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F-OU-5
COMMENTS

OhioEPA
State of Ohio Environmental Protection Agency

Southwest District Office
40 South Main Street
Dayton, Ohio 45402-2086
(513) 285-6357
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George V. Voinovich
Governor

September 23, 1993

RE: US DOE MOUND
MONTGOMERY COUNTY

Mr. Arthur Kleinrath
U.S. Department of Energy
Dayton Area Office
1 Mound Road
Miamisburg, Ohio 45343

Dear Mr. Kleinrath:

The Ohio Environmental Protection Agency (Ohio EPA) has completed review of the Final Draft (Revision 3) of the Operable Unit (OU) 5 Work Plan, Field Sampling Plan and Quality Assurance Project Plan. Based on this review, Ohio EPA has determined that DOE failed to adequately incorporate previous Ohio EPA comments related to the hydrogeologic and geologic characterization of OU5. Specifically, DOE failed to incorporate the following comments from Ohio EPA's previous review comments:

> March 12, 1993 comment letter, comments 84, 85, 86, 88, and 96; and
>
> July 9, 1993 comment letter, general comments 1 and 2, and specific comments 24 and 31.

It is Ohio EPA's opinion that absent incorporation of the above referenced comments, the OU5 Work Plan will fail to adequately define the full nature and extent of any threat to public health or the environment which may be present within OU5, and hence fail to satisfy the purpose of the FFA as clearly expressed in Article V., paragraph B.2. of that agreement. Furthermore, failure to adequately scope the OU5 investigation will inevitably lead to deficiencies in the risk assessment and hence, in any remedy implemented based on risk identified in that assessment.

Ohio EPA wishes to note for the record that the above comments have been repeatedly conveyed to DOE though Ohio EPA correspondence dated March 12, 1993 and July 9, 1993, and through Ohio EPA's participation in comment resolution meetings held April 15, 1993 and July 20, 1993.

Apparently, DOE wishes to rely on OU9's general site-wide study for characterizing the specifics of OU5's hydrogeology and geology. OU9 data is not and will not be adequate to characterize the specifics of OU5, including the SM\PP Hill, Tributary Valley, and South Property. The hydrogeologic and geologic data from OU9 must be viewed only as a starting point to help focus the more

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comprehensive characterization necessary for OU5. OU9 data is not a substitute for the site-specific characterization of OU5 or for any of the other operable units at the Mound facility. Absent adequate characterization of the hyrogeology and geology of OU5, it is not possible to identify all potential pathways of contaminant migration or select appropriate contaminant sampling locations.

Without satisfactory resolution of the issues raised in Ohio EPA's above referenced comments, Ohio EPA cannot concur with or endorse the approach presently outlined in the OU5 Work Plan.

If you have any questions, please call me at (513)285-6035.

Sincerely,

Jeffrey R. Smith
Site Coordinator
Division of Emergency & Remedial Response

cc: J. Kwasniewski, DERR/CO
S. Nitecki, DERR/CO
J. Hines, SWDO/DERR
M. Allen, SWDO/DERR
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F-OU-5
COMMENTS

George V. Voinovich
Governor

March 12, 1993

RE: US DOE MOUND
MONTGOMERY COUNTY

Mr. Arthur Kleinrath
U.S. Department of Energy
Dayton Area Office
1 Mound Road
Miamisburg, Ohio 45343

Dear Mr. Kleinrath:

The Ohio Environmental Protection Agency (Ohio EPA) has reviewed the Operable Unit 5 Work Plan, Field Sampling Plan and Quality Assurance Project Plan and found them to be deficient in several respects and not approvable in their present form. The attached comments must be incorporated into the documents in order to obtain agency approval. Please submit responses to these comments and revised documents within 45 days of receipt of both Ohio and U.S. EPA's comments.

As discussed in the March 11, 1993 monthly manager's meeting, it would be beneficial to have a meeting to discuss these comments and the objectives of the Operable Unit 5 Remedial Investigation/Feasibility Study. Please contact me after March 23, 1993 to set up a date for holding the meeting.

If you have any questions, please call me at (513) 285-6052.

Sincerely,

Martha L. Hatcher

Martha L. Hatcher
Site Coordinator
Division of Emergency & Remedial Response

enclosures

cc w/enc: J. Kwasniewski, OEPA/DERR
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US DOE MOUND
RI/FS
OPERABLE UNIT 5
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN
DRAFT (REVISION 0)
FEBRUARY 1993
OHIO ENVIRONMENTAL PROTECTION AGENCY COMMENTS

General Comments

1. The name of this operable unit, "Radioactively Contaminated Soils," is no longer relevant since the scope has changed. It would be more appropriate to give it a name that specified its geographical emphasis. Please change references throughout the document to coincide with the new name.

2. The conceptual models presented in section 3 are not consistent with the conceptual model developed for OU 9. More detailed comments will follow.

3. In order to help evaluate the sampling proposed in the Field Sampling Plan, please include a map for each area in Section 3 which includes previous sampling locations and the concentrations at each point.

4. The Preliminary Risk Analysis that was developed for OU 9, that is partially included here, should not be used. The document was never finalized because there were issues that never were resolved regarding the presentation of the data. In an effort to save time in negotiating an analysis in an approvable form, the Ohio EPA recommends that the DOE use Preliminary Remediation goals (PRGs) developed using the Risk Assessment Guidance for Superfund (RAGS), Part B, (as recommended by the National Contingency Plan) in order to do a comparative risk analysis of the OU 5 AOCs. Therefore, delete sections 3.3 through 3.3.6. In addition, delete references to this analysis in the text of section 3 and revise section 4.3.

5. It is improper and unnecessary to reduce the list of chemicals of concern at this stage. Since complete investigations have not yet taken place with USEPA or OEPA oversight, it is premature to reduce the list of chemicals of concern. In addition, when it does become necessary to develop chemicals of concern, it is important that the analysis be completed consistent with the guidance in Section 5.8 and 5.9 of RAGS. Please delete references to reducing the list of chemicals of concern and concentrate on stating the nature and extent of known contamination.

6. Data Quality Objectives (DQOs) have not been adequately described in this work plan. The entire section on data needs must be consolidated with the data quality objectives section and reworked to identify specific objectives and decision statements of the investigation. After this has been completed, the work plan must state how the data collected will be used to meet objectives and support decisions. It would be helpful to

list the objectives, decisions and associated tasks in a table format. For additional guidance, see Section 3.4 of the U.S. EPA guidance "Data Quality Objectives for Remedial Response Activities."

7. Rationale and background information have been included in the Field Sampling Plan (FSP) that belong in the Work Plan. The work plan should identify the existing conditions and establish rationale and decisions to be made, and the FSP should outline the implementation of the data collection.

8. Many data needs regarding geology, hydrogeology and nature and extent of contamination are identified in Section 4. These need to be specifically addressed in OU5. The work plan relies on OU9 too much for area specific characterization.

9. The work plan should contain all pertinent and current information including: process history, disposal practices, historical topography, fill thickness, fill contents, surface drainage patterns and swales, hydrology, geology, hydrogeology, previous sampling locations and results including figures, sampling rational, etc. that is critical for the OU5 RI.

10. All figures should be updated with the most recent information. Figures regarding the location of AOCs, sample results and sample locations should contain topographic contours to indicate drainage patterns and possible erosion and redeposition of contaminated soils, sediments, fill, etc.

11. Data needs or unknowns discussed in the various sections (background, geology, hydrogeology, etc.) should be specifically identified as data needs and summarized in the following section or at the end of each section. The work plan should clearly focus on the data needs and explain how the data needs will be determined.

Specific Comments

1. Table of Contents, List of Illustrations, Page vii:
Please complete the referenced page numbers for the illustrations.

2. Executive Summary, Table ES-1, Page ES-8:
a) The title of this table is "known or suspected contaminants;" however, it only includes known contaminants. Please include suspected contaminants as well.
b) Please update to include contaminants that are identified in upcoming comments.

3. Executive Summary, Page ES-9, Last Paragraph:
A complete characterization should also conform to the requirements of the Federal

Facilities Agreement (FFA). Please revise the bullets to include all the goals in section 5 of Attachment I of the FFA: a) types of contaminants present - hazardous properties, quantity, and chemical composition; b) physical and chemical characteristics; and c) migration and dispersal characteristics of contaminants.

4. Executive Summary, Page ES-9, Last Paragraph, 2nd Bullet:
Please change "determine" to "scope." Field instruments cannot determine the extent of contamination to the preliminary remediation goals.

5. Executive Summary, Page ES-10, First Paragraph, 2nd Sentence:
The goal stated here is a short term goal. The goals should also include gathering sufficient information in order to conduct a Remedial Investigation and Feasibility Study (RI/FS).

6. Executive Summary, Page ES-10, 3rd Paragraph, 2nd Sentence:
The objectives of operable units 3 & 6 are different that the objectives for OU 5; OU 3 collected data for scoping purposes and OU 6 is collecting data mainly for verification and risk assessment purposes. While there are similarities, the objectives should include gathering information in order to complete a full RI/FS. Please restate.

7. Executive Summary, Page ES-10, 3rd Paragraph, Last Sentence:
a)Depending on the objective, different levels of data quality may be appropriate. The general statement that level IV data is required may be overcompensating.
b) Field screenings are either level I or II data. Please correct.

8. Executive Summary, Page ES-10, 4th Paragraph, 1st Sentence:
The investigations should also confirm previous studies and not merely fill data gaps. Please revise sentence.

9. Executive Summary, Page ES-10, 4th Paragraph, Last Sentence:
Soil gas surveys are scoping tools that help to guide **future** sampling, not refine past sampling. Please revise.

10. Executive Summary, Page ES-11, 1st Paragraph:
It was agreed to by the project managers that the technical memoranda required by the FFA will only be required for the OU 9 RI/FS. Please delete the sentences pertaining to technical memos.

11. Executive Summary, Page ES-11, 2nd Paragraph, 3rd & 4th Sentences:
The purpose of Applicable or Relevant and Appropriate **Requirements** (not regulations) are to include all potential ARARs up-front, so that you know what you are dealing with,

and then narrow the list down later. Please revise.

12. Section 1.1, Page 1-2, 2nd Paragraph
Operable Unit 5 investigation is designed to go through the RI/FS process, including evaluating and selecting its own remedial alternative.

13. Section 1.1, Page 1-3, 1st Paragraph:
a) The objectives should also include providing data for the risk assessment and evaluation of remedial actions.
b) The work plan should already include data needs; they should not have to be determined.

14. Section 1.2.2, Page 1-5, Last Paragraph:
All of the OU 3 sites that are geographically located in OU 5 will be re-assigned to OU 5. Please revise.

15. Section 1.2.3, Page 1-6, 1st Paragraph:
The schedule for D&D states that cleanups will continue through the year 2000. Please revise.

16. Section 1.2.5, Page 1-6, 3rd Paragraph:
As stated previously regarding underground storage tanks, the active tanks should be listed in the operable units in which they are geographically situated in order to provide a complete picture of all possible sources. Please revise.

17. Table I.1, Page 1-8:
See previous comment # 2.

18. Illustration 1.2, Page 1-12:
The contaminated soil should be considered as a pathway, and include exposure to receptors from ingestion and dermal contact.

19. Pages 1-14 through 1-17:
These pages are repeats of tables and figures that have already been included. Please delete.

20. Section 2.2.2.3, Page 2-2, 3rd Paragraph
Recent data from boring 384 near Area 7 suggests that the tributary valley is much deeper that originally thought. Recently collected data should be reviewed and incorporated into the Mound Plant geology and hydrogeology.

21. Section 2.2.2.3, Page 2-4, 3rd Paragraph
The "clayey, gravelly sand" outwash units within the tributary valley only appear to be discontinuous because of the two dimensional aspect of the cross-sections. These outwash units may meander down the valley and should not assumed to be discontinuous. This is a data need and should be addressed with Phase 1 or 2 site characterization. The interpretation of the cross-section should be corrected to present other possible scenarios until conclusive evidence regarding these deposits is available. This is important since this geographical area has been incorporated into OU5 the valley drains a major portion of the facility and could act a natural "french drain" that transports contaminants to the buried valley sole source aquifer.

22. Section 2.2.2.3, Pages 2-5 and 2-6, Figures 2.2 and 2.3
Cross-sections should be up dated. In addition, boring and well numbers do not correlate with cross-section traces shown on Figure 2.1. The cross-section should be updated and corrected.

23. Section 2.2.3, Page 2-7, General
Surface water drainage patterns, past and present, are important to note for this operable units since it involves dumping contaminated soil over different parts of the facility. Surface hydrology will control, in part, the redistribution of contaminated soils. This information is already available should be supplied in more detail in this document. The information should included maps displaying past and present drainage swales (lined and unlined). All this information should be used to develop the sampling rationale, locations and frequency.

24. Section 2.4.1, Page 2-10, 2nd Paragraph
The location and chemistry of seeps on the SM/PP hill are not well known and should be determined within the first phase of field work for the OU5. The location of known seeps, topography and their relationship to AOCs should be shown on a figure. The data from the seeps should be used to help develop the Phase II work.

25. Section 2.4.1.1, Page 2-10, 3rd Paragraph
The location of the current monitoring wells, proposed OU9 monitoring wells, SM/PP hill, AOCs, topography and OU5 in general should be included in a figure.

In addition, monitoring well 0309 is located in Area B, OU1.

26. Section 2.4.1.3, Page 2-14, 2nd Paragraph
The lack of information regarding the recharge for the SM/PP Hill is data gap. Understanding the recharge sources will aid in determining migration pathways that may carry contaminants away from the OU5. The text should reflect this data gap and

explain how and when this investigated.

27. Section 2.4.1.4, Page 2-14, 3rd Paragraph
Discharge from the upland areas (SM/PP) into the plant valley represents a primary pathway of contaminant migration into the sole source aquifer. As indicated above, additional investigation is needed to characterize the valley sediments and the interconnection it may represent between the contaminant sources and the sole source aquifer. This should be considered as a data need for the first phase of field work. Seismic refraction methods may provide the additional data needed to identify the valley axis and placement of additional monitoring wells.

28. Section 2.4.1.6, Page 2-17, 3rd Paragraph
Water quality data for bedrock beneath the SM/PP Hill is not available as indicated. This should be considered a data gap. As indicated above, seeps should be located and sampled. Available monitoring wells should also be sampled during the Phase I investigation.

29. Table III.1, Pages 3-2 to 3-4:
a) Area 3 should also include rare earths, uranium and radium as potential contaminants as these were contained in the thorium sludge. Please include.

b) As stated in Ohio EPA's comment #1c on the Preinvestigation Evaluation of Remedial Action Technologies (PERAT) for OU 5, radium and radon should be included as potential contaminants for Area 7 since soil from Area 15 were disposed of in Area 7.

c) Page 3-28 states that thorium contamination is suspected in Area 21. Please include.

d) The comments under "historical uses" for Area 21 states that "High-level wastes from the radium-actinium program were probably also stored here." Therefore, include these as potential contaminants. It also states that wastes with high gamma radiation were stored here, so please include gamma emitters as a potential contaminant as well.

e) Bismuth-207 and Bi-210 metastable should be included as potential contaminants for Area 22 since soils from Area 20 were placed there.

f) Gasoline-contaminated soils from the tank cleanups at the garage were placed in the spoils area (see Waste Management Report). Please include the following as potential contaminants: Total Petroleum Hydrocarbons, Polyaromatic Hydrocarbons, benzene, ethylbenzene, toluene and xylene, and lead.

30. Illustrations 3.1, 3.3, and 3.5, Pages 3-5, 3-9, and 3-15:
a) Contaminated soil is also a pathway and should include the following exposure routes: ingestion, dermal contact and direct radiation.

b) The human receptors of inhalation of ground water should be marked on the table.

c) The resident farmer should be included as a receptor, as previously included in OU 9 risk discussions.

d) The food source exposure route should be included in the table as well (see OU 9 WP, page 3-26) since the ingestion of contaminated biota and plants will be considered.

31. Section 3.1.1.3, Page 3-7, 7th Paragraph:
Were the beds dismantled as planned in 1991 (Waste Management Report)? If so, include the information from that dismantling in this section.

32. Section 3.1.2.1, Page 3-10, 4th Paragraph, 1st Sentence:
Delete "RCRA-permitted facility" from this sentence as the facility does not yet have a permit (still in review).

33. Section 3.1.2.1, Page 3-11:
The core locations listed on this page mean nothing without a map to reference. See previous general comment #3.

34. Section 3.1.2.1, Page 3-11, 4th Paragraph:
Contaminants found in well #122 above maximum contaminant levels (MCLs) include dichloromethane (7 ppb) and 2-butanone (23 ppb). In addition, actinium-227 was found in well #122 at 1.4 pCi/L. Please include in text.

35. Section 3.1.2.1, Page 3-11, 5th Paragraph:
Contaminants found in well #137 above MCLs include: 2-butanone (36 ppb), carbon tetrachloride (7 ppb), and trichloroethene (6ppb). Please include in text.

36. Section 3.1.2.2, Page 3-12, 2nd Paragraph, 2nd Sentence:
Drums of waste oil and "other RCRA-permitted waste" are no longer stored outside. Please correct to state that this was a historic practice.

37. Section 3.1.2.2, Page 3-12, 3rd Paragraph, 3rd Sentence:
If known, include the "other RCRA-permitted waste" as potential contaminants.

38. Section 3.1.2.3, Page 3-12, 4th Paragraph, 4th Sentence:
Instead of saying that "alpha and beta emitting solidified and packaged wastes" are staged here, state that Pu-238 and tritium transuranic wastes are staged here (Waste Management Report).

39. Illustration 3.6, Page 3-16:
Please should show the hits from the soil gas survey on this figure.

40. Section 3.1.3.1, Page 3-19, 2nd Paragraph:
Please include other contaminants detected above MCLs in monitoring well #111: 2-butanone (95B ppb, with no information on blank concentration), dichloromethane (110 ppb), and bis(2-ethylhexyl)phthalate (7 ppb).

41. Section 3.1.3.1, general:
The Site Scoping Report, Volume III indicated that a polonium contaminated washing machine was also disposed of in Area 7. Please include in text.

42. Section 3.1.3.4, Page 3-22, Last Paragraph, 3rd Sentence:
An investigation of Radar's Hill needs to be included in the OU 5 investigations.

43. Section 3.1.3.7, Pages 3-28 to 3-30:
The Site Scoping Report, Volume III, cites that strontium-90 may be present because of the presence of other reactor wastes (i.e. cesium-137).

44. Section 3.1.3.8, Page 3-31, 1st Paragraph:
Please include the concentrations of cobalt-60 in this paragraph.

45. Section 3.1.3.8, Page 3-31, 5th Paragraph:
Please include a copy of the geophysical map of the area with a brief explanation of the anomalies.

46. Section 3.1.3.8, Page 3-31, Last Paragraph, Last Sentence:
This background information belongs in the work plan, not the field sampling plan. Please include in the work plan.

47. Section 3.1.3.9, Page 3-32, 1st Paragraph, Last 2 Sentences:
These sentences contradict one another: one says that the use of the area began in 1985, and the other states that the initial date of operation is unknown. Does this mean that the disposal area was used prior to 1985, but only began to be used as an engineered disposal area in 1985? Please clarify.

48. Section 3.1.3.9, Page 3-32, 2nd Paragraph:
Gasoline-contaminated soils from a tank cleanup at the garage were disposed of in the spoils area. Please include this information in the text.

49. Section 3.1.3.9, Page 3-32, 4th Paragraph:
If use of the spoils area as a disposal site did not begin until 1985, then the Site Survey Project collected samples prior to the initiation of the disposal area. This is important information that would need to be included.

50. Section 3.2, Page 3-32, 5th Paragraph, 1st Sentence:
The illustration referenced here is a figure showing the OU 5 areas of concern (AOCs). Please correct reference to Illustration 1.2.

51. Section 3.2.1, Page 3-35, 1st Paragraph:
This data was not collected under the oversight of USEPA or OEPA, and can not be accepted for use in the risk assessment without confirmation sampling or data package validation. At this point in time, the data can only be used for scoping purposes.

52. Section 3.2.1.1, Page 3-37, 1st Paragraph:
This list should include petroleum hydrocarbons, which have been detected at the powerhouse tanks site, the waste oil drum field and the fire-fighting pits.

53. Section 3.2.1.1, Page 3-40, 1st Paragraph, 3rd Sentence:
The preliminary risk analysis referred to here should be deleted from this work plan, because it is not appropriate. Please delete this sentence.

54. Section 3.2.1.2, Page 3-40, 2nd Paragraph, 5th Sentence:
Please list the maximum and minimum concentrations as well as the average.

55. Table III.4, Page 3-41:
a) Frequency of Detection - For those parameters that have only one number listed under this column, please include the total number in the data set so that the frequency can be determined. Otherwise, rename the header of this column.
b) Please specify on the table or in the text the period of time from which this table was compiled.
c) Tritium - The maximum concentration of tritium detected in past sampling was 367.75 nCi/L in seep 601. Please correct.

56. Section 3.2.1.3, Page 3-45, 2nd Paragraph, 1st Sentence:
Chloroethene results from a minor pathway in the degradation of trichloroethene, but is the major degradation product of the breakdown of cis 1,2-dichloroethene. This sentence

is misleading, please correct.

57. Section 3.2.1.3, Page 3-45, 5th Paragraph, Last Sentence:
Not all of the compounds listed in this paragraph are components of gasoline, just benzene, ethylbenzene and toluene. Please correct sentence to reflect this.

58. Section 3.2.1.3, Page 3-46, 2nd Paragraph:
a) Please include the maximum concentrations of both plutonium-238 and tritium in this paragraph, not just the average value.
b) The most recent environmental monitoring report was the 1991 version, released in November, 1992. Please include information from this report.
c) 1st Sentence - Tritium has been detected in both on- and off-site wells. Please correct.

59. Section 3.2.2.2, Page 3-50, 2nd Paragraph, Last Sentence:
Zinc has a reference dose, and should not be dismissed because it is a nutrient. In addition, it is important to evaluate copper because of its impact on the aquatic environment. Any evaluations in the future should include these metals. Please correct text.

60. Section 3.2.2.2, Page 3-50, 3rd Paragraph, 2nd Sentence:
It is inappropriate to state that benzene, toluene, ethylbenzene and xylene have background ranges. These are not naturally-occurring compounds, but may be present in the environment from anthropogenic sources. According to RAGS, "...do not eliminate anthropogenic chemicals because, at many sites it is extremely difficult to conclusively show...that such chemicals are present at the site due to operations not related to the site or the surrounding soils." These chemicals should not be eliminated at this time. Please revise.

61. Section 3.3.6.1, Page 3-87, Last Paragraph:
Add the sentence "However, the National Contingency Plan states that 'The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for the alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.'"

62. Section 3.4.1, Page 3-100, Last Paragraph, 1st Sentence:
a) Correct reference to Illustration 1.2.
b) The first sentence includes air as affected media; however, table III.16, referenced in the next sentence, does not include air. It would be helpful to the reader to explain that the air pathway is being addressed by OU 9 and will not be included here.

63. Table III.16, Page 3-101, Surface Water Remedial Action Objectives:
The second remedial action objective should read "Prevent ingestion, inhalation, or contact with **surface water**...."

64. Section 3.4.1, Page 3-102, 1st Paragraph, Last Sentence:
Operable unit 5 will be characterizing and remediating ground water. Delete last sentence (as requested in Ohio EPA comments on OU5 PERAT).

65. Section 3.4.3, Page 3-102, 3rd Paragraph, 2nd Sentence:
Please change reference from OU 9 here to earlier sections in this plan that describe extent of known contamination, which are more comprehensive.

66. Table III.17, Page 3-106, Ground Water Containment Actions:
The text was not revised in response to Ohio EPA comments on OU 5 PERAT, "'Ground water aquifers/Containment Actions' should include a hydraulic barrier as a 'Remedial Technology Type' and pumping wells as a 'process option.' This could apply to Radioactive, Hazardous and Mixed Waste applicabilities. Please revise.

67. Table III.17, Page 3-107, Treatment Actions/Biological:
Check radioactive waste applicability for biological treatment actions. See previous Ohio EPA PERAT comment #23.

68. Table III.17, Page 3-108, Waste Applicability:
In response to Ohio EPA comment #24 on OU5 PERAT, the DOE stated that "Reference to 'hazardous' will be revised to indicate organics or inorganics." Please revise.

69. Section 3.5.3, Page 3-115, 2nd Paragraph, 1st Sentence:
The PRGs developed using RAGS Part B have been reviewed and agreed to. Please delete first sentence.

70. Table III.19, Page 3-116 to 3-117 and reference on Page 3-115:
This table is not consistent with table III.5. Table III.19 was developed for the OU 9 investigations and is not appropriate for OU 5. Please delete this table and references to it.

71. Section 3.5.4, Page 3-115, 3rd Paragraph, 6th Sentence:
The ARARs were prepared based on **three** types of media: surface water, soils/sediments and **ground water**. Please revise sentence.

72. Section 3.5.4, general:
Please review tables XVI.1 through XVI.6 in the OU 9 work plan and add the ARARs

from those lists that are not included here.

73. Section 3.5.4.1, Page 3-115, 5th Paragraph:
This paragraph should also consider using MCLs as potential ARARs for the ground water investigation since there is ground water located beneath OU 5 in the bedrock and the buried valley aquifer tongue. Please revise.

74. Table III.20, general:
a) Change the title of this table to reflect that it includes ground water standards as well.

b) This list is not based on the tables of contaminants of concern (COC), as stated in text. Please expand to encompass all COCs (i.e. chloroethene, manganese, RDX, carbon tetrachloride, etc.).
c) Please move the tables over on the page so that the parameter names do not get cut off by the hole punch.

