0.1
Gamma Exposure Time factor	T_e	0.33
Radionuclide Concentration in Soil (External Exposure)		6.05 pCi/g

Total

	CS_{TOTAL}	3.89E+00 pCi/g

Construction Worker - Soil/Sediment Exposure Pathway

Variables defined in Table 4.1.3 p93 RBGV Report 3/97
Equations listed in Table 4.1.3 p92 RBGV Report 3/97

Enter the following:

Series		Pu-238	
Target Risk		1.00E-05	
Oral Cancer Slope Factor		2.72E-10	risk/pCi
Inhalation Cancer Slope Factor		3.36E-08	risk/pCi
External Cancer Slope Factor		7.22E-11	risk/pCi

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series Segment	Ingestion	Inhalation	External Exp
Pu-238	2.72E-10	3.36E-08	7.22E-11
Total	2.72E-10	3.36E-08	7.22E-11

Ingestion			
Target Risk	TR	1.00E-05	
Exposure Duration 1	ED_1	5	yrs
Exposure Frequency	EF	250	days/yr
Oral Cancer Slope factor	SF_0	2.72E-10	risk/pCi
Conversion Factor 1	CF_1	0.001	g/mg
Ingestion rate - Soil	IR_{soil}	480	mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	61.27	pCi/g
Inhalation			
Inhalation Cancer Slope factor	SF_i	3.36E-08	risk/pCi
Conversion Factor 2	CF_2	1000	g/kg
Inhalation Rate	IR_{air}	20	m^3/day
Soil to Air Volatilization Factor	VF	1	m^3/kg
Particulate Emission Factor	PEF	4.28E+09	m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	5.10E+04	pCi/g
External			
External Cancer Slope Factor	SF_e	7.22E-11	risk/pCi
Exposure Duration 2	ED_2	3.425	yrs
Gamma Shielding Factor	S_e	0.1	
Gamma Exposure Time factor	T_e	0.33	
Radionuclide Concentration in Soil (External Exposure)		1.35E+05	pCi/g
Total			
	CS_{TOTAL}	6.12E+01	pCi/g

Commercial/Office Worker - Soil/Sediment Exposure Pathway (Radionuclides)

Variables defined in Table 5.1.3 p110-111 RBGV Report 3/97
Equations listed in Table 5.1.3 p109 RBGV Report 3/97

Enter the following:

Series	Ra-226+D	
Target Risk		1.00E-05
Oral Cancer Slope Factor		3.39E-09 risk/pCi
Inhalation Cancer Slope Factor		2.55E-08 risk/pCi
External Cancer Slope Factor		8.49E-06 risk/pCi

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series	Segment	Ingestion	Inhalation	External Exp
Ra-226	Pb-210	7.30E-10	1.16E-08	8.49E-06
Pb-210	Pb-206	2.66E-09	1.39E-08	4.21E-09
	Total	3.39E-09	2.55E-08	8.49E-06

Ingestion		
Target Risk	TR	1.00E-05
Exposure Duration 1	ED_1	25 yrs
Exposure Frequency	EF	250 days/yr
Oral Cancer Slope factor	SF_0	3.39E-09 risk/pCi
Conversion Factor 1	CF_1	0.001 g/mg
Ingestion rate - Soil	IR_{soil}	50 mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	9.44 pCi/g
Inhalation		
Inhalation Cancer Slope factor	SF_i	2.55E-08 risk/pCi
Conversion Factor 2	CF_2	1000 g/kg
Inhalation Rate	IR_{air}	20 m^3/day
Soil to Air Volatilization Factor	VF	1 m^3/kg
Particulate Emission Factor	PEF	4.28E+09 m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	1.34E+04 pCi/g
External		
External Cancer Slope Factor	SF_e	8.49E-06 risk/pCi
Exposure Duration 2	ED_2	17.125 yrs
Gamma Shielding Factor	S_e	0.2
Gamma Exposure Time factor	T_e	0.08
Radionuclide Concentration in Soil (External Exposure)		1.03 pCi/g
Total		
	CS_{TOTAL}	9.30E-01 pCi/g

Construction Worker - Soil/Sediment Exposure Pathway

Variables defined in Table 4.1.3 p93 RBGV Report 3/97
Equations listed in Table 4.1.3 p92 RBGV Report 3/97