75. Table III.20, Page 3-118:
a) The maximum contaminant level (MCL) and maximum contaminant level goal (MCLG) for dichloromethane are no longer proposed, but are final. Please revise.
b) The RCRA Subpart S corrective action level for N-nitrosodiphenylamine is 7E-3. Please include.
c) The RCRA Subpart S corrective action level for PCBs is 5E-6. Please include.

76. Table III.20, Page 3-119:
The MCL for copper is not proposed, but rather is final as an action level. Please move to the final MCL column and footnote with "j."

77. Table III.21, Pages 3-122 through 3-125:
a) This list needs to be expanded to include all COCs associated with OU 5.
b) The RCRA Subpart S corrective action level for benzene is 3E-2. Please include.

78. Table III.23, Page 3-130:
a) Pollution of Waters - The Ohio **Revised** Code (ORC) 6111 and 3767 are not location-specific ARARs, but action-specific. Please include in an action-specific ARAR table.
b) Well Abandonment - Well abandonment is an action-specific ARAR. Please include in an action-specific table.

79. Section 4, Page 4-1, 1st Paragraph, Bullets:
An additional objective that should be included is to complete a risk assessment. This would consist of identifying pathways and receptors in order to evaluate the threat to human health and the environment.

80. Section 4.1.1, Page 4-2.
Data needs, such as soil characterization for OU5, is deferred to Phase 2 in the SAP, but explain how the sampling locations, depths and frequency be proposed. In other words, explain when, where and how the sample locations be determined and be collected and what will be the approval vehicle.

81. Section 4.1.1, Page 4-2, 1st Paragraph:
See Section 5.0 of Attachment I of the FFA. Additional contaminant-specific information will need to be compiled as information is gained on the types of contaminants present. Please revise strategy to include compiling this information.

82. Section 4.1.1.1, page 4-2, 2nd Paragraph, 4th Sentence:
Not only is the information needed for remedial action design and to conduct a risk assessment, but it is also needed to screen alternatives for the Feasibility Study. Please revise to include this objective.

83. Table IV.1, Page 4-3:
Soil pH is an important physical parameter that needs to be measured in order to evaluate treatment options. Please include.

84. Section 4.1.1.2, Page 4-4, General/1st Paragraph
Operable Unit 9 boring/well program was not intended to fully asses ground water characterization/contamination. Operable Unit 9 is intended to gather information "necessary to obtain <u>regional and background data</u> on ground water, soils, surface water and sediment, air quality, and ecological assessments." When completed, this information should provide a preliminary data base for other operable units and help define the relationships between operable units. Operable Unit 9 provides the means and vehicle to address the Site as a whole and develop a Site Wide risk assessment. Operable Unit 9 does is not take the place of site specific hydrogeologic characterization that is required by the FFA for other operable units. **The FFA states (Page 13, Appendix --) "that the program shall provide the following information for the region (OU9), for the Site (all OUs), and as appropriate for the localized areas (AOCs) within the Site (See Appendix __, pages 12 through 15)."** The reference to operable units and AOCs is added to clarify understanding. Since the Site has been divided up for management purposes (Operable Units) and OU9 is intended to gather information on a Site Wide and regional basis, other operable units will need to provide the information listed on page 13 and 14 of Appendix I of the FFA. This strategy and understanding should be clearly incorporated into the work plan.

85. Section 4.1.1.2, Page 4-4, 2nd Paragraph
The FFA (Appendix I, pages 12 through 15) requires characterization of the properties

of both the consolidated bedrock and unconsolidated overburden and soil deposits, including those found in the tributary valley.

86. Section 4.1.1.2, Page 4-4, 2nd Paragraph
Additional data needs that are identified in this section include:
- ground water flow paths in bedrock and sediments on the SM/PP Hill and tributary valley, pg. 4-4, 2nd Paragraph;
- flow paths within permeable sand and gravel fills around utility trenches;
- interconnection between upland unconsolidated and consolidated and tributary sediments that drain a large portion of the plant property;
- interconnection of the permeable zones in the tributary valley and its ability to transmit contaminants into the main portion of the sole source buried valley aquifer;
- hydraulic properties of the bedrock on the SM/PP Hill;
- relationship of the AOCs to the permeable zones that may transmit contaminants outside OU5 and off property;
- recharge and discharge relationship on the SM/PP Hill and tributary valley; and
- bedrock chemistry, etc.

87. Section 4.1.1.2, Page 4-4. 4th Paragraph, Last Sentence:
This sentence states that there is an absence of mapped seeps; however, there have been reports of seeps on the west side to the SM/PP hill, adjacent to Area B. Please include a reference to this, and add that the presence of these seeps will be investigated.

88. Section 4.1.1.2, Page 4-4, 5th Paragraph
Operable Unit 5 will need to address/investigate all ground water that may transmit contaminants within and out of OU5. This includes shallow bedrock, deep bedrock (if necessary), and the tributary valley. Nothing should be dismissed at this time.

89. Section 4.1.1.3, Page 4-5:
The surface water system is being investigated in OU 9. If OU 5 identifies additional pathways that have not already been evaluated, then the data needs identified here will be pursued. Please revise section to state that the OU 5 investigation will evaluate if the investigation under OU 9 is sufficient to characterize surface water transport prior to

proceeding with further investigations.

90. Section 4.1.1.3, Page 4-5, 3rd Paragraph
The work plan indicates that sediments need to be analyzed for geotechnical properties including moisture content, organic content, particle size distribution, pH, porosity, etc. The work plan and FSP do not provide the sampling locations, frequency, means or schedule to collect this information. The FSP defers all this to Phase 2. The work plan and FSP will need to be modified to collect this data or provide additional information explaining when and how this will be collected.

91. Section 4.1.1.4, Page 4-5, 5th Paragraph:
Operable unit 9 is conducting an evaluation to determine if the current air monitoring network (which was designed to assess impact to the public from the site) is sufficient to characterize the air pathway from contaminated areas. The OU 9 work plan has developed a phased approach to evaluate atmospheric contaminant transport. Additional information that is deemed necessary to characterize the air pathway will be collected under the OU 9 work plan. Please revise this paragraph to be consistent with this approach.

92. Section 4.1.2, Page 4-6, 2nd Paragraph:
The bullets that identify the site characterization should include objectives that identify the nature of the contamination as well as the extent. Please add that information will be compiled to include contaminant type, physical and chemical characteristics, and migration and dispersal characteristics (Section 5.0 of Attachment I of the FFA).

93. Section 4.1.2, Page 4-6, 2nd Paragraph
The OU5 site characterization should also include incorporating all known or potential contaminant sources identified in other operable units; i.e., OU3 Limited Site Investigation sites. This should also include investigations regarding leach fields, leach pits, floor drains, waste tanks, etc. that have been used on the SM/PP Hill. Change the text to address this comment.

94. Section 4.1.2.1, Page 4-7, 1st Paragraph, 3rd Sentence:
Please include a statistical justification for using a 50' grid for sampling.

95. Section 4.1.2.2, Page 4-7, 4th Paragraph
If contaminants have migrated beyond the geographic boundaries designated as OU5, the investigations under OU5 will have to continue to define the extent of contamination. The investigation does not stop at geographic boundaries. Operable Unit 9 is not designed to define the extent of contamination from any operable unit. The text should be changed to reflect this comment.

96. Section 4.1.2.2, Page 4-8, 1st Paragraph
It is premature to determine that the boring data from each area of concern and existing/proposed ground water monitoring locations will suffice to determine if the AOC is contributing to groundwater contamination. Additional information may be needed. In addition, the background data supplied in this documents is incomplete. The Phase I investigation should look at all available information including borings/piezometers/wells in the vicinity of the AOC. Pertinent information such as well depths, monitoring well or piezometer construction, specific gradients (if known), the monitoring well location in relationship to gradients, well screened depth, stratigraphy, continuity of geologic units, thickness of units, depth to bedrock, bedrock contours, etc. Area 7 and the Spoils area are discussed below for examples.

For example, Area 7 is located in the upper portion of the tributary valley. One boring/well is located immediately south of the area. The stratigraphy indicates that the fill is underlain by a till unit, saturated sand and a lower till of unknown thickness. The horizontal extent of the geologic units is unknown. Depth to bedrock is unknown, the boring was terminated at 90 feet because field instruments indicated volatile organic contamination may be present. Specific ground water gradients are not known, but at the time, assumed to be down the valley.

The spoils area is located on the edge of the buried valley. Piezometer and monitoring wells are installed near the area but specific gradients below the spoils are not defined yet because the new OU1 and OU9 wells and piezometers have not been surveyed for elevation. Depth to bedrock and stratigraphy is fairly well defined (check boring logs). Monitoring wells may need to installed because the monitoring wells may not be directly down gradient and analytical data from piezometers is unacceptable.

97. Section 4.2, general:
This section is poorly written and contains a lot of extraneous information. Please rewrite to focus on objectives and data needs.

98. Section 4.2, Page 4-11, 3rd Paragraph, 2nd Sentence:
The evaluation of remedial action alternatives are also based on technical implementability. Please include.

99. Section 4.2, Page 4-11, 3rd Paragraph, 3rd Sentence:
Section 300.430(e)(2)(i)(A)(2) of the National Contingency Plan (NCP) states that in the development of remedial action objectives:

> *For known or suspected carcinogens...The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives*

when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.

It is not acceptable to use the DOE ALARA-based criteria as goals for remedial action objectives. Please revise.

100. Section 4.2.1, Page 4-11, 4th Paragraph, 2nd Sentence:
Again, OU 3 and OU 6 have different objectives than OU 5 and do not apply. Please delete sentence.

101. Section 4.2.1, Page 4-11, 5th Paragraph, 1st Sentence:
Data requirements **can** be established prior to developing cleanup criteria. How else can an entity justify collecting data? As a starting point, detection limits are evaluated against preliminary remediation goals and ARARs. Delete sentence or rework to reflect this logic.

102. Section 4.2.1, Page 4-13, 2nd Paragraph:
See previous comment regarding using statistical methods involving cleanup standards.

103. Section 4.2.2, Pages 4-14 through 4-17:
The purpose of this section and how it relates to the RI/FS is not clear. Please rewrite section to focus on objectives and data needs of collection of information for use in the feasibility study.

104. Table IV.3:
This table does not relate to the sections around it, nor is it referenced. Please delete.

105. Section 4.3, General:
See general comment #4. The analysis should not reference the risk to a current worker, but should evaluate the areas in terms of relative risk, without using a scenario that identifies an exposure or an "acceptable risk." Identifying a risk based on an incomplete data set would be misleading and is not necessary to accomplish the prioritization.

106. Section 4.3, Page 4-17, 3rd Paragraph, Last Sentence:
Add to the end of the sentence: "...and OU 5 risk assessment."

107. Section 4.3, Page 4-19, 1st Paragraph, risk index:
This index appears set up to be able to identify relative risks. However, the text suggests that the prioritizations were made with exposures derived from section 3. This method is not acceptable and references to it should be deleted.

108. Table IV.6, Pages 4-21 to 4-22:
The information listed under the column "Ingestion Toxicity" appear to be oral slope factors. If this is the case, please label as such.

109. Section 5.4.1, Page 5-3, 3rd Paragraph, 1st Sentence:
The sampling in OU 5 will also collect information that will expand on existing data in order to define nature and extent of contamination. Please revise sentence.

110. Section 5.4.1, Page 5-3, 3rd Paragraph, Last Sentence:
The use of this guidance is not applicable since a cleanup has not been performed and we do not have cleanup standards. It would be more appropriate to use Appendix A, "Statistical Considerations," of the US EPA guidance "Data Quality Objectives for Remedial Response Activities," March 1987.

111. Section 5.4.1, Page 5-3, 4th Paragraph, 3rd & 4th Sentence:
The new wells will also supply data for the ground water quality in the Buried Valley Aquifer (BVA) tongue (please revise 3rd sentence). In addition, the phased approach proposed here for the AOCs on the SM/PP Hill will also need to expanded to include the AOCs that overlie the BVA tongue. On-plant, the OU9 hydrogeological study focused on defining ground water flows and contaminant migration pathways. Therefore, it will be necessary to expand the monitoring system in the BVA tongue and the SM/PP Hill if the current system proves inadequate to evaluate contamination from OU 5 AOCs.

112. Table V.1, Page 5-4:
a) What is the purpose behind sampling for TCLP? It would be much more cost effective to sample first for TCL and TAL parameters; and if the results show that the contaminant level is such that the media may qualify as a hazardous waste, then additional sampling may be done.
b) Please include the geotechnical sampling parameters here as well as the geochemical.

c) Why are Co-60, Cs-137, Ni-63, and Cd-113 listed separately? These isotopes would be picked up in a gamma spectrometry scan. Please delete or provide a reason for their separation.

113. Section 5.6, Page 5-7, 1st Paragraph, 3rd Bullet:
Delete "baseline." There will only be one baseline risk assessment completed for the site, and that will be performed under OU 9.

114. Section 5.6.1, Page 5-7, 3rd Paragraph, 2nd Sentence:
a) Since OU 2 has not even developed a work plan for the RI/FS, it is unlikely that the data collection activities will begin before OU 5. Please delete "2" from list of OUs that

will begin data collection before OU 5.
b) Delete "8" from the list as OU 8 has been phased out and tanks assigned to operable units in which they are geographically located.

115. Section 5.7, Page 5-9, 2nd Paragraph, 1st Sentence:
Delete "baseline." See previous comment #113.

116. Section 5.8, page 5-10, 2nd Paragraph, 1st Sentence:
This literature survey should be completed prior to the completion of the RI/FS work plan to help in developing data needs.

117. Section 5.9, Page 5-10, 3rd Paragraph:
The project managers have agreed to only complete RI technical memoranda for the OU 9 RI/FS. Please delete the references to technical memoranda here.

118. Section 5.10, Page 5-11:
Please include a discussion of the submittal of the technical memorandum on Initial Screening of Remedial Action Alternatives/ARARs for the FS.

119. Section 5.10.1.4, Page 5-11, Last Paragraph:
An initial screening of technologies should be completed to eliminate options based on technical implementability, using waste characteristics as screening criteria. This should be completed and submitted to the Ohio EPA and US EPA as a technical memorandum (Initial Screening of Alternatives) and should identify ARARs. Please revise to include.

120. Section 5.12, Page 5-16:
This section is not applicable since U.S. EPA is not the lead agency, and is not necessary. Please delete.

121. Illustration 6.1, Page 6-2:
This schedule needs to be much more specific, and include dates for specific field work tasks and submittals of documents.

122. Section 7.1.2.2, Page 7-2, 3rd & 4th Paragraphs:
These two paragraphs contradict each other. The first states that it is more efficient to separate OUs by potential contaminants, while the second paragraph states that a separation by physical systems is more efficient. Please rectify contradiction.

123. Section 7.1.2.2, Page 7-2, 5th Paragraph, 3rd Sentence:
Community participation has identified that the public wishes to have the Miami-Erie canal as the highest priority. However, further prioritization has not been completed by

the community.

124. Table VII.1, Page 7-6:
a) Section 1 - This states that the index of the file will be submitted quarterly to U.S. EPA and Ohio EPA; however, these updates have not yet been submitted. When will the first submittal of these updates occur?
b) Section 3, Document Reviews/Approvals - Please list documents other that work plan submittals (i.e. RIs, FS, RD/RA work plans, etc.).

cc:
Jennifer Kwasnieski, Ohio EPA
Claire Gesalman, EM-453, HQ
John Sands, EM-453, HQ
Art Kleinrath, DAO
Sam Cheng, DAO
Chuck Friedman, EG&G Mound
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OCT 28 1993

Ms. Diane Spencer
U. S. Environmental Protection Agency
HSRM-6J
77 W. Jackson
Chicago, IL 60604

Mr. Jeff Smith
Ohio Environmental Protection Agency
40 South Main Street
Dayton, Ohio 45402

Dear Ms. Spencer and Mr. Smith:

In accordance with section XI.G.6 of the Mound Federal Facilities Agreement, the Department of Energy is extending the period for submittal of the final OU5 RI/FS Work Plan twenty (20) days. The new submittal will be due November 15, 1993.

This extension is as agreed upon in the October 19, 1993, comment resolution meeting held between Ohio EPA, USEPA, and DOE. The extension will allow us to respond to the comments in the manner agreed upon in that meeting.

An advanced copy of this memorandum was faxed to Ms. Spencer on October 25, 1993.

Sincerely,

for James A. Johnson
Michael A. Reker
Chief, Environmental Branch

cc: See Page 2

F-OU-5
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F-OU-5
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If you have any questions, please contact Art Kleinrath of my staff at (513) 865-3597.

Sincerely,

Michael A. Reker
Chief, Environmental Branch

cc:
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Environmental Restoration Program

Operable Unit 5

South Property
Remedial Investigation/Feasibility Study
Work Plan

Mound Plant
Miamisburg, Ohio

Final
(Revision 0)

Prepared For:
EG&G Mound Applied Technologies
and
The U.S. Department Of Energy

Prepared By:

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December 1993

93-0020

Environmental Restoration Program

SOUTH PROPERTY
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
OPERABLE UNIT 5
WORK PLAN

Mound Plant
Miamisburg, Ohio

FINAL
(Revision 0)

PREPARED FOR:
EG&G MOUND APPLIED TECHNOLOGIES
AND
THE U.S. DEPARTMENT OF ENERGY

PREPARED BY:
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December 1993

93-0020

ADDENDUM

(Revision 1)

Operable Unit 5
South Property
Remedial Investigation/Feasibility Study
Work Plan, Draft Final (Revision 1)

This addendum to the Operable Unit 5 (OU5) Remedial Investigation (RI)/Feasibility Study (FS) Work Plan, Draft Final (Revision 1) has been developed in response to Regulator concerns that the OU5 Work Plan must more adequately define the full nature and extent of any threat to public health or the environment. If inconsistencies exist between the Work Plan or Field Sampling Plan texts and this addendum, then the addendum governs. To support this effort, the field investigations will be phased. The data collected during the RI phase of the site characterization will delineate the nature and extent of contamination, as well as develop a risk assessment.

During Phase 1, site reconnaissance investigations, the data obtained from the field-screening techniques are a qualitative screen that can be used to determine a strategy for directing investigations in areas of probable contamination and acquire data needed to prepare refined Data Quality Objectives (DQOs) for additional investigations in subsequent phases.

Phase 2 will provide detailed data of sufficient and consistent quality to define areas of contamination, contaminant pathways and migration, and confirm negative screening results from Phase 1. Samples for the various media will be obtained and analyzed.

Phase 3 and subsequent phases will be performed to fill data gaps found as a result of previous phase activities and to provide detailed investigations into hydrogeologic characterizations.

To assist in understanding the relationship between the various phases, a phase investigations flow chart (Figure ADD.1.) is provided. Phase 1, 2, and 3 (and subsequent phases) are each divided into two steps; Step 1, Data Collection, and Step 2, Preparation for the following phase, with each step subdivided into RI tasks. In addition to the RI tasks identified in Figure ADD.1., if warranted, ambient air monitoring

and site-specific ecological studies will be done during the field work.

These investigations are discussed in the work plan as well as in the Field Sampling Plan (FSP) for OU5. However, if inconsistencies exist between the work plan or FSP texts and this addendum, then the addendum governs.

Environmental Restoration Program

SOUTH PROPERTY
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
OPERABLE UNIT 5
WORK PLAN

Mound Plant
Miamisburg, Ohio

FINAL
(Revision 0)

PREPARED FOR:
EG&G MOUND APPLIED TECHNOLOGIES
AND
THE U.S. DEPARTMENT OF ENERGY

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December 1993

93-0020

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LIST OF ACRONYMS

AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BRA	Baseline Risk Assessment
BVA	Buried Valley Aquifer
CAA	Clean Air Act
CEARP	Comprehensive Environmental Assessment Response Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	Contaminant of Concern
CRP	Community Relations Plan
CSCSC	Cost and Schedule Control Systems Criteria
CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DOE	United States Department of Energy
DOE AL	Department of Energy Albuquerque Office
DOE DAO	Department of Energy Dayton Area Office
DOE HQ	Department of Energy Headquarters
DQO	Data Quality Objective
EA	Environmental Assessment
EM	Electromagnetic
EPA	United States Environmental Protection Agency
ER	Environmental Restoration
ES&H	Environmental Safety and Health
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FFA	Federal Facilities Agreement
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FS	Feasibility Study
FSP	Field Sampling Plan
GC	Gas Chromatograph
HEA	Health Effects Advisory
HSP	Health and Safety Plan
MCL	Maximum Contaminant Level
MRC	Monsanto Research Corporation
MS	Mass Spectrometry
NAAQS	National Ambient Air Quality Standards
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
O&M	Operations and Maintenance
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Act
OU	Operable Unit

LIST OF ACRONYMS

PAH	Polynuclear Aromatic Hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability and Completeness
PCB	Polychlorinated Biphenyls
PERAT	Preliminary Evaluation of Remedial Action Technologies
PRG	Preliminary Remediation Goals
QAPjP	Quality Assurance Project Plan
RA	Risk Assessment
RAG	Risk Assessment Guidance
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI	Remedial Investigation
RIR	Remedial Investigation Report
ROD	Record of Decision
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SCS	Soil Conservation Service
SDWA	Safe Drinking Water Act
SM/PP	Special Metallurgical/Plutonium Processing
SNAP	Spare Nuclear Auxiliary Power
SOP	Standard Operating Procedure
SOW	Statement of Work
SRDS	Storm Water Retention and Discharge System
TBC	To be Considered
TSCA	Toxic Substances Control Act
USDA	United States Department of Agriculture
USATHAMA	United States Army Toxic and Hazardous Materials Agency
VOC	Volatile Organic Compound
WBS	Work Breakdown Structure
WD	Waste Disposal
WTS	Waste Transfer System

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EXECUTIVE SUMMARY

This Remedial Investigation/Feasibility Study (RI/FS) Work Plan is for Operable Unit (OU) 5, South Property (formally known as Radioactively Contaminated Soils), at the U.S. Department of Energy (DOE) Mound Plant Facility. Mound Plant is an integrated research, development and production facility that operates in support of DOE weapons and energy programs under contract to EG&G Mound Applied Technologies. It occupies 306 acres on the southern outskirts of Miamisburg, Ohio, approximately 10 miles south-southwest of Dayton (Figure ES.1.). Mound Plant began operation in 1948 to investigate the chemical and metallurgical properties of polonium-210. Work has since expanded to include uranium, plutonium, thorium, tritium, and the stable isotope noble gases.

Physical Setting

Mound Plant is located on the eastern side of the Great Miami River Valley, within the Till Plains section of the Central Lowlands Province. The regional topography consists of generally flat-lying uplands, river valleys, and surficial glacial features such as kames and moraines. Mound Plant occupies two adjoining hills consisting of bedrock shales and limestones. The hills are separated by a tributary valley of the Great Miami River. The modern Great Miami River occupies an ancient valley that was formed by meltwater from continental glaciers. The valley is filled with thick, extensive deposits of permeable sand and gravel and is referred to as the Buried Valley Aquifer (BVA).

In 1988, the BVA was designated as a sole source aquifer in recognition of its importance as a resource and its susceptibility to contamination. Published maps of the extent of the BVA do not include the groundwater beneath Mound Plant property. However, the water-bearing unconsolidated deposits beneath the west side of Mound Plant and beneath the plant valley are continuous with similar deposits in the main valley, and are considered part of the BVA in this report.

There are two hydrogeologic regimes at Mound Plant: flow through the bedrock beneath the Main Hill and Special Metallurgical/Plutonium Processing (SM/PP) Hill, and flow within the unconsolidated glacial deposits and alluvium associated with the BVA in the Great Miami River Valley and the tributary valley between the Main Hill and SM/PP Hill. The bedrock system, an interbedded sequence of shale and limestone, is dominated by fracture flow. Groundwater movement within the till, and sand and gravel within the buried valley, occurs as porous media flow.

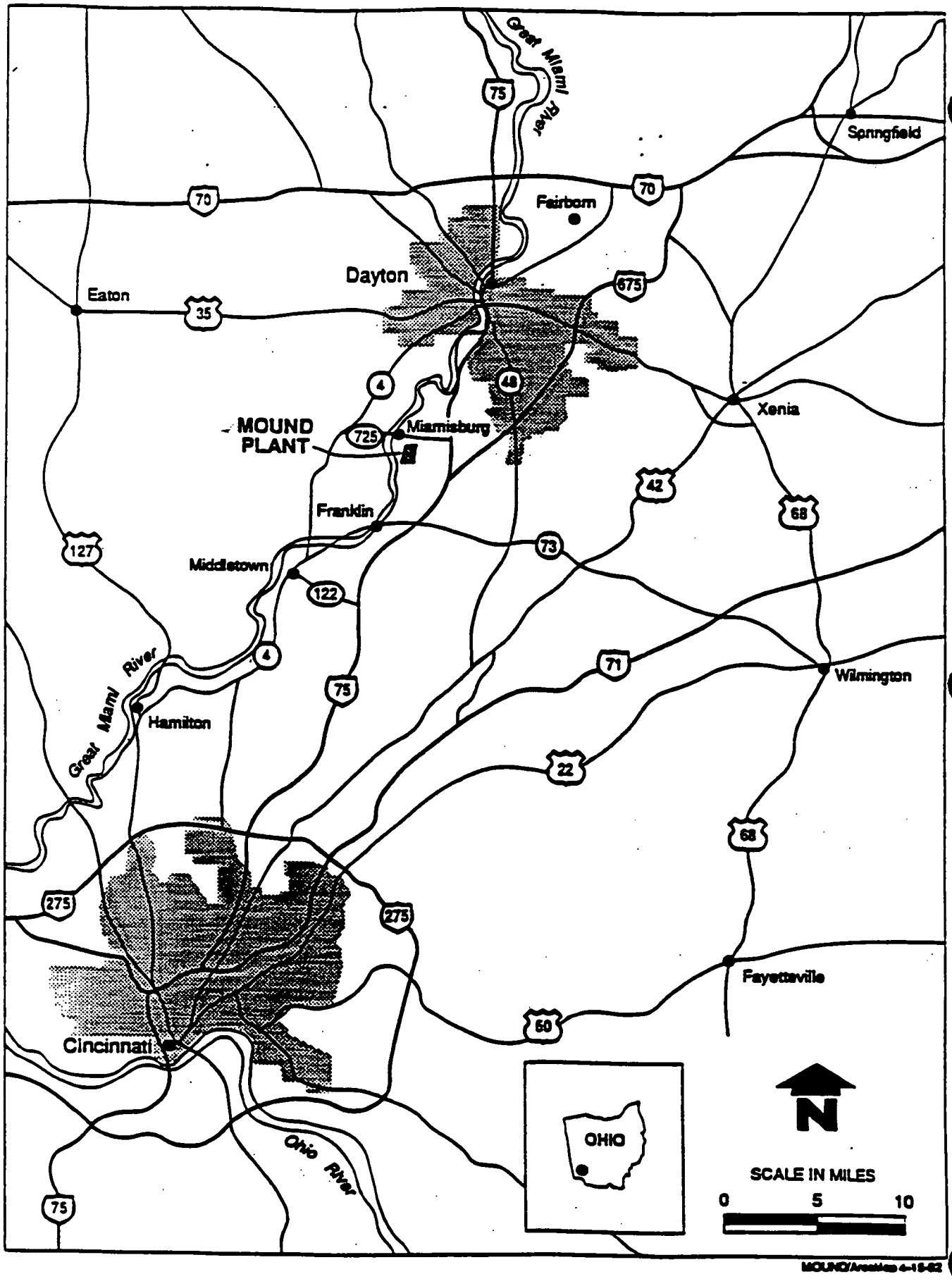


Figure ES.1. Location of Mound Plant, Miamisburg, Ohio

Elevations on the plant range from 710 to 900 feet above sea level, with the Great Miami River at an elevation of 680 feet near the plant. Natural slopes on the plant range up to 20 degrees from horizontal. Elevations in OU5 range from approximately 710 to 880 feet above sea level. The dominant geomorphic features of the plant are two adjoining hills (Main Hill and SM/PP Hill) consisting of bedrock shales and limestones covered by a thin veneer of unconsolidated deposits. The two hills are separated by a tributary valley of the Great Miami River which contains the plant drainage ditch and is underlain by interbedded till, sand and gravel deposits. The topographic lows occur in the southwest portion of the New Property and at the western-most location of the tributary valley. Much of the original surface of the hills has been regraded and reworked during plant construction.

Overland flow from the hill slopes is collected by roads or lined open ditches and culverts. The natural surface drainage patterns on much of Mound Plant property have been altered by roads and structural modifications. During facility expansion, a plant drainage ditch was engineered to control surface water storage and discharge. The storm water retention and discharge system (SRDS) is a network of sediment settling basins along the plant drainage ditch that allows for retention of low-level plutonium-contaminated silt and clay particles produced by erosion of surficial soils within the plant.

The RI/FS Process

As a result of historic disposal practices and contaminant releases to the environment, Mound Plant was placed on the National Priorities List (NPL) on November 21, 1989. Pursuant to Sections 120 and 105 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), the DOE and United States Environmental Protection Agency (EPA) entered into a Federal Facilities Agreement (FFA) on August 7, 1990, with DOE designated as the lead agency. The agreement became effective October 12, 1990.

DOE is conducting RI/FS activities for a broad geographic area including the area within Mound Plant as well as some areas beyond Mound Plant boundaries. The DOE is committed to the accomplishment of all appropriate action necessary to ensure full compliance with environmental laws and regulations, including CERCLA (Superfund), the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), the Toxic Substances Control Act (TSCA), DOE Policy SEN-15-90, and other environmental laws and directives.

The FFA statement of work requires that DOE conduct a RI/FS sufficient to characterize the site for all hazardous substances that potentially pose a threat to human health and the environment. The Mound

Plant RI/FS was originally subdivided into nine OUs for managerial purposes, and has since been consolidated into seven OUs. Each OU is responsible for investigation of specific areas of the site, while OU9 focuses on off-site and site-wide investigations.

The original operable units and their current status are as follows:

Operable Unit 1	Area B	active
Operable Unit 2	Main Hill	active
Operable Unit 3	Miscellaneous Sites	active
Operable Unit 4	Miami-Erie Canal	active
Operable Unit 5	Radioactively Contaminated Soils	active
Operable Unit 6	Decontamination and Decommissioning	active
Operable Unit 7	Limited Action Sites	eliminated
Operable Unit 8	Inactive Underground Storage Tanks	eliminated
Operable Unit 9	Site-Wide	active

As a result of the implementation of the FFA, the RI/FS process (as outlined in this OU5 Work Plan) follows the Superfund program's established methodology for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites and for evaluating remedial options. This approach is a flexible process tailored to specific circumstances characteristic of individual areas and can be adjusted as additional information becomes available. This work plan will be amended as more information is acquired concerning the various areas of contamination in OU5.

OU5 must address the radiological and chemical contamination within the physical boundaries of the OU that occur as a result of direct releases or migration of contamination in air, surface water, groundwater, sediments and soils. The OU5 Work Plan provides a conceptual model showing migration pathways and potential impacts to the public and the environment. This conceptual model shows that possible contaminant sources are ground disposal of soils and construction spoils (debris), improper storage of radioactive and hazardous waste materials, and wastewater treatment activities. Potential mechanisms of release from these sources may be sludge treatment leaks and spills, soil and spoils infiltration and percolation, and storm water runoff. Potential receptors (those exposed to contamination) include aquatic and terrestrial biota, area residents, Mound Plant employees, and visitors. This conceptual model is used to develop field investigations which will be used to ascertain the nature and extent of contamination within OU5, to provide the data needed to prepare a risk assessment (RA), and to initially evaluate potential remedial alternatives.

The purpose of this work plan is to present a plan of action to gather the data necessary to determine the nature and extent of any threat posed by the release of hazardous substances and to support evaluation of proposed remedial alternatives. The OU5 Work Plan follows the general format recommended by the EPA for conducting a RI/FS under CERCLA and describes the field activities proposed to perform a RI/FS. This work plan will initially address only eleven areas of concern (AOCs), out of the 17 currently identified in the OU9, Site-Wide Work Plan (DOE 1992a). Two of these identified AOCs have been reassigned to OU2 because of their geographic location, and the other 4 AOCs are still active areas of Mound Plant.

This work plan will also address the following three specific questions:

- Are the identified AOCs in OU5 contaminated?
- Are other areas in OU5 not presently identified as AOCs contaminated?
- What remedial action will be taken if any OU5 area is contaminated?

The three questions will be answered by identifying the data needs and by developing the sampling program necessary to fill the data needs. As additional AOCs are added to OU5, they will be addressed by adding individual addenda to this work plan.

The objectives of the OU5 RI/FS process are:

- to comply with the FFA and Ohio state law;
- to develop and refine the conceptual site model of potential exposure pathways and receptors that will assist in the preliminary assessment of risk;
- to more accurately determine the nature and extent of OU5 soil contamination;
- to determine the nature and extent of OU5 surface water and sediment contamination;
- to determine the nature and extent of OU5 groundwater contamination; and,
- to provide details and rationale of data needs for broadly defined remedial action alternatives.

Operable Unit 5 Setting

OU5 is broadly defined as the SM/PP Hill, including the plant drainage ditch, and the New Property south of the hill (Figure ES.2.). The western slopes of the SM/PP Hill periodically received construction debris

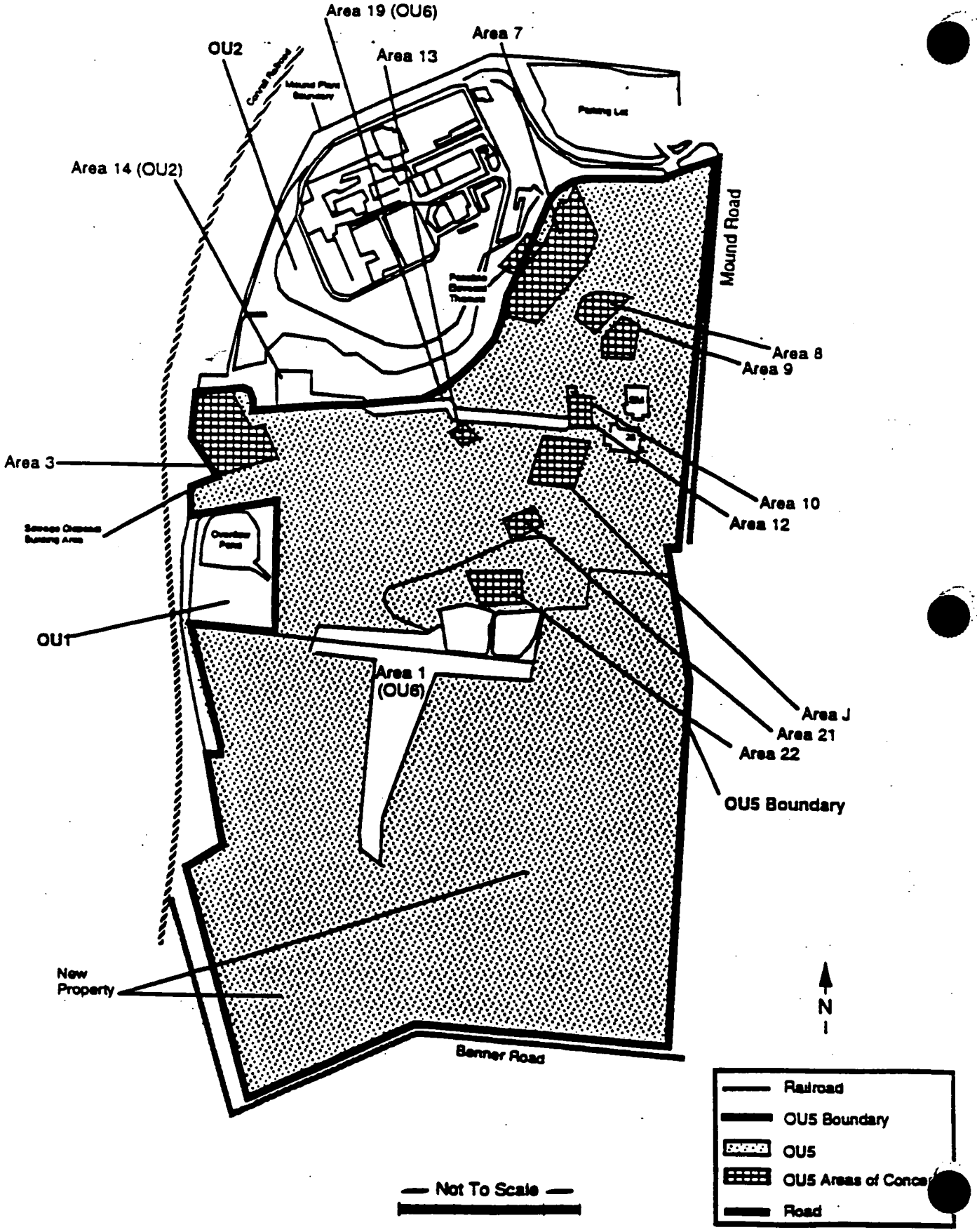


Figure ES.2. Operable Unit 5 Boundaries of Areas of Concern

and soil materials that reshaped the slopes. The Mound Plant drainage ditch, which separates the SM/PP Hill from the Main Hill, is the only perennial stream within Mound Plant. OU5 includes a collection of individual areas that have undergone various degrees of previous investigations.

Within the OU, a number of AOCs are known to be contaminated with radioactive materials (principally plutonium or thorium). Other AOCs may have been contaminated by dispersion of material from contaminated AOCs through natural processes (wind, surface water, groundwater transport, erosion, plants or animals) or by human actions (excavation, hauling, dumping, etc.). Some areas within OU5 have not been investigated and may or may not be contaminated.

The primary sources of radioactive contamination in OU5 result from wastewater treatment, storage of radioactive materials, and ground disposal of soils and construction spoils. Identified potential storage area release sites include the Sewage Disposal Building area, Area 3, and Area 9. Potential release sites from ground disposal of construction spoils include Areas 7, 10, 13, and J. Potential release sites from ground disposal of soils occurred in Area 8, Area 12, Area 21, and Area 22.

The currently identified contaminants in the OU5 AOCs are shown in Table ES.1. Investigation of lateral and vertical extent of contamination (how far the contaminants may have spread) within OU5 will initially include those contaminants in this table as well as the OU9 contaminants of concern (COCs). The OU9 COCs will be modified to specific OU5 AOC COCs as more information is developed. Additional data is anticipated to reduce the OU5 AOC-specific COC list.

Investigation Approach

A complete characterization of the nature and extent of contamination within OU5 is required. The site characterization program will:

- determine nature and extent of contamination, per Section 5, Attachment I of the FFA, by collecting information on: a) types of contaminants present, b) physical and chemical characteristics of contaminants, and c) migration and dispersal characteristics of contaminants;
- confirm the location and concentration of radiological contaminants detected in the OU9, Site Scoping Report: Volume 3 (DOE 1993a);
- scope the horizontal extent of radiological contamination with a field instrument survey;
- determine specific concentrations and areal extent of initial OU5 COCs in surface water and groundwater;

Table ES.1. Known Contaminants in Operable Unit 5

Release Site	Known Contaminants
Area 3, storage and redrumming area	Plutonium-238, thorium, 1,2-transdichloroethylene
Area 7, soil from SW cave, contaminated ventilation exhaust system, and crushed empty thorium drums	Plutonium-238, thorium, cesium-137, actinium-227, tritium, and xylene
Area 8, contaminated soils from Areas 9 and 1	Plutonium-238, thorium, and tritium
Area 9, former thorium storage and redrumming area	Plutonium-238 and thorium
Area 10, concrete from Unit 4 Dayton Operations	Plutonium-238
Area 12, contaminated soil from Area 1 and SM Building operations	Plutonium-238, thorium, and cobalt-60
Area 13, polonium-contaminated wood	Plutonium-238[a]
Area 21, old bunker	Plutonium-238, cesium-137, and tritium
Area 22, orphan soil	Plutonium-238, cobalt-60, radium-226, cesium-137
Area J, dredged material disposal and hillside	Paint and thinners, plutonium-238, thorium, tritium, cobalt-60
Sewage disposal building area	Plutonium-238 and thorium-232

[a]Although polonium-210 decays to stable lead, lead is not listed as a suspected contaminant. The relatively high specific activity of polonium-210, and the limited amount of polonium-210 that was present at Mound Plant, would yield extremely small quantities of stable lead (Pb^{206}). Low concentrations of Plutonium-238 were found in this area, possibly from run-on cross contamination.

(Developed by Roy F. Weston, Inc.)

- determine specific concentrations and areal extent of initial OU5 COCs in surface soils, subsurface soils, and sediment samples;
- determine whether chemical (non-radiological) contamination is present in OU5; and
- determine whether OU5 AOCs contain mixed waste.

The data collected during the RI phase of the site characterization effort must be used to delineate the nature and extent of contamination and then to develop a RA. Until the clean-up criteria are established and reviewed, calculated OU9 Site-Wide Preliminary Remediation Goals and DOE Decontamination and Decommissioning (D&D) criteria will continue to be used to set analytical detection limits and as inputs for the OU5 RA.

Data quality objectives (DQO) analytical levels require consistency across operable units to provide for mutual use of data. For this work plan's DQOs, many of the areas of technical focus (e.g., COCs, level of concern, etc.) will be taken from the OU9, Site-Wide Work Plan (DOE 1992a). Depending on the laboratory parameter to be analyzed, the DQOs have specified the appropriate analytical levels as either EPA Level III, IV or V. Field screening activities, however, will be done with less stringency (e.g., Level I or II) during initial reconnaissance surveys. Data generated during field sampling require the data validation discussed in the OU5 Quality Assurance Project Plan (QAPjP).

As a result of the evaluation of data needs, OU5 field investigations have been developed to confirm analysis from previous studies and fill RI/FS data gaps. These include soil, water and sediment sampling, possible well installation, soil gas and geophysics surveys and water level monitoring. Geophysical investigations will be conducted where it is likely that buried debris material exists. Field screening, such as soil gas surveys, will be used to guide future sampling in each area.

Investigations will be phased so that data collected from early phases can assist in determining later sampling strategies (by statistically basing the number and location).

Geologic investigations may include compilations of stratigraphic and lithologic data in specific OU5 AOCs when obtained during contamination characterization. This information can be used to update geologic cross-sections for OU9. Hydrogeologic investigations will be conducted to characterize the nature and extent of groundwater contamination associated with potential sources in the AOCs. Hydrogeologic investigations can include the installation of piezometers and monitoring wells along with conducting borehole geophysical tests. If warranted, ambient air monitoring and site-specific ecological

studies will be done during the field work. These investigations are discussed in the work plan as well as in the Field Sampling Plan (FSP) for OU5.

Work Plan Content

This work plan discusses the planning of field work activities and creation of the standard documents associated with RI/FS efforts, including the RI and the FS Reports. At the completion of the RI/FS for each operable unit, the data and information will be compiled in the Site-Wide RI Report (RIR) in order to present a comprehensive, site-wide characterization of Mound Plant.

The OU5 Work Plan follows those CERCLA guidelines established by EPA to evaluate the risk to human health and the environment. As such, the applicable or relevant and appropriate requirements (ARARs) and "to be considered" (TBC) information are outlined for locations and specific chemicals. Action specific ARARs are not discussed because potential remedial actions are still in the preliminary stages of review. Action specific ARARs will be added as the proposed remedial actions are narrowed down to those which specifically apply to sites within OU5.

Potential remedial actions are discussed in this work plan but are based upon the limited data available from the OU9, Site-Wide Work Plan (DOE 1992a) and OU5 Preinvestigation Evaluation of Remedial Action Technologies (PERAT) (DOE 1991a) and include chemical, biological and thermal treatment, removal and no-action. The remedial actions listed are highly preliminary and will be refined as more data become available.

This work plan explains that the DOE intends to achieve compliance with NEPA during the RI/FS process. Responsibility for preparing NEPA documents resides in the DOE line organizations, as stated in Secretary of Energy Notice SEN-15-90. In addition, the FFA states that any selected interim and final remedial actions will be implemented in accordance with the CERCLA/SARA and federal and state hazardous waste laws and regulations. The RI/FS activities are conducted according to schedules called for by the FFA and approved annually by the EPA.

A QAPjP, Health and Safety Plan (HSP), and FSP are provided as companion documents to this work plan. All four documents will be revised, if necessary, as more information regarding waste management at the site and more field data are collected for the other Mound Plant OUs. Work at some of these units will begin (or have begun) before field work starts in OU5.

1. INTRODUCTION

This section provides the following discussions: a historical summary of Mound Plant operations, a brief description of the physical extent of Operable Unit (OU) 5, a summary of known and suspected contaminants within OU5, the full OU9 contaminants of concern (COCs) list, a generic conceptual site model for Mound Plant OU5, a discussion of the coordination between other OUs and OU5, and a discussion of the work plan purpose and scope.

Section 1 closes with a discussion of the OU5 Work Plan organization. This subsection assists the reader in understanding how the balance of the document is presented in order to support the work plan and associated Remedial Investigation/Feasibility Study (RI/FS) objectives.

1.1. HISTORY OF MOUND PLANT

Mound Plant originated as part of the Manhattan Engineer District in 1943. Its purpose was to determine the chemical and metallurgical properties of polonium (DOE 1986). The work was performed for the United States Army at several locations in Dayton, Ohio, by Monsanto Research Corporation (MRC). In 1946, 182 acres were purchased for the permanent Mound Plant on the outskirts of the city of Miamisburg, in Montgomery County, Ohio. The site is approximately 10 miles south-southwest of Dayton and 45 miles north of Cincinnati. In 1948, work being performed at the Dayton units was moved to this site, and in January 1949, operations involving radionuclides began. Some of the Dayton units were dismantled in 1950 and moved to Mound Plant to allow the short-lived polonium-210 (half-life 138 days) to decay away.

The early Mound Plant programs investigated the chemical and metallurgical properties of polonium-210 and its applications, particularly the fabrication of neutron and alpha sources for weapon and non-weapon use. Investigations involving uranium, protactinium-231, and plutonium-239 were performed from 1950 to 1963 as part of the national civilian power reactor program. In 1954, separation of the stable isotopes of noble gases was begun.

In 1954, the thermoelectric generator fueled with polonium-210 was invented at Mound Plant and patented. This invention utilized heat from the radioactive decay of polonium-210. The first space nuclear auxiliary power (SNAP) generator, a SNAP-3A fueled with polonium-210, was demonstrated in 1959. The development of plutonium-238 heat sources was started at Mound Plant in 1961 because of its high specific activity and relatively short half-life (87.74 years). Since that time, heat sources fueled

with plutonium-238 have been developed and fabricated for use in thermoelectric generators and as heat sources for lunar experiments, weather satellites, navigational satellites, and spacecraft. The SNAP-27 units left on the moon during the Apollo program and the satellite for the Jupiter Fly-By mission were powered by thermoelectric generators fueled with plutonium-238 heat sources built at Mound Plant. Power sources for the Mariner-Jupiter-Saturn mission were subsequently built. Mound Plant heat sources were used to power the Pioneer spacecraft and also to provide heat for their delicate instruments. Other heat sources have been developed for use in life-support systems, artificial hearts, and cardiac pacemakers (MRC 1985).

In late 1954, Mound Plant began construction on a thorium refinery, but never finished it. Approximately 6,000 drums of thorium sludge were received in 55-gallon drums. The thorium ore and sludges consisted of hydroxide, oxalate, and minor oxide. From 1955 to 1965, the thorium was repackaged (due to drum damage and degradation) approximately three separate times, and the drums were stored in large groups (DOE 1993a). In 1966, the thorium was moved to bulk-type silo storage in Building 21. The thorium was never processed at Mound Plant and was completely removed in 1974. Uranium sludge containing thorium ("Cotter concentrate") was later obtained and used in small quantities for research purposes.

In 1956, a new mission assigned to Mound Plant was the development, production, and surveillance of detonators for military applications. Development of timers for explosives in 1959 led to their manufacture starting in 1963. The development and manufacture of ferroelectric transducers and firing sets (components that control initiation of detonators) began in 1962. All these programs are presently continuing.

The first of several programs requiring tritium-handling technology was initiated in 1954. Today, Mound Plant has an extensive capability for handling and studying tritium and tritium compounds for weapons and non-weapons applications. A facility also exists for the recovery and purification of tritium from all types of wastes generated at United States Department of Energy (DOE) sites that handle tritium. Facilities also exist for the development of tritium-containing materials and processes for weapons applications and possible manufacture (MRC 1985).

In the early 1970s, as national concerns about the environment and the conservation of resources mounted, Mound Plant expanded its comprehensive programs into environmental control, waste management, and energy conservation. In January 1975, Mound Plant formally came under the jurisdiction of the Energy

Research and Development Administration upon dissolution of the Atomic Energy Commission. In October 1977, Mound Plant was incorporated into the DOE complex.

An additional 124 acres of land south of the original 182 acres were purchased in 1981 to make up the current plant property. The New Property remains undeveloped and is currently included as part of OU5.

Mound Plant is now an integrated research, development, and production facility that operates in support of the DOE weapons and energy programs. Mound Plant manufactures non-nuclear components and tritium-containing components for nuclear weapons.

Mound Plant was placed on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, i.e., Superfund) National Priorities List (NPL) in November 1989. Pursuant to that designation, a CERCLA Section 120 Federal Facilities Agreement (FFA) was signed between the DOE and the United States Environmental Protection Agency (EPA) and became effective October 12, 1990, (EPA 1990a). The FFA defines Mound Plant as follows:

> "'Site' shall mean any area where hazardous substances, pollutants, or contaminants have come to be located, due to the activities at the Mound Plant (hereafter referred to as the Site). The U.S. EPA, after consulting with OEPA and the U.S. DOE, may change the Site designation on the basis of additional investigations to more accurately reflect the areas contaminated by hazardous substances, pollutants or contaminants, related in whole or in part to the Mound Plant. The work to be performed in this Agreement will conform to the definition of the Site as established by U.S. EPA."

Consistent with this definition, DOE is proposing RI/FS activities for a broad geographic area including the area within Mound Plant as well as areas beyond the Mound Plant boundaries.

The DOE is committed to the accomplishment of all appropriate action necessary to ensure full compliance with environmental laws and regulations, including CERCLA, the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Clean Air Act (CAA), the National Environmental Policy Act (NEPA), the Toxic Substances Control Act (TSCA), DOE Policy SEN-15-90, and other environmental laws and directives.

Because of the magnitude and complexity of the Mound Plant RI/FS, the site has been divided into OUs as a means of managing the investigation, assessment and remediation. Regardless of the current subdivision of the site, the RI/FS must ultimately address all CERCLA and RCRA regulated environmental

releases. At the completion of the RI/FS for each OU, the data and information will be compiled in the Site Wide RI Report (RIR) in order to present a comprehensive, site wide characterization of Mound Plant. The division of OUs for the remedial design/remedial action (RD/RA) may not correspond exactly to that for the RI/FS, and the number of Records of Decision (ROD) that will be necessary will be dependent in part on the outcome of the RI/FS for the individual OUs.

As described in the OU9, Site-Wide Work Plan (DOE 1992a), the Environmental Restoration (ER) Program at the Mound Plant is divided into nine (9) OUs to more effectively conduct the RI/FS activities. The OUs have been consolidated in Spring 1993, so that seven OUs are currently active.