Enter the following:

Series	Th-230+D	
Target Risk		1.00E-05
Oral Cancer Slope Factor		3.59E-09 risk/pCi
Inhalation Cancer Slope Factor		5.40E-08 risk/pCi
External Cancer Slope Factor		8.50E-06 risk/pCi

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series Segment		Ingestion	Inhalation	External Exp
Th-230	Ra-226	2.02E-10	2.85E-08	8.19E-10
Ra-226	Pb-210	7.30E-10	1.16E-08	8.49E-06
Pb-210	Pb-206	2.66E-09	1.39E-08	4.21E-09
	Total	3.59E-09	5.40E-08	8.50E-06

Ingestion			
Target Risk	TR	1.00E-05	
Exposure Duration 1	ED_1	5	yrs
Exposure Frequency	EF	250	days/yr
Oral Cancer Slope factor	SF_0	3.59E-09	risk/pCi
Conversion Factor 1	CF_1	0.001	g/mg
Ingestion rate - Soil	IR_{soil}	480	mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	4.64	pCi/g
Inhalation			
Inhalation Cancer Slope factor	SF_i	5.40E-08	risk/pCi
Conversion Factor 2	CF_2	1000	g/kg
Inhalation Rate	IR_{air}	20	m^3/day
Soil to Air Volatilization Factor	VF	1	m^3/kg
Particulate Emission Factor	PEF	4.28E+09	m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	3.17E+04	pCi/g
External			
External Cancer Slope Factor	SF_e	8.50E-06	risk/pCi
Exposure Duration 2	ED_2	3.425	yrs
Gamma Shielding Factor	S_e	0.1	
Gamma Exposure Time factor	T_e	0.33	
Radionuclide Concentration in Soil (External Exposure)		1.15	pCi/g
Total			
	CS_{TOTAL}	9.20E-01	pCi/g

Construction Worker - Soil/Sediment Exposure Pathway

Variables defined in Table 4.1.3 p93 RBGV Report 3/97
Equations listed in Table 4.1.3 p92 RBGV Report 3/97

Enter the following:

Series		Th-232+D
Target Risk		1.00E-05
Oral Cancer Slope Factor		3.33E-09 risk/pCi
Inhalation Cancer Slope Factor		1.92E-07 risk/pCi
External Cancer Slope Factor		1.23E-05 risk/pCi

Cancer Slope Factors
HEAST Table 4 (April 2001)

Series	Segment	Ingestion	Inhalation	External Exp
Th-232	Ra-228	2.31E-10	4.33E-08	3.42E-10
Ra-228	Th-228	2.29E-09	5.23E-09	4.53E-06
Th-228	Pb-208	8.09E-10	1.43E-07	7.76E-06
	Total	3.33E-09	1.92E-07	1.23E-05

Ingestion		
Target Risk	TR	1.00E-05
Exposure Duration 1	ED_1	5 yrs
Exposure Frequency	EF	250 days/yr
Oral Cancer Slope factor	SF_o	3.33E-09 risk/pCi
Conversion Factor 1	CF_1	0.001 g/mg
Ingestion rate - Soil	IR_{soil}	480 mg/day
Radionuclide Concentration in Soil (Ingestion)	CS_{ing}	5.01 pCi/g
Inhalation		
Inhalation Cancer Slope factor	SF_i	1.92E-07 risk/pCi
Conversion Factor 2	CF_2	1000 g/kg
Inhalation Rate	IR_{air}	20 m^3/day
Soil to Air Volatilization Factor	VF	1 m^3/kg
Particulate Emission Factor	PEF	4.28E+09 m^3/kg
Radionuclide Concentration in Soil (Inhalation)	CS_{inh}	8.94E+03 pCi/g
External		
External Cancer Slope Factor	SF_e	1.23E-05 risk/pCi
Exposure Duration 2	ED_2	3.425 yrs
Gamma Shielding Factor	S_e	0.1
Gamma Exposure Time factor	T_e	0.33
Radionuclide Concentration in Soil (External Exposure)		0.79 pCi/g
Total		
	CS_{TOTAL}	6.84E-01 pCi/g