These OUs and their current status are as follows:

Operable Unit 1	Area B	active
Operable Unit 2	Main Hill	active
Operable Unit 3	Miscellaneous Sites	active
Operable Unit 4	Miami-Erie Canal	active
Operable Unit 5	South Property (Formally known as Radioactively Contaminated Soils)	active
Operable Unit 6	Decontamination and Decommissioning	active
Operable Unit 7	Limited Action Sites	eliminated
Operable Unit 8	Inactive Underground Storage Tanks	eliminated
Operable Unit 9	Site-Wide	active

As a result of the implementation of the FFA, the RI/FS process in OU5 (as outlined in this work plan) follows the Superfund program's established methodology for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites and for evaluating remedial options (EPA 1988a). This approach is a flexible process tailored to specific circumstances characteristic of individual areas and can be adjusted as additional information becomes available.

1.2. OPERABLE UNIT 5 DESCRIPTION

OU5 includes the geographic area of the site which is south and east of the plant Access Road. OU5 is broadly defined as the Special Metallurgical/Plutonium Processing (SM/PP) Hill, the plant drainage ditch, the New Property, and those Areas of Concern (AOCs) not geographically within the boundaries of OU2 or OU1 (Figure 1.1.).

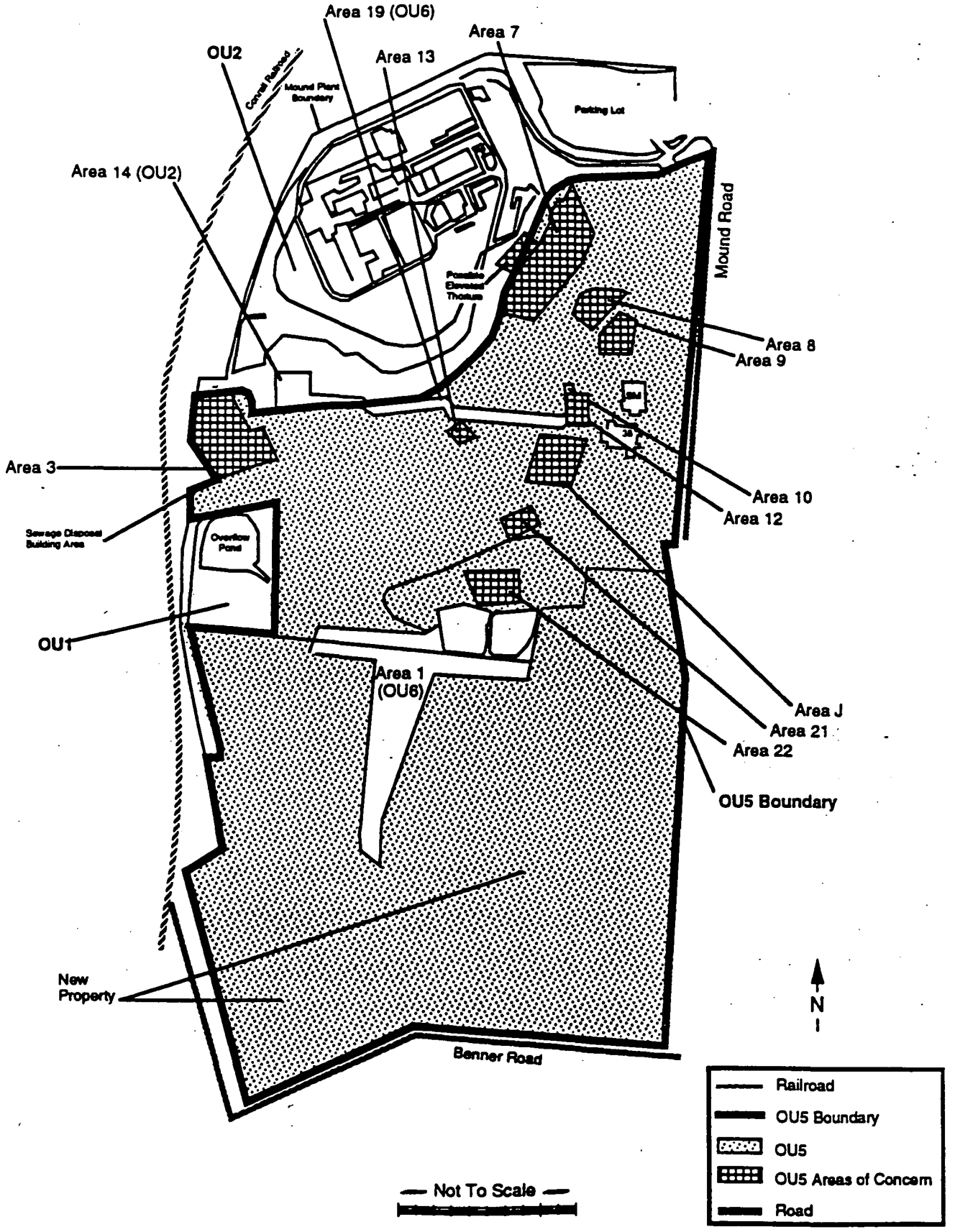


Figure 1.1. Operable Unit 5 Areas of Concern at Mound Plant

Although the original description of OU5 focused on identified radioactively contaminated soils, the scope of OU5 responsibilities also requires the determination of the nature and extent of non-radioactive (chemical) contamination in the OU5 soils, and determination of the nature and extent of groundwater contamination if an OU5 AOC is identified as its source.

Within the OU, a number of AOCs are known to be contaminated with radioactive materials (principally plutonium or thorium). Other AOCs may have been contaminated by dispersion of material from known (or from unknown) contaminated AOCs through natural processes (wind, surface water, or groundwater transport, erosion, plants or animals) or by human actions (excavation, hauling, dumping, etc.). Some areas within OU5 may be uncontaminated.

1.2.1. List of Known Contaminants

The AOCs in OU5 were identified on the basis of known radiological contamination (plutonium-238, thorium-232, cobalt-60, cesium-137, and actinium-227). Potential chemical (non-radioactive) contaminants include waste oils, paint, paint thinners, solvents, and various metals (DOE 1992a). The known contaminants found in each AOC are presented in Table I.1. In addition to the known contaminants, there are some associated radioactive contaminants that may be found as a result of impurities of the feed materials which could have been released in the processing and storage at Mound Plant. The possible radioactive contaminants are presented in Table I.2., along with the half-life, type of radioactivity emitted, decay products, health standards and possible source. Not all of these contaminants (Table I.2. listed contaminants and/or decay products) have been found in OU5. However, these contaminants may exist in some of the OU5 areas.

The primary sources of radioactive contamination in OU5 result from wastewater treatment, storage of radioactive materials, and ground disposal of soils and construction spoils. Identified potential release sites and storage areas include the Sewage Disposal Building area, Area 3, and Area 9. Ground disposal of construction spoils (debris) occurred in Areas 7, 10, 13 and J. Ground disposal of contaminated soils occurred in Area 8, Area 12, Area 21, Area 22.

1.2.2. Generic Conceptual Site Model

Figure 1.2. shows a generic conceptual model for contamination and transport within Mound Plant. The suspected release sites included in this OU contain radioactively contaminated surface or near surface soil. The releases (sludge treatment, leaks, spills, leaching) from the primary sources described above have, in

Table I.1. Known Contaminants in Operable Unit 5

Release Site		Known Contaminants
Area 3, storage and redrumming area		Plutonium-238, thorium, 1,2-transdichloroethylene
Area 7,	soil from SW cave, contaminated ventilation exhaust system, and crushed empty thorium drums	Plutonium-238, thorium, cesium-137, actinium-227, tritium, and xylene
Area 8,	contaminated soils from Areas 9 and 1	Plutonium-238, thorium, and tritium
Area 9,	former thorium storage and redrumming area	Plutonium-238 and thorium
Area 10,	concrete from Unit 4 Dayton Operations	Plutonium-238
Area 12,	contaminated soil from Area 1 and SM Building operations	Plutonium-238, thorium, and cobalt-60
Area 13,	polonium-contaminated wood	Plutonium-238[a]
Area 21,	old bunker	Plutonium-238, cesium-137, and tritium
Area 22,	orphan soil	Plutonium-238, cobalt-60, radium-226, cesium-137
Area J, dredged material disposal and hillside		Paint and thinners, plutonium-238, thorium, tritium, cobalt-60
Sewage disposal building area		Plutonium-238 and thorium-232

[a]Although polonium-210 decays to stable lead, lead is not listed as a suspected contaminant. The relatively high specific activity of polonium-210, and the limited amount of polonium-210 that was present at Mound Plant, would yield extremely small quantities of stable lead (Pb^{206}). Low concentrations of Plutonium-238 were found in this area, possibly from run-on cross contamination.

(Developed by Roy F. Weston, Inc.)

Table Development

Column 1 was created from a table of contaminants that were listed in the Mound OU9, Site Scoping Report: Volume 7 - Waste Management Report. The waste management report list in the Mound Plant Process descriptions, conducting interviews and literature searches, review of key project notes and descriptions, research of historical spills and review of the OU9, Site Scoping Report: Volume 3 - Radiological Site Survey. Columns 2 and 3 information was extracted from the Radiological Health Handbook Revised Edition, 1970. The column 4 information was provided by the RADDECAY computer program and the Table of Isotopes, Sixth Edition (Lederer, Hollander, Peralman). Column 5 information was developed from the US DOE ORDER 5480.11 "Radiation Protection for Occupational Workers". Column 6 information was developed from US EPA Federal Guidance Report No. 11, September 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion". Columns 7 and 8 were extracted from the United States Code of Federal Regulations (10CFR) Part 20 "Standards for Protection Against Radiation", Appendix B "Concentrations in Air and Water Above Natural Background." Columns 9 and 10 information was developed from the Mound OU9, Site Scoping Report: Volume 7.

KEY TO SYMBOLS AND ABBREVIATIONS USED IN TABLE I.2.

Columns 1, 3, 4 and 10

Ac Actiumium	Cd Cadmium	He Helium	Pd Palladium	Z Zinc
Fr Francium	Co Cobalt	In Indium	Ra Radium	m metastable
Ag Silver	Cs Cesium	Ni Nickel	Sb Antimony	
Am Americium	Cu Copper	Np Neptunium	Th Thorium	
Ba Barium	Po Polonium	Pa Protactinium	Tl Thallium	
Bi Bismuth	H Hydrogen	Pb Lead	Y Yttrium	

Columns 9 and 10

DOE Department of Energy
SSP DOE Site Survey Project
D&D Decontamination and Decommissioning
R&D Research and Development
PPO Pressed Plutonium Oxide process
OU Operable Unit

Columns 2, 5, 6, 7, and 8

Half-life Lung Retention Class

m minute
h hour
d day
y year

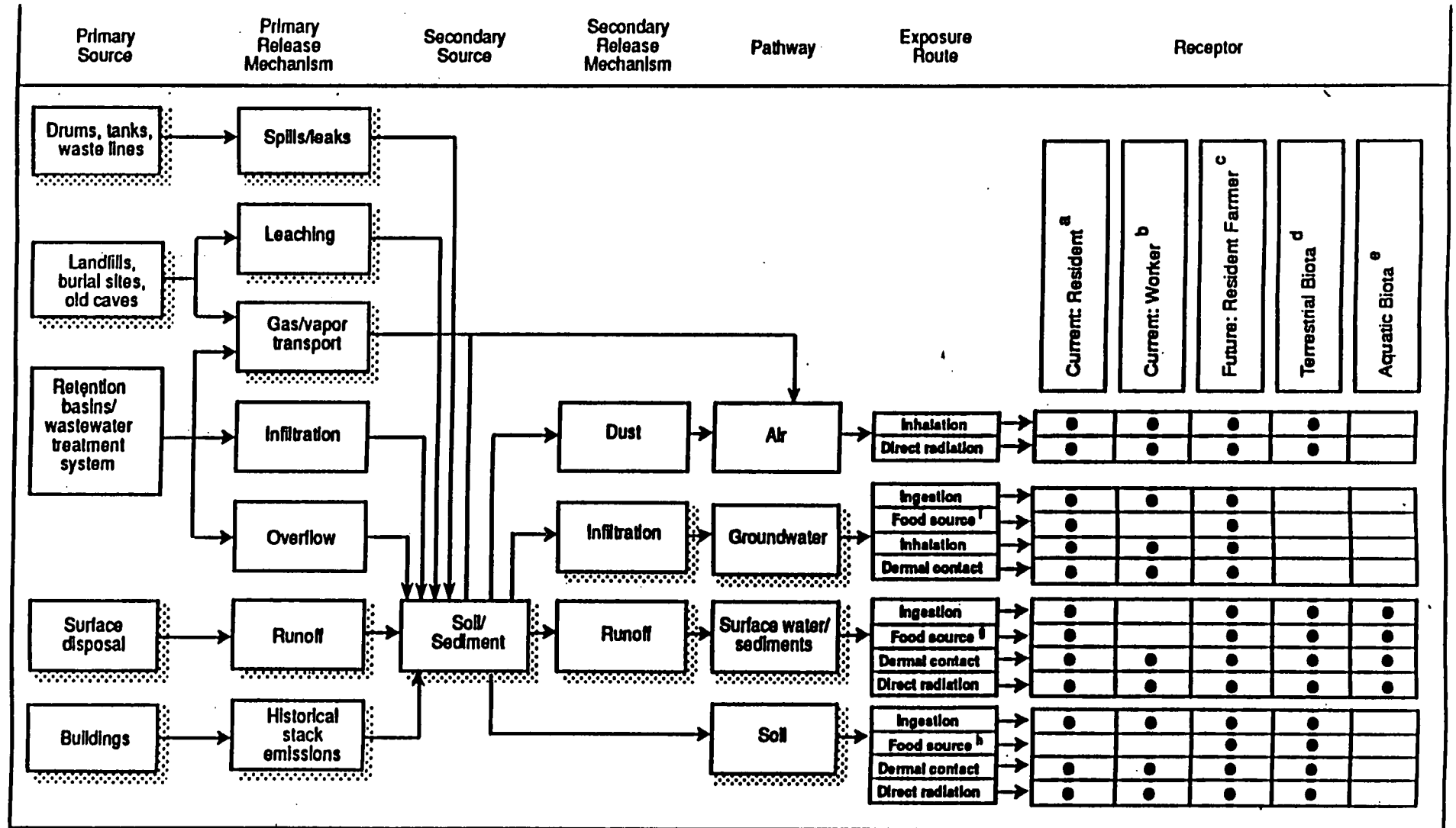
D less than 10 days for the inhaled material to clear the lung

W 10-100 days for inhaled material to clear the lung

Health Standards

S Soluble
* values are given for submersion in a semispherical infinite cloud of airborne material
WLM Working Level Month

(Developed by Roy F. Weston)



Legend

a CURRENT RESIDENT - Visits the canal as a child, lives downgradient from the site in a house with a current-use domestic well.

b CURRENT WORKER - Works on the site as a laborer. Receptor is exposed to contaminants in environmental media; not an evaluation of occupational exposure.

c FUTURE RESIDENT FARMER - Establishes a farm onsite.

d TERRESTRIAL BIOTA - Analysis of terrestrial biota will include quantitative analysis to the extent possible but will not be possible for all exposure routes such as dermal contact.

e AQUATIC BIOTA - Analysis of potential impacts to aquatic biota does not include quantitative risk assessment.

f FOOD INGESTION from the groundwater pathway will be based on consumption of vegetables grown in gardens irrigated with contaminated groundwater.

g FOOD INGESTION from the surface water pathway will include ingestion of fish.

h FOOD INGESTION from the soil pathway will include ingestion of plants that have taken up contaminants from soil.

Figure 1.2. Conceptual Site Model for Mound Plant Operable Unit 5

most instances, led to a secondary source of contaminated soils. The secondary release mechanisms include volatile emissions, dust, infiltration, percolation, and storm water runoff. The pathways of concern in OU5 include transport of contaminants or contaminated soils by wind, groundwater, surface water, and stream sediments. Potential receptors in the OU5-specific risk assessment include aquatic and terrestrial biota, area residents, site visitors, and site employees. Potential future users are also included as potential receptors for risk calculations.

The intent of the OU5 RI activities is to obtain enough information to confirm or disprove each of the assumptions used in preparing the conceptual site model. These assumptions entail the secondary sources, secondary release mechanisms, and pathways. At the completion of the RI Report, by answering the three overall questions listed in Section 4, the conceptual site model can be stated without assumptions. This is needed for determining the most appropriate site clean up method.

Additional documents supporting the OU5 Work Plan include the OU5 Health and Safety Plan (HSP) and the OU5 Sampling and Analysis Plan (SAP). The SAP is comprised of the Quality Assurance Project Plan (QAPjP) and the Field Sampling Plan (FSP).

1.3. COORDINATION WITH OTHER OPERABLE UNITS

Based on a better understanding of the history and physical environment of the plant, the OUs were consolidated into broad geographic areas in December, 1992 (Figure 1.1.), and the AOCs were re-assigned to the OUs in which they were located. This section provides a brief description of the current OUs and their relationship to OU5.

1.3.1. Operable Unit 1 (Area B)

OU1 includes a historical waste disposal area (landfill) from which there has been a known release of volatile organic compounds (VOCs) to the Buried Valley Aquifer (BVA). Two stages of the remedial investigation have been performed for Area B, and a third is under way. Due to the proximity of OU1 to OU5 (Figure 1.1.), data coordination will be required between the OUs for OU5 specific determination of type, nature, and extent of contamination present that might migrate into OU5.

1.3.2. Operable Unit 2 (Main Hill)

OU2 (Main Hill) includes all AOCs geographically located on the Main Hill and its slopes (to the foot of the hill). With the exception of the small AOC that has been addressed by the OU1 Work Plan, OU2, OU5 and OU6 will be responsible for the remainder of the site property. OU2, OU5 and OU6 managers

will need to work together in defining the assignment of AOCs that lie near or on the current boundary between the two OUs. Other issues that may need to be resolved include investigations regarding the source of groundwater contamination, the placement of wells or collection of soil samples, the assessment of OU specific risks (if necessary), and the evaluation of remedial action alternatives. When OU2 completes its work plan development, this OU5 Work Plan may be modified to address issues that affect both OUs and any site wide activities.

1.3.3. Operable Unit 3 (Miscellaneous Sites)

OU3 addresses 22 areas at Mound Plant that require investigation since little or no data are available. After receiving regulator approval on the disposition of the OU3 AOCs, an addendum to the OU5 Work Plan will be submitted incorporating the previous OU3 AOCs into the OU5 RI/FS program.

The OU3 Limited Field Investigation study (DOE, 1992b) identified 72 potential release sites (see Table I.3.). Some of these sites have been identified for further investigation within OU5. Future revisions of the OU5 Work Plan will include the sites which have been incorporated into OU5.

1.3.4. Operable Unit 4 (Miami-Erie Canal)

OU4 addresses an abandoned segment of the Miami-Erie Canal west of Mound Plant which contains plutonium-contaminated sediments from a 1969 waste line break, and tritium-contaminated soils. Although a mile long, it is considered to be one potential release site and of highest priority to the local community.

1.3.5. Operable Unit 6 (Decontamination and Decommissioning [D&D] Sites)

OU6 consists of sites (AOCs) remediated by, and others scheduled for remediation under, the Decontamination and Decommissioning (D&D) Program. Additional sites may be added to the program in the future for final D&D verification including areas from OU5.

1.3.6. Operable Unit 7 (Limited Action Sites)

OU7 has been eliminated. All of the limited action sites have been tentatively re-assigned to either OU2 or OU5 without any additional work necessary past the initial scoping. Any re-assignment of OU7 AOCs to OU5 will be addressed in an addendum to the OU5 Work Plan.

Table I.3. Potential Sites Within OU5
page 1 of 4

Potential Release Site	Recommended Operable Unit Assignment	Is Site Currently Assigned to the Mound Plant ER Program? [a]
Area A, Construction Soils from T Building	5	No
Area C, Waste Storage Area	5	Yes
Area E, Waste Oil Spill	5	No
Area J, Dredge Material Disposal Area	5	Yes
Area 3, Thorium Drum Storage and Redrumming Area	5	Yes
Area 5, Radioactive Waste Line Break	5	Yes
Area 7, Thorium, Polonium and Actinium Wastes	5	Yes
Area 8, Thorium-Contaminated Soils from Areas 1 and 9	5	Yes
Area 9, Thorium Storage and Redrumming Area	5	Yes
Area 10, Concrete Debris from Dayton Unit IV	5	Yes
Area 12, Thorium-Contaminated Soil from Area 1	5	Yes
Area 13, Polonium-Contaminated Wood from Dayton Unit IV	5	Yes
Area 20, Radioactive Waste Line Break	5	Yes
Area 21, Old Bunker	5	Yes
Area 22, Orphan Soil from other Areas	5	Yes
Area 23, Building 23 Thorium-Contaminated Soil	5	No
Spoils Disposal Area/Construction Spoils Area	5	Yes
Farm Trash Area	5	Yes
Oil Burn Structure	5	Yes
Fire Fighting Training Facility Pits	5	Yes

Table I.3. Potential Sites Within OU5
page 2 of 4

Historical Firefighting Training Pit	5	No
Pyrotechnic Waste Disposal Area (Area H)	5	Yes
Trash Burner	5	Yes
Waste Oil Drum Field Area	5	Yes
Old Firing Range Drum Storage Area	5	Yes
Building 1 Leach Pit (Area I)	5	Yes [b]
Building 1 Explosives Wastewater Settling Basin (Tank 200)	5	Yes
Building 27 Leach Pit (Area I)	5	Yes [b]
Building 27 Solvent/Drum Storage Area	5	Yes
Building 27 Filtration System	5	No
Building 27 Concrete Flume (Tank 217)	5	Yes
Building 27 Settling Sump (Tank 218)	5	Yes
Building 29 Septic Tank (Tank 224)	5	No
Building 34 Aviation Fuel Storage Tank (Tank 219)	5	Yes
Building 36 Historic Gasoline Tank (Tank 239)	5	No
Building 36 Historic Gasoline Tank (Tank 240)	5	No
Building 43 Explosives Wastewater Settling Basin (Tank 201)	5	No
Building 51 Waste Solvent Storage Tank (Tank 220)	5	Yes
Building 51 Waste Solvent Incinerator	5	No
Building 51 Waste Solvent Incinerator Scrubber	5	No
Building 61 Area, Former Heavy Equipment Area	5	Yes
TF2 Building Diesel Fuel Storage Tank (Tank 122)	5	No

Table I.3. Potential Sites Within OU5
page 3 of 4

Past Hazardous Waste Storage Area	5	Yes
Chemical Waste Storage Area	5	No
Warehouse 1	5	No
Warehouse 2	5	No
Warehouse 3	5	No
Warehouse 4	5	No
Warehouse 5	5	No
Warehouse 6	5	No
Warehouse 7	5	No
Warehouse 8	5	No
Warehouse 9	5	No
Warehouse 10	5	No
Warehouse 11	5	No
Warehouse 12	5	No
Warehouse 13	5	No
Warehouse 14	5	No
Warehouse 15	5	No
Warehouse 15A	5	No
Railcar Decontamination Area	5	No
Site Survey Project-Identified Potential Hot Spot, Location C0007	5	No
Site Survey Project-Identified Potential Hot Spot, Location C0028	5	No
Site Survey Project-Identified Potential Hot Spot, Location S0168	5	No

Table I.3. Potential Sites Within OU5
page 4 of 4

Site Survey Project-Identified Potential Hot Spot, Location S0307	5	No
Site Survey Project-Identified Potential Hot Spot, Location S0425	5	No
Site Survey Project-Identified Potential Hot Spot, Location S0647	5	No
Site Survey Project-Identified Potential Hot Spot, Location S0706	5	No
Site Survey Project-Identified Potential Hot Spot, Location S0971	5	No
Site Survey Project-Identified Potential Hot Spot, Location S0982	5	No
Area of Possible Elevated Thorium Activity	5	No
Quonset hut (historical location)	5	No
Lower Storage Area	5	No

[a] - Determination based on an operable unit reorganization which occurred in September, 1990, immediately prior to the effective date of the FFA.

[b] - The Building 1 and Building 27 Leach Pits are considered a single site under current Mound Plant ER Program alignment.

1.3.7. Operable Unit 8 (Inactive Underground Storage Tanks)

OU8 has been eliminated. OU8 consisted of approximately 106 underground storage tanks located at or near 28 separate buildings at Mound Plant. After tank removal, any AOC re-assigned to OU5 will be addressed in an addendum to the OU5 Work Plan.

1.3.8. Operable Unit 9 (Site-Wide)

OU9 includes the assessment of off-site migration of contaminants in groundwater, soils, surface water and sediments; airborne contamination; and ecological impacts. The site wide RI/FS will additionally ensure that a comprehensive investigation is performed by compiling all data from individual OU investigations into a comprehensive report. Data from specific site wide investigations conducted under the OU9, Site-Wide Work Plan (DOE 1992a) will be initially presented in interim reports or technical memoranda to ensure that the off-site and regional data are available to the individual OUs for risk assessment (RA) use.

The OU9, Site-Wide Work Plan (DOE 1992a) is concerned with background and regional information rather than specific contaminated AOCs. The OU9, Site-Wide Work Plan (DOE 1992a) also contains a complete list of currently identified contaminated AOCs with potential release areas for each OU and their initial evaluation. Comprehensive regional and site wide hydrogeological investigations are being conducted as part of the OU9 RI. Hydrogeological investigations for AOCs within OU5 are required if groundwater is found during contaminant characterization. A multi-volume scoping report has been prepared (listed below), providing descriptions and summaries of the current conditions and characteristics of Mound Plant.

VOLUME	TITLE
1	Groundwater Data: February 1987 - July 1990
2	Geologic Log and Well Information Report
3	Radiological Site Survey Report
4	Engineering Map Series
5	Topographic Map Series
6	Photo History Report
7	Waste Management
8	Environmental Monitoring Data
9	Annotated Bibliography
10	Permits and Enforcement Actions
11	Spills and Response Actions
12	Release Site Data Base

A comprehensive baseline risk assessment (BRA) will be conducted as part of the OU9 RI/FS. The OU9 BRA will characterize site wide current and potential threats to human health and the environment posed

by radiological and non-radiological contaminants present in, or migrating to, groundwater, surface water, sediment, soil, air and the food chain. The OU9 BRA will also evaluate exposure pathways that may result from contaminants migrating off-site.

The OU5 RI characterization activities will require extensive coordination with the OU9 site-wide mission, including: site wide and regional hydrogeology and geology, site wide and regional background data, ecological field data, preliminary surface water and sediments in the OU5-assigned plant drainage ditch and New Property ephemeral drainage system, as well as airborne transport of contaminants. OU5 characterizes the AOCs for nature and extent of chemical and radiological contamination, if need be, by following the contaminant pathway across any OU boundary or, in the case of OU5 non-AOC locations, to the source. Information sharing between OU9 and OU5 (as well as OU1 and OU2) regarding on-going or proposed programs will be used to help determine the field collection efforts required by OU5 for groundwater, surface water, soil, and sediment sampling programs. Air pathway fate and transport modeling will be based on the results of AOC soil sampling.

Coordination of field data will be necessary to ensure that OU5 field characterization studies generate adequate data to develop both an OU5-specific RA and the OU9 BRA. Information that will need to be coordinated between OU's include: background data for air, soils, surface water and sediment; meteorological and air quality data; surface water and sediment data (areas within OU5 boundaries); and ecological data. By coordinating OU and RI/FS responsibilities, the FFA, Appendix I requirements will be met.

1.4. WORK PLAN PURPOSE AND SCOPE

The purpose of this OU5 Work Plan is to present a plan of action to determine the nature and extent of the threat posed by the release of hazardous substances to the environment by testing the assumptions used to develop the conceptual site model, as well as supporting the selection and evaluation of proposed remedial alternatives. The OU5 Work Plan presents an evaluation of available site wide scoping information, reconnaissance information, and existing data generated from other activities and their relationship to OU5 objectives.

This work plan was developed to be flexible in scope. As more information is acquired concerning the various sites of contamination in OU5, it will be incorporated into this work plan and the associated QAPjP, FSP, and HSP. The objectives of the OU5 RI/FS program are:

- To comply with the FFA between the DOE and the EPA (EPA 1990a), and with Ohio state law;

- To refine the conceptual site model (potential exposure pathways and receptors) that will assist in the preliminary assessment of risk;

- To more accurately determine the nature and extent of soil contamination in OU5 AOCs;

- To determine the nature and extent of soil contamination in the South Property that has not been identified as an AOC;

- To determine the nature and extent of the OU5 surface water and sediment contamination;

- To determine the nature and extent of groundwater contamination emanating from OU5 sources; and,

- To provide details and the rationale of data needs for broadly defined remedial action alternatives.

1.5. WORK PLAN ORGANIZATION

In general, the work plan is organized to introduce the reader to the site's history, tentatively identify the overall known or suspected problems, and define the objectives or goals of the remedial investigation. The reader is then familiarized with the site's physical setting. Groundwater and surface water transport mechanisms (hydrogeology and hydrology) are described within the limitations of known data. The geology (soils and rock), sediment transport, topography, air, climate, and ecology are also described. Based on these descriptions, the reader should be able to view the site in three-dimensions and understand the initial evaluation describing the potential migration and exposure pathways of known or suspected contaminants (e.g., the type, nature, and extent of contamination, if present). Under CERCLA guidance, the initial evaluation provides a preliminary assessment of public health, environmental impacts, and/or Applicable or Relevant and Appropriate Requirements (ARARs) for the identification of preliminary remediation goals (PRGs). However, the OU5 Work Plan has adopted the OU9, Site-Wide Work Plan COCs list, analyte list, levels of concern, and detection limits with appropriate analytical levels for use in the initial field work activities. When more information becomes available through field and laboratory programs, the issue of adopting OU5 specific COCs and PRGs will be re-evaluated for all future field work.

There are three specific questions addressed in this work plan:

- 1) Are the identified AOCs in OU5 contaminated?;
- 2) Are other areas in OU5 not presently identified as AOCs contaminated?; and
- 3) What remedial action will be taken if any OU5 area is contaminated?

With the description of physical setting and initial evaluation identifying all known data, the work plan rationale defines the data needs for both the RI characterization and general information required to support the alternatives evaluation. The data needs are determined during the formation of data quality objectives (DQOs) with the sampling plan illustrating how the activities will satisfy data needs given the level of site understanding. Once the data needs are filled, the RI/FS process can be completed within the mandated FFA requirements.

The balance of the work plan identifies and discusses the tasks to be performed during the RI/FS, and when they are to be performed. The OU5 Work Plan is organized into seven (7) sections and one appendix. It follows the format recommended by the EPA for conducting a RI/FS under CERCLA (EPA 1988a). Under these guidelines, the following sections appear in this work plan:

- Section 1, Introduction, provides a general history of Mound Plant, description of OU5, and the coordination of OU5 with the other OUs. This section also identifies the work plan purpose, scope, and objectives.

- Section 2, Physical Setting, provides an overview of the site physiography, geology, surface water hydrogeology, groundwater hydrogeology, climate and ecology.

- Section 3, Initial Evaluation, provides a preliminary identification of the AOCs, a discussion of the site conceptual model, a discussion of the BRA, preliminary identification of remedial action alternatives, and a generic discussion of ARARs.

- Section 4, Work Plan Rationale, provides discussion of the data needed for AOC and non-AOC contaminant determination, characterization of the contamination, evaluation of preliminary remedial alternatives and sampling program objectives.

- Section 5, RI/FS Tasks, discusses in summary format the specific tasks required to complete the site wide RI/FS process, including scoping, project planning, community relations, field investigations, sample analysis, data evaluation, RA, treatability studies and/or pilot tests, RI reports, FS reports, post-RI/FS support, miscellaneous support and RD/RA.

- Section 6, Schedule, discusses the preliminary schedule prepared for OU5 RI/FS activities.

- Section 7, ER Program: Project Management at Mount Plant, discusses and summarizes the ER Program effort to provide a consistent, organized approach to remediating historical environmental issues at DOE Mount Plant.

- Section 8, References, provides a list of references used to develop the OU5 Work Plan.

- The Appendix provides supporting information for areas that may impact OU5. This information includes: Mound Plant chemical soil data, soil gas sampling data, radiological contours, and detailed maps (plates).

2. PHYSICAL SETTING

This section provides a brief overview of Mound Plant's physical setting, relying heavily on references to the OU9, Site-Wide Work Plan (DOE 1992a) and supporting volumes, specifically: Volume 1: Groundwater Data (February 1987 - July 1990) and Volume 2: Geologic Logs and Well Information Report. In addition, information on recently installed monitoring wells has been obtained from the report, Remedial Investigation/Feasibility Study, Operable Unit 9, Hydrogeologic Investigation Well Information Report (DOE 1993b). Because investigations of OU9 and other operable units are ongoing, the understanding of the site conditions and physical setting is dynamic, making the planning for future investigations such as this one a continuing exercise. The information presented in this section represents the state of knowledge of the site from published reports available at the time of preparation of this work plan. Where recent preliminary studies suggest a need to revise interpretations of concepts presented here, they will be noted in the text.

In the following subsections, the natural and human shaping processes that physically formed the surface and sub-surface of the site (geomorphology) are discussed, as well as the resulting groundwater (hydrogeology) and surface water/sediment (hydrogeology) transport mechanisms within the limitations of known data. In addition, a description of consolidated and unconsolidated materials, rock and soils (geology) that underlay the site is provided. The section closes with a discussion of the general ecology and climate. Based on the overview provided in this section, in conjunction with the referenced OU9 documents, the reader should be able to view the site in three dimensions and understand the physical mechanisms that may impact the possible spread (transport) of contaminants within or from OU5.

2.1. PHYSIOGRAPHY

Mound Plant is located on the eastern side of the Great Miami River Valley, within the Till Plains section of the Central Lowlands Province. The regional topography consists of generally flat-lying uplands, river valleys, and surficial glacial features such as kames (low hills of stratified glacial deposits) and moraines (general glacier-laid sediment). The modern Great Miami River occupies an ancient valley that was formed by meltwater from continental glaciers. The valley is filled with thick, extensive glacial deposits of permeable sand and gravel and is referred to as the BVA, an important groundwater resource.

The dominant geomorphic features (i.e., surface forms) of the plant are two adjoining hills (Main Hill and SM/PP Hill) consisting of bedrock (solid rock underlying unconsolidated sediment) shales and limestones covered by a thin veneer of unconsolidated deposits. The two hills are separated by a tributary valley of

the Great Miami River which contains the plant drainage ditch (the only perennial stream within the Mound Plant boundary) and is underlain by interbedded glacial till (unsorted, unstratified glacial deposits) and outwash deposits (sediment deposited by glacial meltwater streams). Topographic relief is on the order of 200 feet at Mound Plant. The topographic highs occur at the tops of the Main and SM/PP Hills and the lows occur in the southwest portion of the New Property and at the western-most location of the tributary valley. The tributary valley is referred to as the Mound Plant Valley. Much of the original surface of the hills has been regraded and reworked during plant construction; for example, the Main Hill was leveled in 1947 for foundation stability. Reworked materials (mostly tills) were relocated to the southern slopes of the Main Hill. The SM/PP Hill has not undergone as extensive regrading as the Main Hill, but the western slopes have periodically received construction debris and soil materials that have effectively and locally reshaped the hill slopes.

2.2. GEOLOGY

The OU9, Site-Wide Work Plan (DOE 1992a) describes in detail the regional stratigraphy, tectonic setting, and seismology. The site-wide geology of Mound Plant is also presented in detail in the OU9, Site-Wide Work Plan, Section 5.2., with maps and cross sections. A brief discussion of Mound Plant geology pertinent to OU5 is provided below.

2.2.1. Bedrock Geology

The bedrock section beneath Mound Plant consists of thin, nearly flat-lying beds of alternating shale and limestone of the Richmond Stage of the Cincinnati Group (Upper Ordovician-about 450 million years ago). The Cincinnati Group is present at the surface at Mound Plant and underlies the Main Hill and the SM/PP Hill. The limestone beds range from 2 to 6 inches in thickness and the shale layers are commonly 5 to 8 feet thick.

2.2.2. Glacial Deposits

Pleistocene age (less than about 2 million years old) glacial deposits at Mound Plant include both till and outwash deposits. The till in the area of Mound Plant is composed of an unsorted, unstratified mixture of clay, silt, sand, and coarser material (Struble 1987). Water-laid deposits consist of outwash composed of well-sorted sand and gravel. The sand and gravel is horizontally layered, and commonly cross bedded. The outwash in the vicinity of Mound Plant occurs as restricted valley-train deposits that were formed by the aggregation of glacial meltwater streams (Goldthwait, et al. 1979). The outwash deposited in the Miami River Valley and the associated tributary valley forms the BVA and contiguous deposits. The glacial deposits are overlain, in part, by recent alluvial deposits (deposits from rivers and streams).

2.2.3. Distribution of Quaternary and Bedrock Units

The major portion of Mound Plant is covered by Quaternary (the youngest period of geologic time, containing the recent and Pleistocence Epochs) deposits ranging in thickness from 0 feet (at bedrock exposures) to greater than 195 feet on the western edge of the New Property. Over most of the SM/PP Hill these deposits are less than 20 feet thick (DOE 1992c). Throughout the tributary valley beneath the plant drainage ditch, the Quaternary deposits are typically 10 to 30 feet thick, but reach a maximum thickness of 70 feet and more near the western fence line of the plant. Moreover, recent drilling in and near the tributary valley in the northern portion of the Mound Plant has revealed thickness of Quaternary deposits of more than 90 feet (DOE 1993b).

Bedrock exposures in OU5 are limited to the steeper, west-facing slopes of the SM/PP Hill and the New Property. The resistant limestone beds usually form ledges that can be followed for tens of feet, while the shale intervals form relatively gentle slopes.

Geologic data from deep boreholes on the SM/PP Hill are limited; however, geologic cross sections for the tributary valley area and outside the western perimeter of Mound Plant were constructed from borehole logs to show the relationship of Quaternary deposits to the underlying bedrock. Three bedrock borings and wells were installed in conjunction with the OU9, Site-Wide Work Plan investigation, and the cross-sections and maps are presented in Section 5 of the OU9, Site-Wide Work Plan (DOE 1992a). Additional lithologic (rock characteristics) data can be found in the addendum to the OU9, Site Scoping Report: Volume 2 - Geologic Log and Well Information Report (DOE 1992c). Additional bedrock borings are proposed as part of the OU9 investigations which will help to quantify the distribution and nature of Quaternary deposits and bedrock in the areas of the SM/PP Hill and the New Property.

2.2.4. Soils

At least nine distinct soil types have formed on the bedrock, glacial, and alluvial deposits at Mound Plant, including Miamian, Fairmont, Milton, Made Land, Corwin, Richey, Ross, Hennepin, and Urban series (SCS 1976). The general soil morphologies of each unit are described in detail in the OU9, Site-Wide Work Plan (DOE 1992a). A detailed soil survey of Montgomery County published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS) provides a general guide to soil types found at Mound Plant and identifies specific soil series (defined as mappable units of similar morphology) and engineering properties of the soil units.

2.3. SURFACE WATER HYDROGEOLOGY

To date, much of the documented radioactive contamination within OU5 has been found in surface and near-surface soils. The presence of surficial contamination increases the possibility that surface water runoff will transport the contamination away from the source location to other areas on and off the plant site. The contaminants and contaminated sediments are transported first by overland flow and then concentrated in ditches, stream channels and surface impoundments. These drainage pathways and concentration points, whether natural or manmade, provide an excellent opportunity for evaluating the presence of contamination above the concentration levels of concern. The drainage pathways and concentration points are, in turn, determined by the site geomorphology. Plate 1 shows the surface drainage patterns at Mound Plant. A detailed discussion of the Mound Plant surface water hydrogeology is included in the OU9, Site-Wide Work Plan (DOE 1992a).

The Mound Plant is situated on top of a river bluff overlooking the Great Miami River and the city of Miamisburg, Ohio. Elevations on the plant range from 710 to 900 feet above sea level, with the Great Miami River at an elevation of 680 feet near the plant. Natural slopes in the plant range up to 20 degrees from horizontal. Elevations in OU5 range from approximately 710 to 880 feet above sea level.

Overland flow from the hill slopes is collected by roads or lined open ditches and culverts. The natural surface drainage patterns on much of Mound Plant property have been altered by roads and structural modifications as the facility has expanded with time. During facility expansion, a plant drainage ditch was engineered to control surface water storage and discharge (Plate 1). The storm water retention and discharge system (SRDS) was developed as a network of sediment settling basins along the plant drainage ditch that allows for retention of low-level plutonium-contaminated silts and clay particles produced by erosion of surficial soils within the plant.

The plant drainage ditch approximately follows the original course of the natural stream situated in the Mound Plant valley, between the Main Hill and the SM/PP Hill (Plate 1). Storm water runoff and sediment from the south portion of the Main Hill and the north portion of the SM/PP Hill are transmitted through the SRDS before being released through National Pollutant Discharge Elimination System (NPDES) Outfall 002. Runoff from the extreme northeast portion of Mound Plant drains in a northeast direction off-site.

Runoff from the central portion of the SM/PP Hill flows towards the overflow pond which eventually discharges through NPDES Outfall 002. On the northwest side of the SM/PP Hill, the runoff is diverted

around the south side of the buildings in the valley to the overflow pond. Along the southern boundary of the SM/PP Hill, runoff is carried west down a concrete-lined channel where it is diverted into the overflow pond to allow for retention of eroded surface soils.

The southwest tip of the New Property lies within the 100-year flood plain (FEMA 1993). The topography along the western edge of the New Property may allow local ponding of water and sediment. Most of the runoff from the New Property collects in the ephemeral stream (flows only in direct response to precipitation) that discharged off-site toward the southwest. The ephemeral stream combines off-site with drainage in the south part of the Miami-Erie Canal and runs under Dayton-Cincinnati Pike and into the Great Miami River.

2.4. GROUNDWATER HYDROGEOLOGY

OU9 is tasked with compiling all groundwater data from other OUs into a comprehensive conceptual model of the site to be presented into one report. The OU9, Site-Wide Work Plan (DOE 1992a) describes the current understanding of Mound Plant hydrogeology and provides for specific investigations that will be conducted to further characterize the local hydrogeology. The discussion of Mound Plant hydrogeology presented here has been summarized from the OU9, Site-Wide Work Plan (DOE 1992a).

There are two hydrogeologic regimes at Mound Plant: flow through the bedrock beneath the Main Hill and the SM/PP Hill, and flow within the unconsolidated glacial deposits and alluvium associated with the BVA in the Great Miami River Valley and the tributary valley between the Main Hill and SM/PP Hill (Figure 2.1.). The bedrock system, an interbedded sequence of shale and limestone, is dominated by fracture flow especially in the upper portions of the bedrock. Groundwater movement within the till and sand and gravel, within the buried valley, is through porous media. Groundwater flow from Mound Plant is generally to the west and southwest toward the BVA of the Great Miami River Valley (Figure 2.2.).

The BVA provides domestic and municipal water supplies through small residential wells and the City of Miamisburg well field, as well as providing industrial supplies for the Dayton Power and Light Hutching Power Stations and the Mound Plant. Because of this usage and the aquifer characteristics, parts of the BVA have been designated a sole source aquifer. The aquifer has been classified as a Class 1 aquifer by EPA to assist in groundwater protection (DOE 1992a).

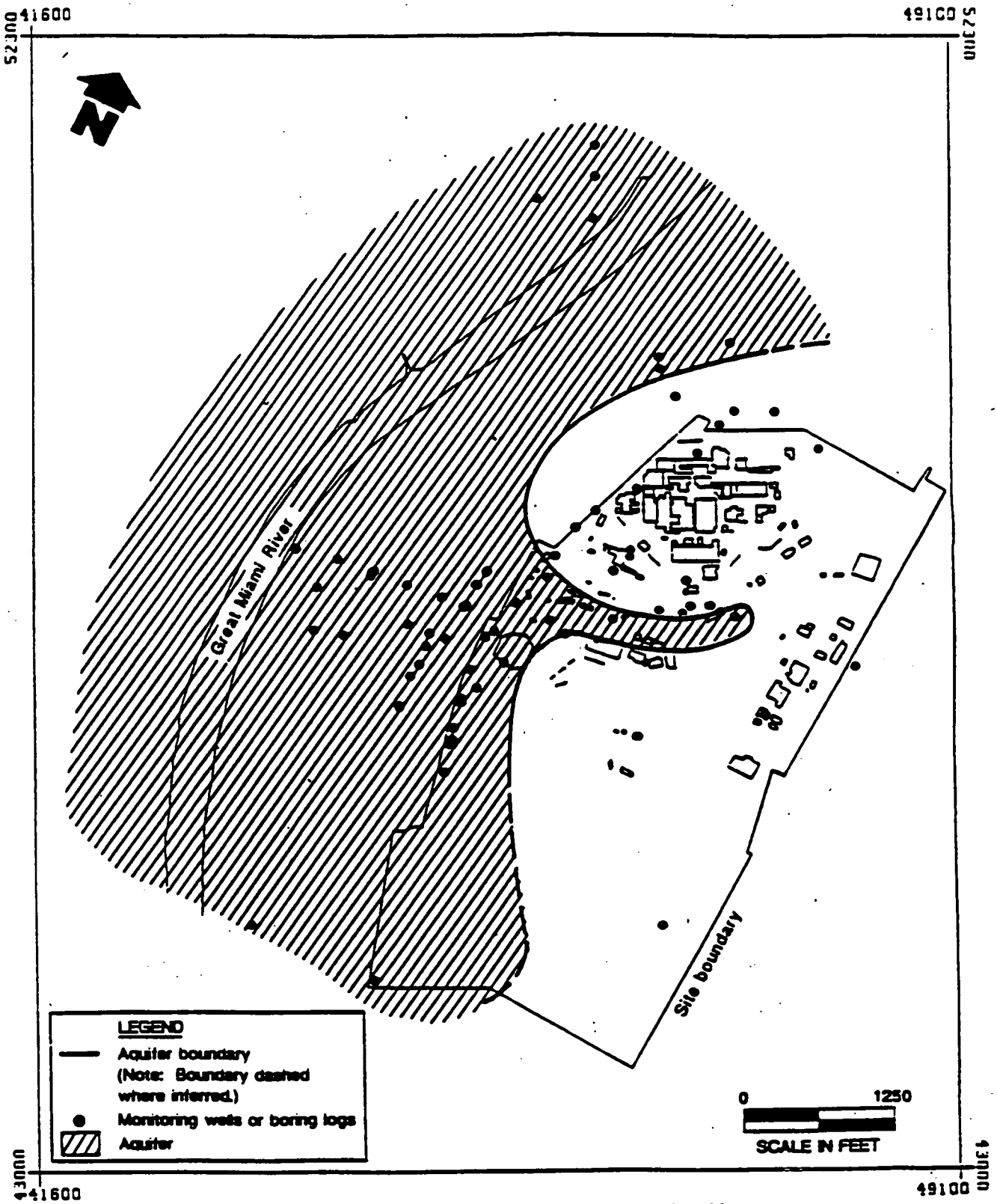


Figure 2.1. Boundary of the Buried Valley Aquifer

2.4.1. Bedrock Flow System

Groundwater flow in the bedrock beneath the SM/PP Hill is strongly controlled by differences in physical properties within the vertical sequence of shale and limestone beds, and by the frequency, orientation, and size of fractures and partings along bedding planes. Vertical movement of groundwater occurs along vertical fractures in these units. Within the vertical sequence of rock units on the Main Hill, relatively impermeable, unfractured shale beds are known to occur at several horizons. Seeps (where groundwater emerges on the land surface) exist at several locations on the Main Hill and may be related to these horizons (Plate 1). However, preliminary hydrogeologic data from investigations of OU9 suggest that groundwater flow in bedrock is controlled solely by an interconnected network of shallow fractures that generally mimic topography. The seeps on the Main Hill may be related to the reduced density and degree of fractures at depth rather than being due to stratigraphic controls. A major difference between the flow systems beneath the two hills is the presence of seeps. To date, only one seep has been mapped on the SM/PP Hill and no flow or water quality data are available for the seep. Recently (winter 1992) an additional seep was located near Area 1. Both seeps will be investigated early in the RI/FS field work, and an OU-wide survey will be accomplished to determine if any additional seeps can be located. Further bedrock drilling and hydrogeologic testing is planned for the SM/PP Hill and New Property as part of the OU9 investigations, which will provide additional data on the characteristics of the bedrock aquifer in this area.

2.4.1.1. Recharge

Groundwater flow within the fractured bedrock flow systems (one on the Main Hill, the other on the SM/PP Hill) is controlled not only by the complex flow paths of the fracture systems but also by the timing and location of recharge (addition of water to the groundwater system). At Mound Plant, water is recharged to the bedrock flow system aerially, as infiltration of precipitation and sprinkler irrigation, and locally as leakage from water transmission pipes and sewers. Local flow systems within the two hills appear to be separate. Groundwater recharge occurs on uplands such as the Main Hill, the SM/PP Hill, and high ground to the east of Mound Plant. Recharge mechanisms will be investigated in OU5 in conjunction with the hydrogeologic investigation being conducted by OU9.

2.4.1.2. Discharge

Groundwater discharge (leakage of groundwater to surface drainage) is expected on the steep flank of hills and into unconsolidated deposits in the plant valley and the valley of the Great Miami River. As mentioned above, discharge at seeps is known to occur at several locations on the Main Hill. Only one seep had been previously found on the SM/PP Hill; however, recently an additional seep was located near

Area 1. A search for more seeps on the SM/PP Hill will be conducted during the wet season after initiation of field work. The degree of interconnection between the bedrock flow system and the BVA has not been determined, and will be investigated at OU5 and in conjunction with the OU9 hydrogeologic studies of Mound Plant.

2.4.1.3. Hydrodynamic Characteristics

Permeabilities for three wells completed in the bedrock on the Main Hill and in the plant tributary valley (0112, 0117, and 0120) were estimated in slug tests (aquifer tests in which a sudden influx (slug) of water is added to a well) conducted in 1988. Results are presented in Table II.1. These tests indicate that the permeability of the bedrock material may range from 5×10^{-2} feet per second (ft/sec) to 5×10^{-6} ft/sec. It is likely that these permeabilities also apply to the bedrock beneath the SM/PP Hill.

Wells completed in the shale bedrock at Mound Plant generally yield less than 5 gallons per minute (gpm) with specific capacities (yield of a well with respect to its rate of drawdown) of 0.25 to 2.50 gpm/ft of drawdown (lowering of the water table caused by pumping) (Dames and Moore 1976a, b). For site-specific data on groundwater flow rates at seeps, 12 test pits and wells were excavated into bedrock on the Main Hill between October 1986 and March 1987. Details about the pit construction are included in the OU9, Site Scoping Report: Volume 2 (DOE 1992c). Flow into the pits was measured by installing flow recording equipment and collector drains in the pits and then backfilling. Flow into the pits was observed to occur from fractures and along the bedding planes of shale units. Flow did not occur in all pits. Where flow occurred, however, the rate ranged from 54 gallons per day (gpd) (0.037 gpm) to 1400 gpd (0.97 gpm) (Terran 1987). It is important to note here that the flow rates measured in the pits on the Main Hill may not be representative of flow on the SM/PP Hill. The existing seeps and any additional seeps found on the SM/PP Hill or the New Property will be tested for groundwater flow using a similar method in conjunction with the hydrogeologic investigations conducted for OU9.

2.4.1.4. Groundwater Quality in the Bedrock

Water quality analyses of samples from the Main Hill bedrock system indicate that the water chemistry varies from calcium bicarbonate-type to sodium chloride-type, with some anomalously high concentrations of nitrate and sodium. Contaminants have been detected in the Main Hill bedrock system seeps, and include tritium and some VOCs at levels above the drinking water standard.

Water quality data for bedrock beneath the SM/PP Hill and the New Property do not exist. Seeps and monitoring wells in these areas will be sampled and analyzed during the OU5 investigation.

Table II.1. Bedrock Permeability Test Results

Date	Well	Analysis Method[a]	K (ft/s)	Test Type
1/20/88	0112[b]	Bouwer-Rice	1×10^{-4}	Slug
1/21/88	0112[b]	Bouwer-Rice	5×10^{-6}	Bail
1/21/88	0117[b]	Bouwer-Rice Hvorslev Skibitzke	1×10^{-6} 2×10^{-4} 6×10^{-5}	Slug
1/22/88	0120[b]	Bouwer-Rice Ferris-Knowles Hvorslev Skibitzke	1×10^{-5} 5×10^{-2} 2×10^{-4} 3×10^{-4}	Slug

[a]Method references Bouwer-Rice (Bouwer and Rice 1976); Ferris-Knowles (Bentall 1963); Hvorslev (Hvorslev 1951); Skitbitzke (Bentall 1963).

[b]Wells are completed in bedrock under confined or semiconfined conditions.

K = permeability

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2.4.2. Buried Valley Aquifer

The unconsolidated Quaternary age deposits are the major source of groundwater in the vicinity of Mound Plant and throughout the Miami Valley. In 1988, the BVA was designated as a sole source aquifer in recognition of its importance as a resource and its susceptibility to contamination. The BVA consists of the saturated glacial outwash deposits in the Great Miami River valley. In historical use, the term "Buried Valley Aquifer" is usually reserved for the deposits in the present day topographic valley. Published maps of the extent of the BVA do not include the groundwater beneath Mound Plant property (e.g., Spieker 1968). However, the water-bearing unconsolidated deposits beneath the west side of Mound Plant and beneath the plant valley are continuous with similar deposits in the main valley, and are considered as part of the BVA in this report.

The BVA occupies a deep bedrock channel that roughly follows the course of the present river. Recent borehole data (DOE 1993b) suggest that the axis of the BVA crosses Mound Plant boundary at the southern end of Mound Plant, and underlies the southwestern portion of the New Property. The bedrock channel is up to 142 feet deep (below land surface) near its center. Tongues of outwash extend from the edge of the buried valley along tributaries, such as the Mound Plant valley that separates the Main Hill and the SM/PP Hill (Figure 2.1.). Quaternary glacial deposits overlie the bedrock on the western margin of Mound Plant. The till deposits are of two major types: nonstratified, or till (ice-laid); and stratified deposits, or outwash (water-laid). The till that exists in and adjacent to OU1 (Figure 1.1.) is generally composed of an unsorted, unstratified mixture of clay, silt, sand, and coarser material. Materials of this composition have permeabilities ranging from 10^{-6} to 10^{-12} ft/sec (Freeze and Cherry 1979).

The till deposits are interstratified with outwash deposits. The complex interstratification of glacial till and outwash forms the BVA and contiguous deposits and has greatly affected the hydrologic condition existing in OU1 and in the balance of the western margin of Mound Plant. In this area, the shape and continuity of till deposits have been affected by stream erosion and deposition. Recent river deposits consist of overbank silt, clay, and sand from the Great Miami River.

Although the outwash deposits are thickest in the valley of the Great Miami River, tongues of sand and gravel extend eastward onto Mound Plant property along topographic embayments. One such embayment underlies the northern margin of OU1.

Data for the BVA are based on a series of 84 monitoring wells, public supply wells, Mound Plant supply wells, and private domestic supply wells (DOE 1992a). The available information indicates that two layers

of outwash exist in the subsurface outside the Mound Plant boundary in the BVA. The upper and lower outwash layers are separated by glacial till and may form upper and lower "aquifer units" (distinct water-bearing sediments) in the BVA. The upper unit has a maximum thickness of 95 feet, and is composed of poorly sorted coarse sand and gravel. The lower unit is believed to be up to 44 feet thick at well 006. It is similar in composition to the upper unit, and is under semi-artesian (under sufficient pressure to cause the water to rise in a well) conditions. Well logs and seismic refraction studies indicate that the lower outwash layer may be absent in the vicinity of Mound Plant except in the southeastern corner of Mound Plant South Property. Additional data generated by OU9 investigations may disprove this two-unit model.

2.4.3. Hydrogeologic Conceptual Model

According to current knowledge of the hydrogeology at Mound Plant:

- there are two groundwater flow systems on the site: the BVA and the fractured, interbedded shale and limestone bedrock;
- the BVA is comprised of unconsolidated alluvium, glacial till and glacial outwash deposits;
- the major flow and contaminant movement from Mound Plant occurs in the BVA, a designated sole source aquifer;
- flow paths within the bedrock are not well understood but are believed to occur along shallow fractures;
- some portion of discharge from the bedrock groundwater system occurs at stratigraphic- or fracture- controlled seeps; and,
- the interconnection between the bedrock and BVA is not well understood at the present time.

Water level data indicate that groundwater flow in the tributary valley is to the west (DOE 1992a). Groundwater flow within the tributary valley is controlled by the bedrock topography as seen in the hydraulic gradient (amount of slope of the water table), which is as high as 0.02 (vertical feet per horizontal feet) due west. This gradient is much higher than that seen in the BVA. The tributary valley acts as a collection point for the south side of the Main Hill and the north side of the SM/PP Hill and may provide a conduit for contaminant movement from the bedrock to the BVA.

In the BVA underlying OU1 and the western edge of Mound Plant, the natural hydraulic gradient is to the west and southwest at approximately 0.006 (Figure 2.2.). Pumpage from Mound Plant production

wells in OU1 (wells 0071, 0076, and 0271) may affect hydraulic gradients and contaminant transport in this area of the BVA.

The major contaminant pathway from Mound Plant is through the highly-permeable glacial outwash in the BVA. The extent of contaminant movement from the bedrock into the BVA is not well documented at this time. Hydraulic gradients between the two units are not well defined since most of the measured gradients are within the range of error in data measurement.

Natural recharge to the Mound Plant groundwater system occurs primarily in three ways: (1) groundwater flow across the northeastern boundary; (2) infiltration from the Great Miami River to the BVA; and (3) through the direct infiltration of precipitation in the BVA and on the Main and SM/PP Hills. Artificial recharge occurs as a result of man-made disturbances in the system: the plant drainage ditch; the runoff ponds; leaks from water and sewer lines; and inflow from improperly abandoned wells on-site.

Groundwater flow from the bedrock system is collected by the tributary valley and transported west into the BVA. Additional bedrock flow may move from the SM/PP Hill and the New Property to the west and into the BVA. The volume of this flow has not been estimated. Other flow in the bedrock system discharges as seeps along the margins of the two hills.

2.5. CLIMATE

The OU9, Site-Wide Work Plan (DOE 1992a) discusses in detail the meteorology and air quality of the site, including an assessment of particulate and gaseous contamination studies conducted in the past. Meteorological data that are pertinent to contaminant migration to and from areas within OU5 and a brief discussion of known contamination due to atmospheric migration are discussed in this section.

The climate in the area of Mound Plant is classified as "continental," with moderate fluctuations in temperature. Summers are rather warm and humid, with an average daily maximum temperature of 86.9 degree Fahrenheit (°F). The relative humidity ranges from 50 percent in the winter to 85 percent in the summer. Winters are moderately cold, with an average of two days of subzero weather; the average daily minimum temperature in January is 23.1°F. Autumns are predominantly cool and dry. Spring is the wettest season. Severe weather is mostly associated with heavy thunderstorms in the summer, resulting in damaging winds and local flash flooding.

Precipitation is common in all seasons. The average annual rainfall equivalent is about 40 inches, including about 27 inches per year of snow. The maximum 24-hour rainfall recorded in Dayton is 4.56 inches.

The wind direction at Dayton is predominantly from the southwest quadrant. Average annual wind speeds range from about 7 to 10 miles per hour.

2.6. ECOLOGY

The OU9, Site-Wide Work Plan (DOE 1992a) addresses the ecological studies necessary to describe the Mound Plant ecology. A brief summary of the ecological information contained in the OU9, Site-Wide Work Plan (DOE 1992a) is included here.

Mound Plant is located in the Eastern Deciduous Forest Province in the transition zone between the beech-maple forest and oak-hickory forest plant associations (Bailey 1978). Much of the site has been altered through construction and use; however, heavily wooded areas do remain on and near Mound Plant. These wooded areas support fauna characteristic of the forest/plant association. Additional information can be found in the Final Environmental Impact Statement (FEIS) for Mound Plant (DOE 1979).

The FEIS indicates that there are no designated sensitive environments within the boundaries of Mound Plant (DOE 1979), although sensitive environments are not the only natural resource areas of concern; all areas where ecological resources may be exposed to site contaminants require consideration. During the period since the FEIS was published, natural sensitive environmental and potentially sensitive man-made environments have been identified at Mound Plant. Sensitive environments as defined by the EPA include aquatic areas, wetlands, flood plains, wildlife breeding areas, and critical habitats for threatened and endangered species. A small area of Mound Plant, specifically the southwestern tip of the New Property, is located within the Great Miami River 100-year floodplain. There are several man-made aquatic areas at Mound Plant that may qualify as sensitive environments. These areas include the asphalt-lined pond, the overflow pond, the retention basins, the plant drainage ditch, and the Miami-Erie Canal, including the South Pond located in the Miamisburg Municipal Park. These sites are addressed in the OU9, Site-Wide Work Plan (DOE 1992a) ecological assessment. In addition, several small ponds in OU5 (west of Area J) may have jurisdictional wetlands of small sizes.

3. INITIAL EVALUATION

This section provides a brief summary of the information currently available on contamination within OU5. Only contaminants that have been positively identified by sampling or that are known to be related to an AOC because of past operations are listed. The absence of a contaminant from the list does not indicate that it is not present. Likewise, the presence of a contaminant on the list does not indicate it exists in all AOCs in OU5. Section 3 also discusses the preliminary identification of AOCs, potential pathways of contaminant migration, a preliminary identification of response objectives and remedial action alternatives, and a brief discussion of ARARs.

3.1. PRELIMINARY IDENTIFICATION OF AREAS OF CONCERN

As of December 1992, 17 AOCs were identified and assigned to OU5. Area 5 and Area 20 were transferred to OU2 in mid-December. Four other AOCs are currently under "active" status and will not be addressed in this work plan. The 11 remaining AOCs (as currently determined) are the most likely locations of contamination within OU5, and are related to wastewater treatment, drum storage, and ground disposal (soil and spoils), as discussed in the Preliminary Evaluation of Remedial Action Technologies (PERAT) (DOE 1991a). Table III.1. lists the 11 AOCs, along with historical uses and potential contaminants. Figure 1.1., Section 1, shows the locations of the 11 AOCs. The conceptual model for Mound Plant OU5 is shown in Figure 1.2. The AOCs described below are grouped according to their origin and history into three categories: wastewater treatment, drum storage areas, and ground disposal areas.

3.1.1. Wastewater Treatment: Sewage Disposal Building Area

The AOC associated with wastewater treatment at Mound Plant OU5 is the Sewage Disposal Building area located southeast of Building 57, near Building 94 (Figure 3.1.). The sanitary wastewater treatment plant at the Sewage Disposal Building area is used for treatment of sanitary and process wastewater produced by Mound Plant. The treatment plant includes several components: the grit chamber, grit conveyer, comminutor, equalization basins, aeration basins, clarifiers, sand filters, and chlorine contact chambers. The system has been in operation since 1975. Sources of wastewater treated by the components of the sanitary wastewater treatment plant include restrooms, showers, laundry facilities, lab sinks, floor drains, and rinse water from a small metal refinishing system (Kearney 1988). The sludge produced is reported to contain plutonium-238 and thorium-232. The sludge does not constitute a RCRA-listed hazardous waste because it is part of an NPDES-permitted system, and does not have hazardous waste characteristics

Table III.1 Historial Information on Operable Unit 5 Areas of Concern
page 1 of 2

Areas	Potential Contaminants	Historical Uses
Sewage disposal building area	plutonium-238 and thorium-232	Mound Plant sanitary and process wastewater are treated. It is reported that the sludge does not constitute a RCRA-listed hazardous waste because it is part of an NPDES-permitted system, and does not have hazardous waste characteristics
Area 3	plutonium-238, thorium, 1, 2 trans-dichloroethene, 1, 2-dichloroethane, styrene, rare earths, uranium, and radium	Area 3 was used for the storage and redrumming of drums containing thorium and plutonium-238 in the late 1950s and early 1960s.
Area 9	plutonium-238 and thorium	Area 9 was constructed in 1966 and was used for thorium drum storage and redrumming. It is currently used to stage both alpha and beta emitting solidified and packaged wastes prior to shipment to off-plant disposal locations.
Area 7	plutonium-238, thorium, cesium-137, actinium-227, tritium, xylene, radium and radon	Area 7 was identified in the early 1970s as a historic burial site for materials containing residual radionuclides. This area has a long history of debris disposal and infilling of residual materials including thorium, polonium-210, and some actinium-227, which was buried in the original ravine.
Area 8	plutonium-238, thorium and tritium	In 1965, soils contaminated with plutonium-238 and thorium from Areas 1 and 9 were deposited here. Area 9 and Area 1 were contaminated by the repackaging of the thorium-232 sludges in 1965 and 1966.
Area 10	plutonium-238	This area is used for the surface disposal of radioactively contaminated concrete.

Table III.1 Historial Information on Operable Unit 5 Areas of Concern
page 2 of 2

Areas	Potential Contaminants	Historical Uses
Area 12	plutonium-238, thorium and cobalt-60	In 1965, soil contaminated with thorium-232 was transferred to Area 12 from Area 1, when the latter was scraped to remove the surface contamination. Soil contaminated with thorium-232 and plutonium-238 from the SM Building was deposited over the area in 1965. In addition, the pipelines that carried low- and high-level radioactive wastes from Building 38 to the WD Building passed through this area and could have been a source of contamination. Beginning in the 1950s, more than 100,000 cubic yards (yd^3) of construction spoils were placed in this area. This area also contains elevated levels of plutonium-238, probably from work performed at the Waste Transfer System (WTS) (Area 19), or from Area 11.
Area 13	plutonium-238[a]	In 1950, wood contaminated with polonium-210 from the demolition of the Dayton operations was stored in this area along with equipment stored in tents.
Area 21	plutonium-238, cesium-137, tritium, thorium, actinium, radium, and gamma emitters	In this area were originally two bunkers: a large one for explosives storage and a small one for detonator storage. These bunkers were also known by the term "dynamite caves"and "dynamite shacks". In the 1940s and 1950s, the bunkers were used extensively for storage of wastes that had high gamma radiation. High-level wastes from the radium-actinium program were probably also stored here. An area with elevated levels of cesium-137 was discovered during the Mound Site Survey Project, and it was postulated that this was the location of an old bunker once used to store radioactive materials from the SW Building.
Area 22	plutonium-238, cobalt-60, radium-226, cesium-137, bismuth-207, and bismuth-210m	This area is also called the "orphan soils" area because it was created when construction projects did not have funding for disposal of unexpected contaminated soil, which was then staged in Area 22 while waiting for funding. This area received soils from various areas at Mound Plant as a result of construction activities.
Area J	paint and thinners, plutonium-238, thorium, tritium and cobalt-60	This area was used from the early 1970s to the early 1980s for the disposal of construction residues, such as excavated soils, pieces of concrete, piping, metal banding, plumbing fixtures, and roofing materials, which were either dumped or bulldozed over the side of the hill. Area J was also used for placement of construction spoils from the early 1950s to the early 1980s. Although records indicate that no hazardous substances were discarded at the hillside, Area J is an uncontrolled area and could have received contaminated materials.

[a]Although polonium-210 decays to stable lead, lead is not listed as a suspected contaminant. The relatively high specific activity of polonium-210, and the limited amount of polonium-210 that was present at Mound Plant, would yield extremely small quantities of stable lead.

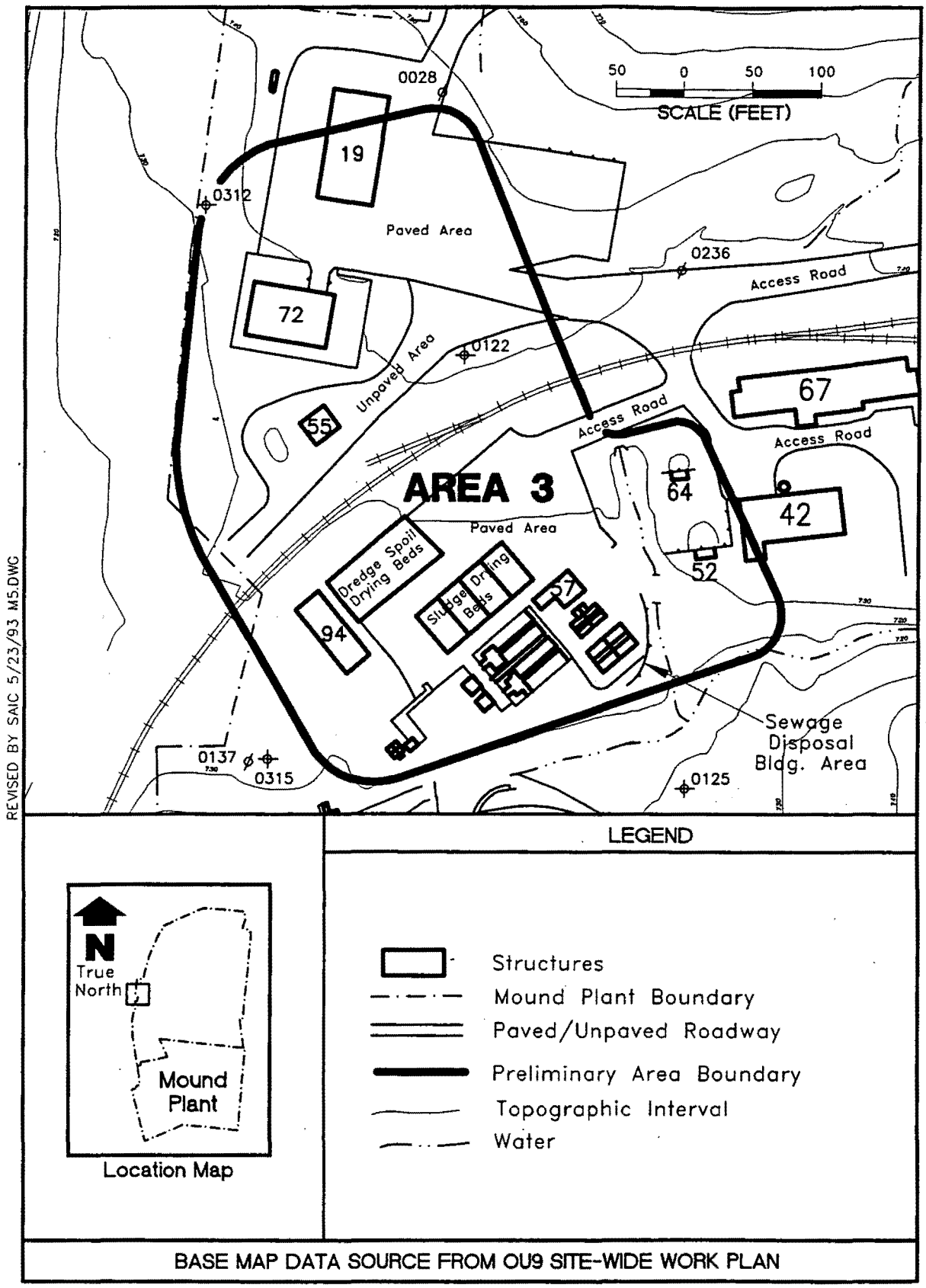

Figure 3.1. Mound Plant Operable Unit 5, Area 3

in Building 21 (Thorium Sludge Storage Facility) beginning in July 1964. In 1965, an area of approximately 40,000 ft^2 of unrecorded depth was excavated at Area 9 to remove thorium-contaminated soils, which were subsequently deposited in Area 8 (MRC 1985; DOE 1993a). The excavation was backfilled with clean soil, however, radioactive hot spots of thorium may remain in some places.

The samples collected in Area 9 during the Mound Site Survey Project were analyzed for plutonium-238 and thorium. For more information, please refer to Table V.4. of the OU9, Site Scoping Report, Volume 3 (DOE 1993a). The sampling locations around Area 9 are shown on Plate A.2 (1 of 2). Only relatively low levels of plutonium-238, with a maximum level of 8.15 pCi/g, were detected at location 0040. Three of the samples collected contained thorium concentrations in excess of 2 pCi/g: core location 0039 at a depth of 18 inches (5.62 pCi/g); core location 0043 at a depth of 18 inches (6.22 pCi/g); and surface location 0339 (12 pCi/g).

The contamination in Area 9 is primarily along the roads at the western edge. Results from other studies indicate that plutonium-238 concentrations range from 0.01 to 2 pCi/g or 0.04 to 8.15 pCi/g and thorium (all isotopes) concentrations range from 2 to 100 pCi/g or 2 to 12 pCi/g (Stought, et al. 1988). The depth of plutonium-238 is generally less than 3 feet while thorium contamination is surficial. Thorium concentrations as high as 150 pCi/g were detected, but were generally in the range of 5 to 15 pCi/g. No data reports of the D&D Program were found during research for the OU9, Site Scoping Report: Volume 3 - Radiological Site Survey (DOE 1993a). The evaluation of the Area 9 samples is based on a review of the site survey data conducted during the preparation of the OU9, Site Scoping Report: Volume 3 (DOE 1993a), and appears to be relatively comparable to the summaries presented in the Mound Site Survey Project. The original report did note that past Site Survey D&D Program core sampling was conducted in this area.

Mound Plant drawing #FSE16472 (DOE 1992d) indicates the depth to bedrock in this area is approximately 48 to 96 inches (4 to 8 feet). The maximum depth sampled during the Mound Site Survey Project was 54 inches, or 4.5 feet. Most of the core locations were sampled at depths of 18 to 36 inches.

3.1.3. Ground Disposal Areas

The AOCs associated with contaminated soils resulting from construction and D&D operations at Mound Plant OU5 include Area 7, Area 8, Area 10, Area 12, Area 13, Area 21, Area 22 and Area J.

3.1.3.1. Area 7

Area 7 is in the northeast portion of Mound Plant southwest of the asphalt-lined pond, and includes an area of approximately 900 feet by 200 feet (180,000 ft^2). It currently is covered by Buildings 51, 66, and 98, and a paved parking lot, which was constructed in 1984 (Figure 3.3.). This area was once a steep ravine that formed the upper reach of the plant drainage ditch. When the parking lot was built in this area, up to 40 feet of fill was used to level the ravine, except where a septic tank was located. This tank, installed during initial construction of the process buildings, was subsequently abandoned.

Area 7 was one of the original areas identified in the early 1970s as a historic burial site for materials containing residual radionuclides. Some errors are apparent on the original map of Hot Waste Burial Sites compiled in the early 1970s and reproduced in the OU9, Site Scoping Report: Volume 7 - Waste Management (DOE 1993c). For example, the thorium contamination was listed as thorium-228, when in fact thorium-232 was the dominant isotope in the Thorium Monex Process. Later versions of the map appeared in the Waste Management Site Plans of the mid-1970s with the correct thorium-232 isotope identified.

This area has a long history of debris disposal and infilling of residual materials including thorium, polonium-210, and some actinium-227, which was buried in the original ravine (DOE 1992c). More detail can be found in the thorium section of the OU9, Site Scoping Report: Volume 3 (DOE 1993a). The OU9, Site Scoping Report: Volume 6 (DOE 1992c) documents several episodes of filling and construction. From 1954 through 1963, crushed, empty thorium drums, soil contaminated with radium, actinium-227, and thorium-228 from the SW Building cave area, and a polonium-210-contaminated ventilation exhaust system from T Building were buried on the side of the ravine. Smaller items contaminated with polonium-210 may also have been buried (Garner 1991).

During the research for the OU9, Site Scoping Report: Volume 3 (DOE 1993a), one unusual entry was noted in the logbooks maintained by decontamination workers. The log records that on April 29, 1965, seven 30-gallon drums of dirt were removed from the road below Warehouse 15A (MRC 1961-1968). Warehouse 15A was used during this time period for a storage and shipping point for radioactive trash and wastes. No other information was obtained for this activity.

(Kearney 1988). The sludge is packaged and shipped to the Nevada Test Site as a low-level radioactive waste.

It is not known whether the sanitary wastewater treatment plant released contaminants to the surrounding area or to the surface water or groundwater. However, an inspection of the system (Kearney 1988) concluded that the potential for contaminant release was moderate to low due to the construction of the system and its observed condition. Any release from the system would flow southeast to a ditch where contamination would most likely be found.

3.1.2. Drum Storage Areas

The AOCs are associated with the storage and redrumming of radioactive and hazardous materials at Mound Plant OU5 and include Area 3 and Area 9.

3.1.2.1. Area 3

Area 3 is in the lower valley area southwest of the Main Hill (Stought, et al. 1988) and includes buildings 19, 42, 55, 94, 72 and 57 (see Figure 3.1.). The area measures approximately 340 feet by 450 feet (153,000 ft^2); the portion of Area 3 not covered by buildings is approximately 40,000 ft^2.

Area 3 was used for the storage and redrumming of drums containing thorium and plutonium-238 in the late 1950s and early 1960s (MRC 1973), and has a varied and complex history. The buildings in Area 3 have served various purposes, including salvage operations, effluent monitoring, sewage treatment, and hazardous waste storage. In 1954 and 1955, about 6,000 55-gallon drums of thorium sludge were delivered by rail to Mound (MRC 1973; Meyer 1979). Some of the drums were stored in Area 3 for prolonged periods during which time exposure to the elements and internal exposure to corrosive solutions necessitated frequent redrumming (MRC 1973). Leakage of the drums, along with redrumming operations, resulted in the release of thorium into the soil. In 1965, the thorium-contaminated soil was reportedly excavated and the area backfilled with clean soil (MRC 1985; Stought, et al. 1988). It is not known how much fill was placed in this area.

Building 72, a RCRA-permitted facility, historically stored (in and near the building) drums containing chemical wastes from various processing facilities at Mound Plant prior to off-site disposal by a licensed contractor in accordance with 40 CFR 262 and 263 (DOE 1986). The chemical wastes include the following:

- organic solvents such as acetone, isopropanol, methanol, trichloroethene, and chlorinated fluorocarbons;
- waste oils;
- paints and thinners;
- spent plating solutions such a chromic acid, cadmium, cyanide, nickel sulfate, nickel chloride, and copper cyanide;
- photoprocessing wastes such as spent fixer solution, developers, bleaches, and rinses;
- extraction procedure toxic wastes (samples); and,
- polymer wastes.

The Mound Site Survey Project analyzed soil samples that were collected from Area 3. Several samples showed elevated levels of plutonium-238 and unspecified isotopes of thorium. The sampling locations around Area 3 are shown on Plate A.2 (1 of 2). The plutonium contamination in Area 3 may have resulted from runoff from the rupture of the waste transfer system (WTS) line between the Waste Disposal (WD) Building and the SM/PP area in 1969 that created Area 14, or by the clean-up operations that followed the break. This event also resulted in the contamination of an off-site area, known as the runoff hollow, west of the fenceline at the western edge of Area 3 (Rogers 1975). Because the runoff hollow is outside the boundary of Mound Plant and was sampled as part of the Miami-Erie Canal (OU4) investigation, it was not addressed by the Mound Site Survey Project (Stought, et al. 1988). The Miami-Erie Canal is the major land mass for OU4 and is not addressed in this Work Plan. The vertical extent of contamination is generally between 3 and 6 feet, but at one location in the southeastern part of Area 3, plutonium-238 contamination was found as deep as 15 feet. The contamination in these areas is primarily plutonium-238, with isolated concentrations of thorium near Building 94.

Most of the elevated plutonium-238 activity is described as being present near Building 19 (core locations 0099, 0100, 0101, 0102, and 0104) and in the southwest corner of the area (surface locations 0547, 0548, 0550, and 0552). See Table V.2. of the OU9 Site Scoping Report, Volume 3 (DOE 1993a) for more information. The maximum plutonium-238 concentration reported for samples collected from Area 3 (50.60 pCi/g) was detected in the sample collected from core location 0104 at a depth of 18 inches. Only five samples contained plutonium-238 concentrations greater than 25 pCi/g. Only four of the samples collected in Area 3 contained levels of total thorium in excess of 2 pCi/g. The maximum concentration (5.30 pCi/g) was detected in a surface sample collected from location 0547. The thorium is a result of the thorium redrumming and storage operations performed in Area 3, particularly near the railroad spur.

In addition to soil sampling, groundwater from Area 3 monitoring well #122, which is completed in the glacial outwash deposits in the tributary valley, has been periodically analyzed. Results of these analyses indicate that trace amounts of tritium, thorium-228, -230, and -232 (only noted as values below the method quantitation limit), and uranium-234 and -238 are present in the shallow groundwater in the tributary valley below Area 3. Monitoring well #122 has been analyzed for VOCs, and exhibits only trace concentrations of trichloroethene and 1,1,1-trichloroethane. Contaminants found in well #122 above maximum contaminant levels (MCL) include dichloromethane (7 ppb) and 2-butanone (23 ppb). In addition actinium-227 was found in well #122 at a concentration of 1.4 pCi/L.

Groundwater samples were taken also from monitoring well #137, completed in the glacial outwash deposits in the tributary valley southwest of Area 3. Results of the groundwater analyses show that 1,2-trans-dichloroethene, 1,2-dichloroethane, and styrene are present, with the latter two in concentrations above the level set by the Safe Drinking Water Act (EPA 1990b). Contaminants found in well #137 above MCLs include: 2-butanone (36 ppb), carbon tetrachloride (7 ppb), and trichloroethene (6 ppb).

Soil gas analyses were completed near monitoring well #137 from a depth of 5 feet at six locations in Area 3. The soil gas analyses indicated the presence of 1,2-trans-dichloroethene, trichloroethene, benzene, toluene, and ethyl benzene.

3.1.2.2. Area 9

Area 9, a thorium storage and redrumming area, is located under and around Building 31 on the north end of the SM/PP Hill in the eastern section of Mound Plant (Figure 3.2.). Building 31 was constructed in 1966 (MRC 1985) and is on the eastern border of the site on the SM/PP Hill. The area is covered by asphalt and is approximately 200 feet x 200 feet (40,000 ft^2). It is currently used to stage both plutonium-238 and tritium wastes prior to shipment to off-site disposal locations. The OU9, Site Scoping Report: Volume 6 - Photo History (DOE 1992c) documents the use of the area for open drum storage through 1959.

In 1954 and 1955, 6,000 55-gallon drums of thorium sludge were delivered to Mound (MRC 1973; Meyer 1979). Some of these drums were stored at Area 9, and prolonged outdoor storage and internal exposure to corrosive solutions necessitated their frequent repackaging to ensure containment. Redrumming was initiated in April 1966 (Meyer 1956). It became routine to repackage 20 to 45 percent of the drums annually. Drums were eventually moved to Area 1 where the thorium sludge was removed and placed

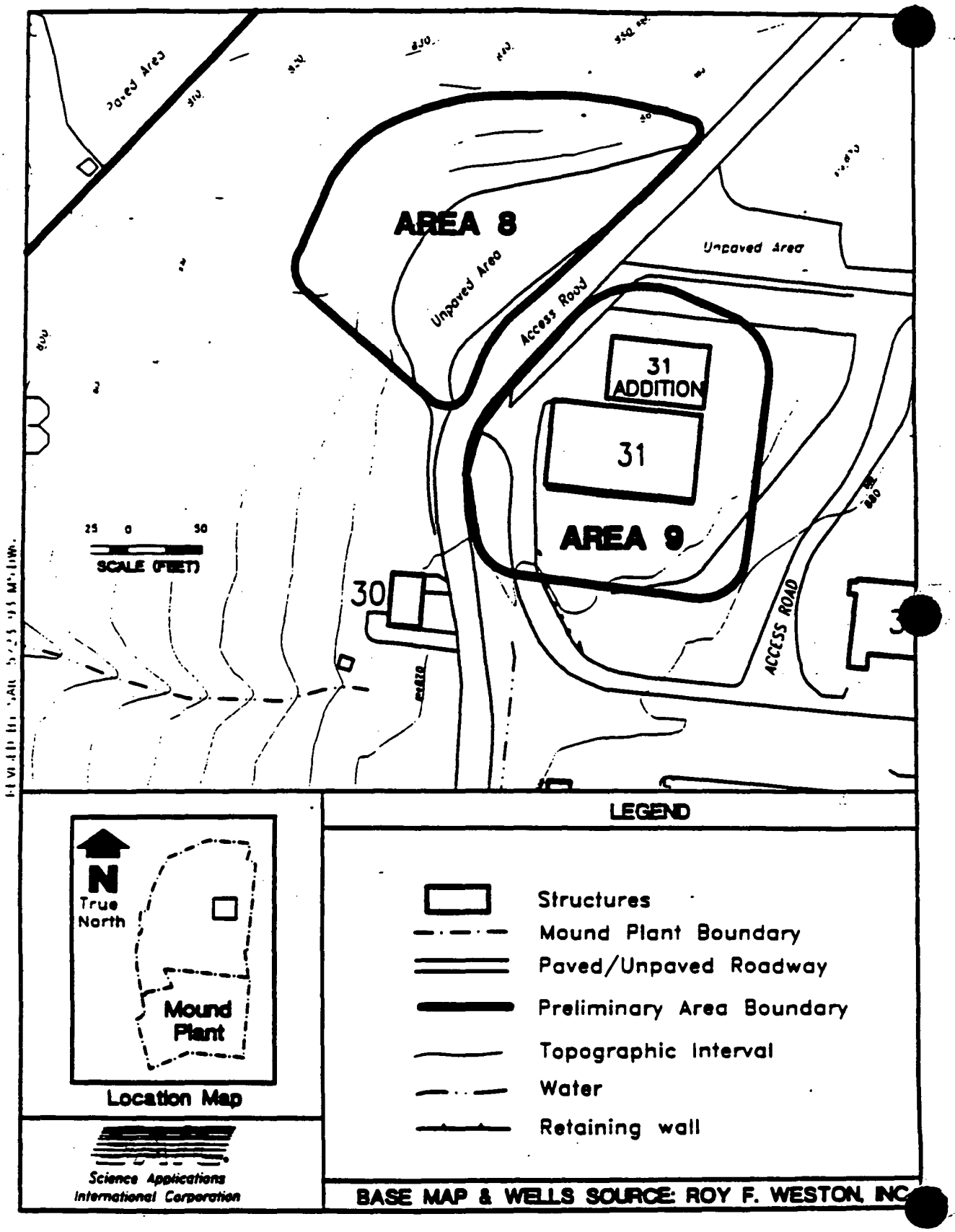

Figure 3.2. Mound Plant Operable Unit 5, Area 8 and Area 9

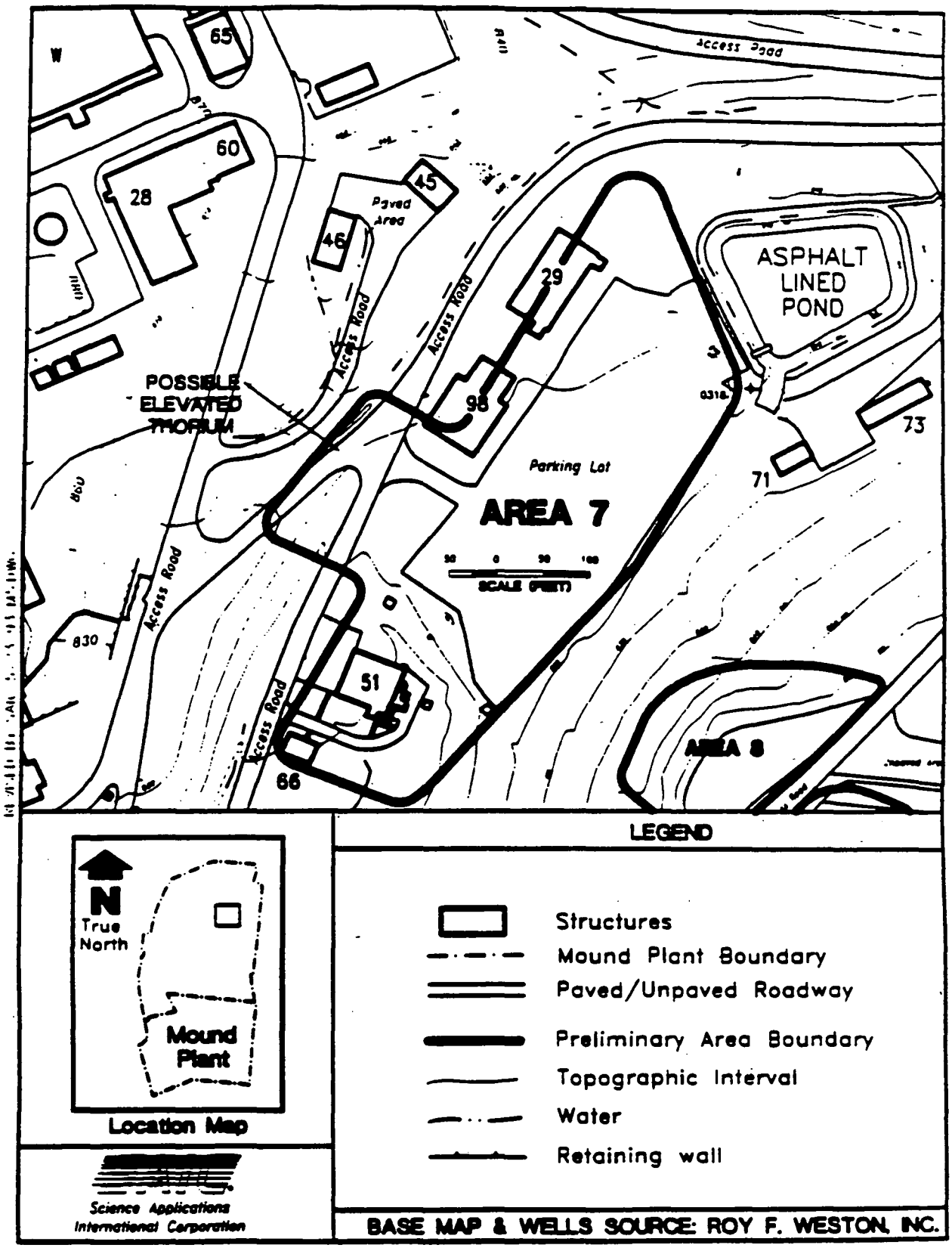

Figure 3.3. Mound Plant Operable Unit 5 Area 7

It was rumored that during the early 1970s, some of the trash from the historic landfill was excavated and removed to the ravine (DOE 1992c). This rumor has been difficult to substantiate; but, if true, it would suggest that some hazardous chemicals could have been relocated from the historic landfill to Area 7.

The thorium repackaging operations that extended from the mid-1950s to the mid-1960s generated between 15,000 and 20,000 steel drums. It is estimated that between 10,000 and 15,000 of these drums were crushed and buried along the western part of the original ravine.

There is no exact information to locate the historic landfill and thorium redrumming operations, but the OU9, Site Scoping Report, Volume 6: Photo History documents several episodes of filling and construction in the area. Plate 4 - Estimation of Fill Materials (OU9 Site Scoping Report, Volume 5: Topographic Maps) indicates that over 30 feet of fill materials may exist in Area 7.

The OU9, Site Scoping Report: Volume 3 (DOE 1993a) reported that 2,500 drums were buried in Area 7, but that number fails to account for the continued replacement and repacking of the drums over the 10-year time span. The best current estimate is that the majority of these drums were placed in Area 7 (Meyer 1991; Garner 1991) and the remainder in Area 2.

Also associated with the thorium project was a flatbed truck and a conveyor belt device used in the repackaging operations. This truck was previously reported to have been buried in the early 1950s and to have been contaminated with polonium-210 (DOE 1993a). It now appears likely that the dominant contaminant was thorium-232 from the repackaging operations and that the truck could not have been buried until that operation was completed in the mid-1960s (Garner 1991).

In either 1959 or 1960, concrete, soil, and gravel excavated from the west side of the SW Building were dumped in an old septic tank in the northern part of what is now included in Area 7 (DOE 1993a). The septic tank was installed for use during plant construction, but was abandoned during the 1950s. The contaminated materials contained radium-226, actinium-227, and thorium-228, which probably originated from a leaky sump (MCC 1953-1957) associated with the "old cave," now known as Area 15. The dirt and gravel were excavated in 1955 as part of the construction of the thorium refinery project (Meyer 1955a).

The samples from Area 7 were analyzed for plutonium-238 and thorium (DOE 1993c). The sampling locations around Area 7 are shown on Plate A.2 (1 of 2). The maximum plutonium-238 concentration detected was 7.40 pCi/g in the surface sample from location 0286. For more information, please refer to Table III.5. in the OU9, Site Scoping Report, Volume 3 (DOE 1993a). The maximum total thorium concentration detected, 20.52 pCi/g, was found in the surface sample collected from location 0298. In addition, actinium-227 contamination was found as deep as 12 to 18 feet near the septic tank behind Building 29 and in levels up to 1400 pCi/g (DOE 1993a). Other radionuclides detected included radium-226 (2 pCi/g), cesium-137 (1.2 pCi/g), and tritium (5.23 nCi/L).

Mound Plant employees report (personal interviews by Weston) that at locations 0008 and 0009, the septic tank was penetrated during drilling and the material inside was sampled. No plutonium or thorium results were given for these samples. These samples were not analyzed for tritium. Although tritium was used extensively in the SW Building, the tritium projects postdate the actinium disposal (DOE 1993a).

The coring locations in Area 7 were drilled and sampled to depths of 8 to 19.5 feet. Mound Plant drawing #FSE16472 (DOE 1992d) indicates depth to bedrock in this area is 9 to 15 feet at the north end of the area, and 65 feet at the southern end near Building 51. Samples from seven core holes (0008, 0009, 0020, 0015, 0024, 0025, and 0032) and four surface samples (0276, 0278, 0299, and 0316) were analyzed for cobalt-60. All analyses indicate that cobalt-60 was not detected above the lower detection limit. Because a boring log is available for only one of the Area 7 locations, it is not known if bedrock was encountered during the drilling; however, it appears that the majority of the core sampling did not penetrate fill or reach the original disposal area soil surface.

Groundwater samples were collected from monitoring well #111 south of Area 7. These samples indicated that xylene and tritium are present in small quantities in the groundwater downgradient from Area 7. Other contaminants detected above MCLs in monitoring well #111 include 2-butanone (95B ppb, with no information on blank concentration), dichloromethane (110 ppb), and bis(2-ethylhexyl)phthalate (7 ppb). Several samples showed elevated concentrations of plutonium-238 (0.01 to 2 pCi/g), thorium (all isotopes) (2 to 100 pCi/g), and actinium-227 (10 to 10,000 pCi/g) (Stought, et al. 1988).

The disposal areas of thorium drums and other magnetic materials are depicted in the Preliminary Results of Reconnaissance Magnetic Survey (DOE 1990). A soil gas survey was performed around Area 7 in 1992 with the objective to provide sufficient data to enhance the planning of site characterization activities,

specifically to identify areas containing VOC contamination within the subsurface soils. Based on previous contaminant characterization, the soil gas samples were initially collected for the analysis of six target compounds: trichloroethene, trans- and cis-1,2-dichloroethene, 1,1,1-trichloroethane, toluene, and trichlorofluoromethane (Freon 113) and tetrachloroethane (DOE 1992d).

A total of 53 samples were collected, including one water sample. Six of the eight target compounds were detected in Area 7. Freon 11 was detected at three locations in concentrations ranging from 7 to 32 ppb. Freon 113 was detected at four locations ranging from 4 to 32 ppb. Cis-1,2-dichloroethene was detected at two locations ranging from 3 to 10 ppb. 1,1,1-Trichloroethane was detected at five locations ranging from 2 to 22 ppb. Tetrachloroethene was detected at two locations at 6 and 7 ppb. Toluene was detected at 24 locations within Area 7. Eight of the 24 locations had associated blank detections. Concentrations of toluene in samples with no associated blank detection range from 3 to 825 ppb (DOE 1992e).

3.1.3.2. Area 8

Area 8 is located in the eastern portion of Mound Plant on the SM/PP Hill. It is in a low-lying area northwest of Building 31 and northeast of Building 30 (see Figure 3.2.). The approximate size of Area 8 is 100 feet by 200 feet (20,000 ft^2).

In 1965, an unknown quantity of soil contaminated with plutonium-238 and thorium from Areas 1 (D&D Program Sites, OU6) and 9 were deposited here. Area 9 and Area 1 were contaminated by the repackaging of the thorium-232 sludges in 1965 and 1966. When these areas were scraped to remove the surficial contamination (in 1965), the soils were disposed of in Area 8 and Area 12. About 6 inches of topsoil was used as a cap.

In 1984, a concrete pad was installed and some of the thorium contaminated soils were excavated. Soils with a contamination level greater than 15 pCi/g were boxed for off-site disposal and the remaining materials moved to the eastern, upper part of Area 12 (Draper 1985).

Results from the Mound Site Survey Project indicate that Area 8 is generally contaminated with thorium (all isotopes) and plutonium-238. Depths of contamination are as much as 12 feet for thorium and 4.5 feet for plutonium-238. Recent Mound Plant data also indicate the presence of thorium (2 to 1,000 pCi/g) and plutonium-238 (0.01 to 100 pCi/g) in the soils in Area 8 (Stought, et al. 1988).

In situ gamma spectroscopy for thorium-232 was performed at 14 core locations in Area 8: 0026, 0027, 0029, 0030, 0031, 0035, 0037, 0283, 0285, 0286, 0287, 0288, 0289, and 0290. Mound Plant personnel report that the *in situ* analysis was performed by driving pipes through the soils to bedrock and lowering the detector down the pipes. The sampling locations around Area 8 are shown on Plate A.2 (1 of 2). For more information on the analyses, please refer to Table V.3. of the OU9 Site Scoping Report, Volume 3 (DOE 1992a).

The maximum thorium concentration reported for Area 8, 254.3 pCi/g, was detected in the sample collected from core location 0045 at a depth of 80 inches. The area of elevated thorium concentrations appears to extend north, down the slope of the hill, and in general, extends beyond the original boundaries of the low-lying area. Therefore, it is probable that some transport of contaminated sediments by surface water has occurred from Area 8.

Plutonium-238 was detected in several samples. The maximum concentration, 24.4 pCi/g, was detected in the sample collected from surface location 0333. The Mound Site Survey Project Report (Stought, et al. 1988) noted that past site survey D&D Field Instrument for the Detection of Low Energy Radiation (FIDLER) screening data indicated thorium levels much higher than 10,000 counts per minute. This information suggests that levels of thorium greater than those given in Table V.3. of the OU9 Site Scoping Report, Volume 3 may be present in Area 8.

Based on the *in situ* analysis performed in Area 8, the depth to bedrock ranges from 8 to 12 feet. The remaining core locations in the area (0034, 0036, and 0038), which were sampled to depths of 9, 9.5, and 9 feet respectively, may also have been sampled to bedrock, but boring logs are not available for these locations.

No information is available on possible RCRA hazardous constituents.

3.1.3.3. Area 10

Area 10 is located west of Building 33 on the SM/PP Hill, just north of Area 12 in the east-central portion of Mound Plant (Figure 3.4.). The size of the area has been estimated, in the past, to be 150 feet by 100 feet (15,000 ft^2). The actual size of the area affected by the debris disposal is unknown and the area should be viewed as schematic.

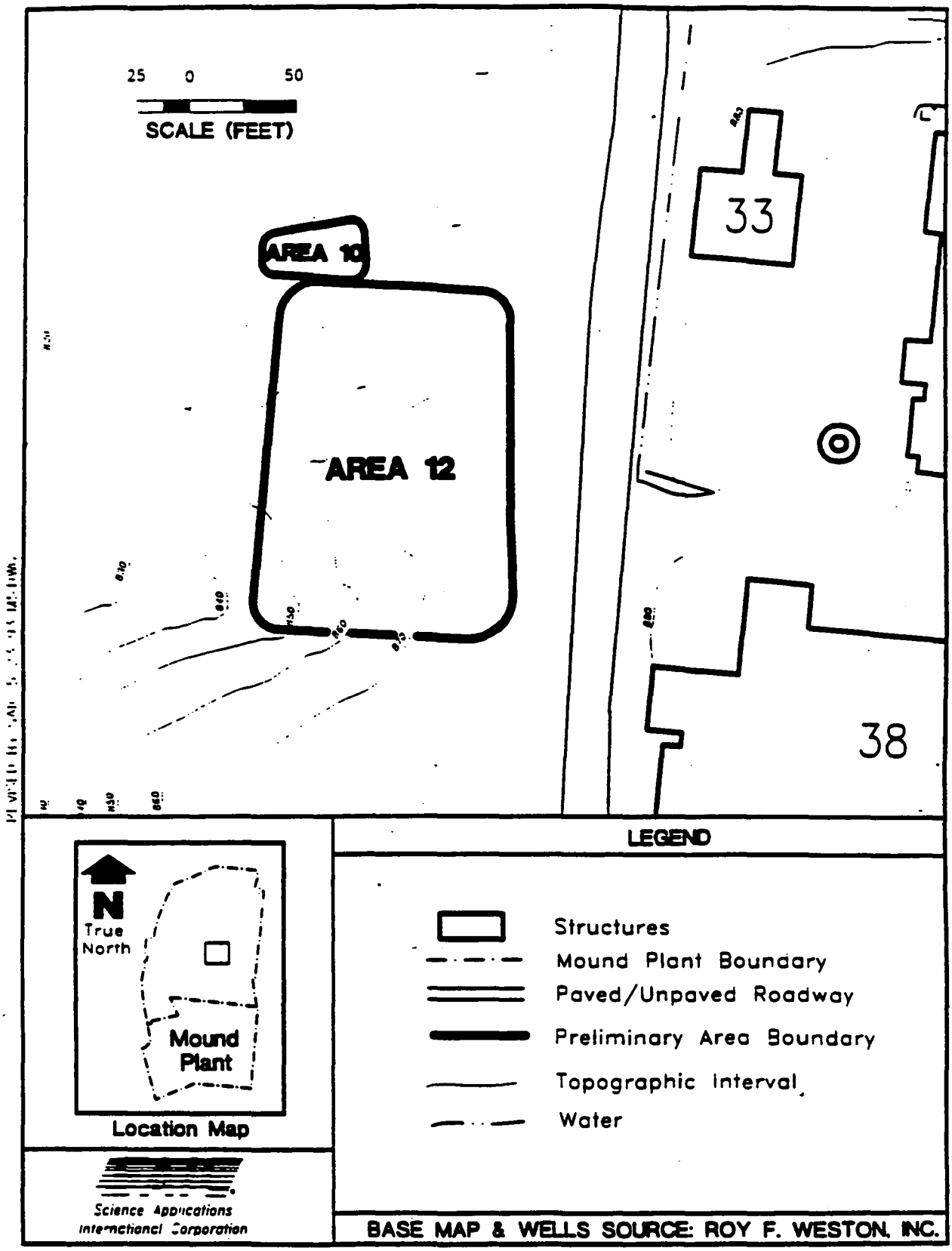

Figure 3.4. Mound Plant Operable Unit 5, Area 10 and Area 12

The following discussion highlights some of the history of the debris in Area 10. Figure 3.4. only indicates the surface where the debris has been found to date. Extensive searches over the SM/PP Hill have not been undertaken.

There are approximately six large pieces of concrete (3 feet by 4 feet) from the demolition of the old Dayton Operations from 1950 lying in the brush at Area 10. These were contaminated with polonium-210 (DOE 1986). Because of its short half-life, 138.4 days, the polonium-210 is no longer present. Additional concrete has been reported in the woods to the north. One hundred sixty truckloads of debris were brought to Mound Plant from Dayton Unit IV (Halbach 1950), and 100 truckloads were brought from Unit III. It is unknown how much of this was stored in Warehouse 10, the tropical huts, or dumped in Area 10. Many of the temporary buildings at Unit III were also razed and brought to Mound Plant when that facility was decommissioned. Recent disposal of concrete may also have occurred, but this is not documented.

One surface soil sample from Area 10, 0604 was collected during the Mound Site Survey Project. The sampling locations around Area 10 are shown on Plate A.2 (1 of 2). For more information on the analyses, please refer to Table III.6. of the OU9 Site Scoping Report, Volume 3 (DOE 1993a). The sample showed an elevated plutonium-238 level of 11.8 pCi/g (Stought, et al. 1988). Hazardous constituents were not analyzed. It is not known where this sample was collected in relation to the concrete. The Mound Site Survey Project report notes that more recent D&D Program core sampling in Area 10 indicated one sample with a plutonium-238 concentration between 10 and 99 pCi/g.

Because of its location on the slope of the SM/PP Hill, Area 10 is in a position to receive surface water runoff from areas upgradient, such as the adjacent Area 12. Since there are no other known contaminants associated with the concrete, it is believed that the plutonium-238 detected in the surface sample is the result of deposition from surface water runoff.

3.1.3.4. Area 12

Area 12 is in the east-central portion of Mound Plant. It is located adjacent to Areas 10 and D of OU6 on the west slope of the SM/PP Hill, west of Building 38, and on the north side of the former location of the radioactive waste line trench (see Figure 3.4.). The size of Area 12 varies in different reports from approximately 19,000 ft^2 to approximately 30,000 ft^2.

In 1965, soil contaminated with thorium-232 was transferred to Area 12 from Area 1, when the latter was scraped to remove the surface contamination. Soil contaminated with thorium-232 and plutonium-238 from the SM Building was deposited over the area in 1965 (DOE 1992a). In addition, the pipelines that carried low- and high-level radioactive wastes from Building 38 to the WD Building passed through this area and could have been a source of contamination.

Beginning in the 1950s, more than 100,000 yd^3 of construction spoils were placed in this area. Area 12 contains elevated levels of plutonium-238, probably from work performed at the WTS (Area 19) or from Area 11. When the WTS pipeline was removed by the D&D program, soil overburden containing low-level thorium contamination was removed to a site south of the area now called Rader's Hill. Another smaller area of plutonium-238 contamination was located west and downgradient of Area 12. This contamination may also be the result of surface water transport from Area 12.

The summary results of the sampling in Area 12 are given in Table V.5. of the OU9, Site Scoping Report: Volume 3 (DOE 1993a). They are similar to the results summarized in the Mound Site Survey Project Report. The results of sampling performed as part of the Mound Site Survey Project indicates that Area 12 is generally contaminated north of the Area 19 waste lines. Both plutonium and thorium contamination was found to a depth of 15 feet.

The 1982 to 1985 Radiological Site Survey (DOE 1993a) found maximum plutonium-238 and thorium concentrations of 313 pCi/g and 189.9 pCi/g, respectively, in Area 12. The sampling locations around Area 11 are shown on Plate A.2 (1 of 2). These concentrations were detected in a sample collected from core location 0131 at a depth of 4.5 feet. The known radioactive contaminants at Area 12 are mainly plutonium-238 (0.01 to 1,000 pCi/g), thorium (2 to 1,000 pCi/g), and cobalt-60 (1 to 2 pCi/g) (DOE 1986; Stought, et al. 1988).

In situ gamma spectroscopy for thorium-232 was performed at two core location (0145 and 0291). The maximum thorium-232 concentration measured using this technique was 22 pCi/g. This concentration was detected in the samples collected from location 0145 at depths of 2 and 3 feet. Most core locations were sampled to a total depth of 11 to 15 feet; however, the maximum sampling depth to bedrock in this area is 10 to 19 feet. It appears that the Area 12 core locations may have been sampled until bedrock was reached, but the boring logs are not available.

No information is available on possible RCRA hazardous constituents.

3.1.3.5. Area 13

Area 13 is northeast of Building 49 in the Test Fire Area, next to the plant drainage ditch in the valley between the Main and SM/PP Hills in the south-central portion of Mound Plant (Figure 3.5.). The exact location of Area 13 is not known. The map of Hot Waste Burial Sites, reproduced in the OU9, Site Scoping Report: Volume 7 (DOE 1993c) depicted Area 13 to the far east of Building 49. The Mound Site Survey Project (Stought, et al. 1988) depicted Area 13 slightly farther west and overlapping Building 49. Evaluation of the historic relationships of the quonset hut and other historic buildings in the area indicate the actual location was even farther west. The historic buildings were also moved from the Dayton units to the lower part of the plant valley.

In 1950, wood contaminated with polonium-210 from the demolition of the Dayton operations was stored in this area along with equipment stored in tents. Wood from the walls was not contaminated and was sold for salvage. The flooring, however, was too contaminated to remove from the plant. In July 1955, the wood flooring and other combustible materials were burned. The wood, tents and other debris was burned in Area 13 in either 1950 (DOE 1986) or 1955 (DOE 1992a). Metal and other non-combustible materials were saturated with fuel oil and burned (Meyer 1955b, 1955c, 1956). Metal and other residual materials that survived the fire were subsequently buried in the historic landfill (Area 2/OU1). With a half-life of 138.4 days, the polonium-210 is no longer present.

Residue was surveyed for radioactivity in August 1955. No alpha activity was detected, but some beta or gamma contamination was detected (Garner 1991). The residual material was moved and buried in the southern part of the historic landfill (Meyer 1955b, d).

The Mound Site Survey Project analyzed two surface soil samples taken in or near the reported location of Area 13 (0670 and 0671). The sampling locations around Area 13 are shown on Plate A.2 (1 of 2). For more information on the analyses, please refer to Table III.7. of the OU9 Site Scoping Report, Volume 3 (DOE 1993a). No elevated levels of radionuclides were detected, although plutonium-238 levels were detected at 0.34 and 5.74 pCi/g (Stought, et al. 1988). No thorium was detected above 2 pCi/g in these samples.

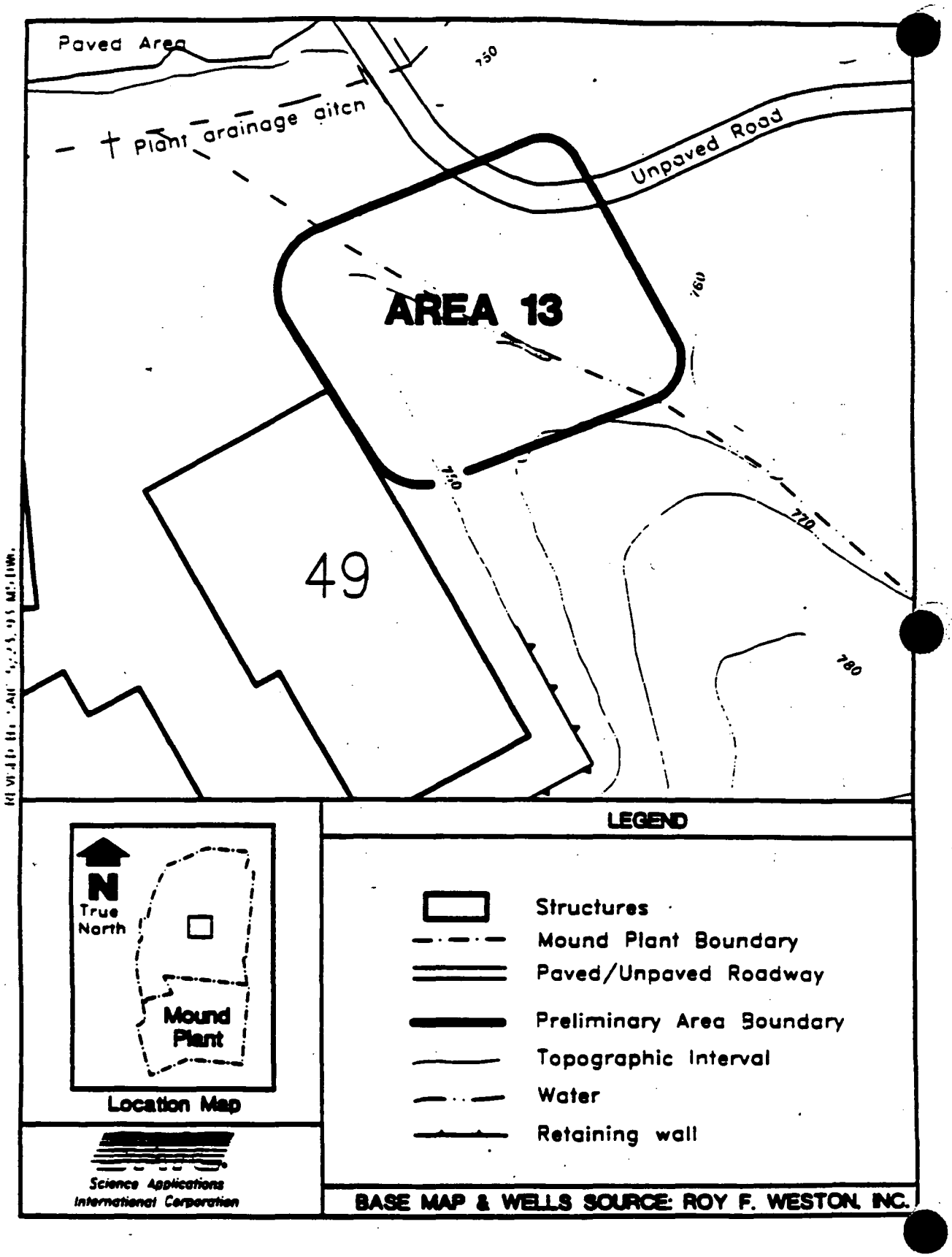

Figure 3.5. Mound Plant Operable Unit 5, Area 13

Area 13, like Area 10, is in position to receive surface water runoff from areas upgradient on the SM/PP Hill, including Area 12, which contains plutonium contamination. It is believed that the plutonium present in the samples taken in Area 13 may be the result of surface water runoff and not the result of additional radioactivity on the polonium-contaminated wood placed in the area.

No information is available on possible RCRA hazardous constituents.

3.1.3.6. Area 21

Area 21 is on the south central slope of the SM/PP Hill at an elevation of approximately 885 feet (Figure 3.6.). Area 21 is located south of Area J and southwest of Building 95, and is known as either the radium shack or old explosives bunker. The boundary of Area 21 is slightly larger than the Area 21 depicted in the Mound Site Survey Project report (Stought, et al. 1988).

This area was not included in the original compilation of known radiation areas at the beginning of the Mound Site Survey Project, but was reportedly found during the gamma surveys. It is not known if the boundaries depicted enclose both of the original bunker locations.

The bunker was accessed by a dirt road and was used for the storage of explosives during plant construction in 1947 and 1948. There were originally two bunkers: a large one for explosives storage and a small one for detonator storage. These bunkers were also known by the term "dynamite caves" (Bradley 1953) and "dynamite shacks" (MRC 1953-1957).

The larger explosives bunker, also known as shack #2, is the one that probably received the greatest use by Mound Plant. The smaller detonator bunker was also known as shack #1. The bunkers were constructed of heavy timbers tied together with steel cables. The floors are believed to have been packed earth. The only current visible sign of the location of the explosives bunker is the residual steel cables that are partly buried. No sign of the detonator shack is apparent.

In the 1940s and 1950s, the old explosives bunker was used extensively for storage of wastes that had high gamma radiation. The isolated location of the bunkers on the far hill of the plant (now the SM/PP Hill) allowed these materials to be stored away from the operational areas.

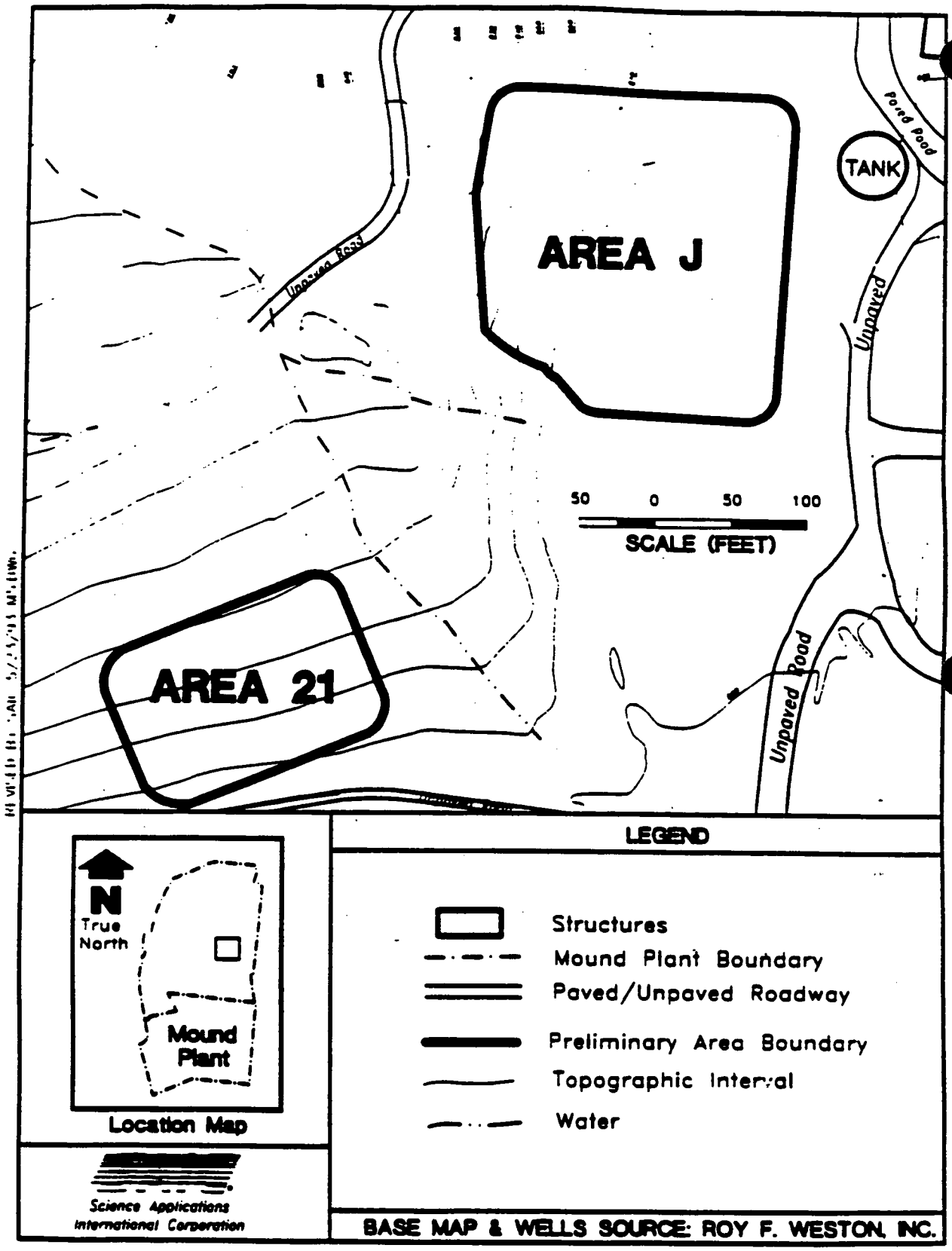

Figure 3.6. Mound Plant Operable Unit 5, Area 21 and Area J

During the era of polonium processing, 20- and 30-gallon drums containing the residual sludge from the bismuth decanting processes in the HH building were moved by truck to the bunkers. These "cans" were used to contain the bismuth-209 slugs which were irradiated in the Clinton Reactor at Oak Ridge to produce bismuth-210. The bismuth-210 then decayed to polonium-210 which was used at Mound Plant. Impurities in the aluminum cans, such as cobalt, iron, tin, and nickel, were also activated in the reactor as a by-product. Because these by-products are radioactive, the cans were stored at the bunker until they could be shipped back to Oak Ridge. The sludges contained high levels of short-lived, gamma-producing radionuclides. Storage of these sludges at the bunker site allowed the radiation levels to subside before they were shipped off-site for disposal (Garner 1991). The drums were trucked from the bunker to the quonset hut, or later to Warehouse 15, for loading onto trucks and shipment to Oak Ridge National Laboratory (ORNL) for burial.

In the early 1950s, the K-65 residues used in the radium-actinium project were stored in the explosives bunker in lead casks. Plant workers would remove small quantities of the residue for processing. This activity resulted in the bunker being called by the name "the radium shack." At the conclusion of the radium-actinium project, the ion exchange resins containing approximately 10 grams of radium were stored at the bunker (Schauer 1953). High-level wastes from the radium-actinium program were probably also stored here.

In July 1952, 37 20-gallon drums of liquid waste were removed from shack #1 and placed in sawdust in 55-gallon drums. These drums showed no external alpha radiation, but showed an average gamma radiation of 150 mR/hr. The drums were moved to Warehouse 7 (MRC 1951-1956). Some wastes were moved to the quonset hut in July 1953 for shipment off-site (Bradley 1953).

Drums stored in the shacks were surveyed in June 1953. The highest readings were 7.5 R/hr in shack #2 and 10 R/hr in shack #1 (MRC 1953-1957). The source of these drums could not be determined from the existing records, but was probably the radium-actinium program.

An area with elevated levels of cesium-137 was discovered during the Mound Site Survey Project, and it was postulated that this was the location of an old bunker once used to store radioactive materials from the SW Building (Stought, et al. 1988).

In August 1953, radiation surveys of surface and air contamination levels on and around drums of waste in storage indicated drum leakage. The problem was suspected to be mainly residual thorium from the purification process and were subsequently shipped off-site (MRC 1953-1957). It is not possible from the historical information to determine exactly how many of the drums were stored in the old bunkers, and what their sources were.

Subsequent surveys in September 1953 indicated little wipeable (surface-removable) contamination in shack #1 and none in shack #2. No direct readings could be taken in shack #2 because of the high gamma level inside the shack (MRC 1953-1957). Shack #2 may have still contained waste drums at that time. No historical data or references to these shacks or bunkers could be found during the research of the OU9, Site Scoping Report: Volume 3. The Mound Site Survey Project (Stought, et al. 1988) reportedly located the area through its gamma surveys of the plant. The sample results do not agree with the evaluation given in the original Mound Site Survey Project Report (Stought, et al. 1988). The project report indicated significant radium-226 activity, but no indications of radium-226 were found in Area 21 during the evaluation for the OU9, Site Scoping Report: Volume 3 (DOE 1993a). Mound Plant drawings (DOE 1992d) indicate that the depth to bedrock in this area as about 3 to 4 feet.

The Area 21 core locations were sampled to 4.5 to 5 feet, and it is probable that bedrock was reached. However, the boring logs for the Area 21 locations are not available. The sampling locations around Area 21 are shown on Plate A.2 (1 of 2). For more information on the analyses, please refer to Table VII.2. of the OU9 Site Scoping Report, Volume 3 (DOE 1993a).

Area 21 contaminants include plutonium-238 (0.1 to 1 pCi/g) and cesium-137 (0.1 to 100 pCi/g). Cesium-137 was found in the area at a level of 31 pCi/g measured in a core from 5 feet deep (DOE 1993a). Plutonium-238 was also found in Area 21 with concentrations up to 1.12 pCi/g. Plutonium-238, tritium, and radium-226 were also detected in several samples, although at relatively low levels (1.67, 0.99, and 1.2 pCi/g, respectively).

No information is available on possible RCRA hazardous constituents.

3.1.3.7. Area 22

Area 22 is located on the south part of SM/PP Hill adjacent to Building 53 (Figure 3.7.). It is roped off and covers approximately 75 feet by 150 feet (11,250 ft^2). This area consists of many piles of soil

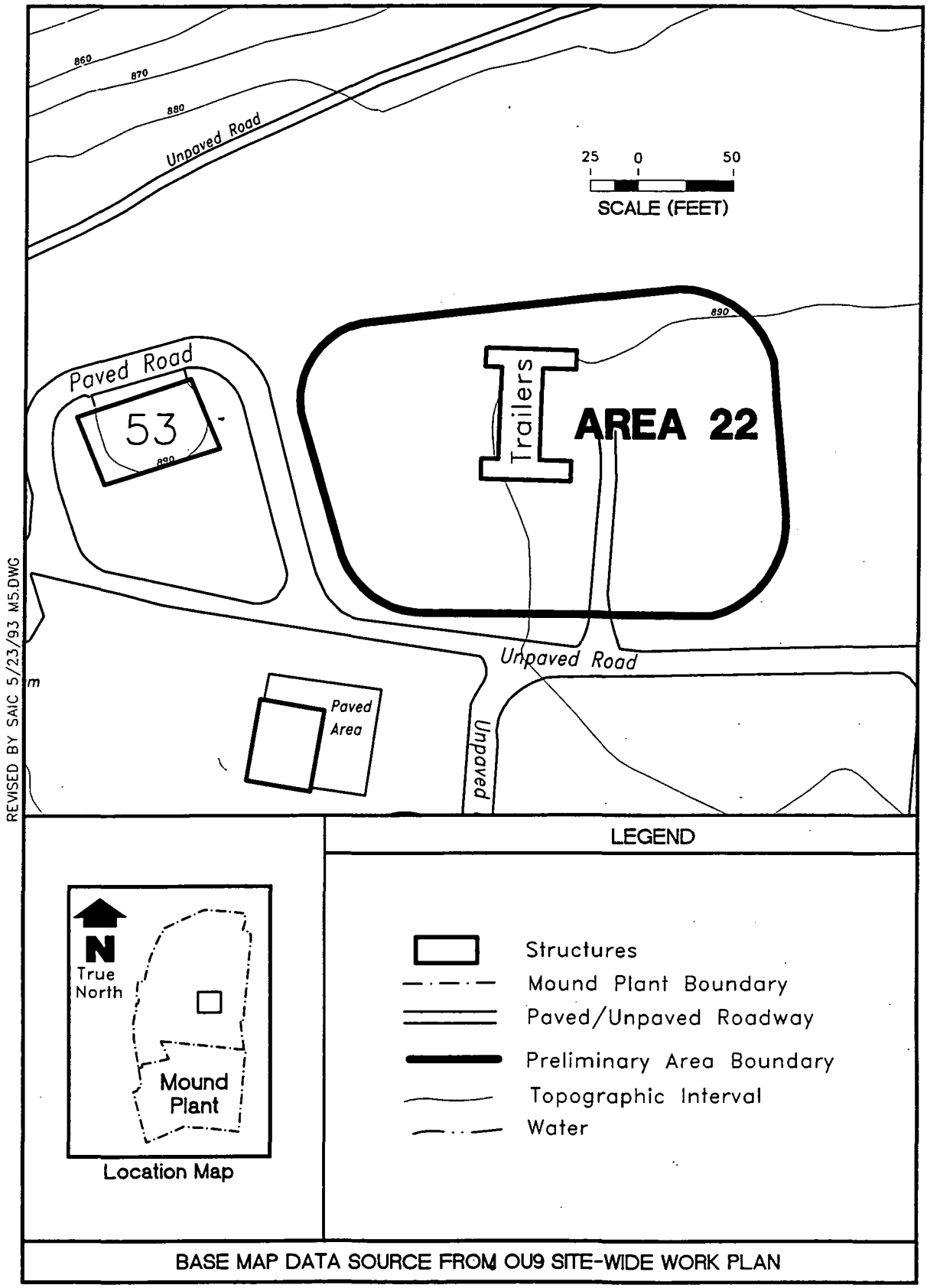

Figure 3.7. Mound Plant Operable Unit 5, Area 22

excavated from other areas at Mound Plant, including Area 20. 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, which was then staged in Area 22 while waiting for funding.

Area 22 was not part of the original compilation of radioactively contaminated areas when the Mound Site Survey Project began, but was identified by the initial gamma surveys (Stought, et al. 1988). The Mound Site Survey Project analyzed soil samples collected from Area 22. Only surface locations were sampled. The sampling locations around Area 22 are shown on Plate A.2 (2 of 2). For more information on the analyses, please refer to Table X.1. of the OU9 Site Scoping Report, Volume 3 (DOE 1993a). Elevated concentrations of cobalt-60 (10 to 1,000 pCi/g), cesium-137 (1 to 2 pCi/g), and radium-226 (0.1 to 1 pCi/g) were reported (Stought, et al. 1988). The sample from location 0787 in the southwest corner of the area contained cobalt-60 at a level of 143 pCi/g, and cesium-137 at a level of 7.0 pCi/g. Cobalt-60 was detected in two of the samples at levels of 143 and 54 pCi/g. The same samples showed radium-226 present in concentrations of 0.4 and 0.7 pCi/g, respectively. The source of radium was waste from the radium-actinium or reactor waste decontamination programs. The remaining two samples in the northeast and southwest corners of the area contained relatively low levels of plutonium-238, with a maximum level of 1.67 pCi/g, but these samples were not analyzed by gamma spectroscopy. Strontium-90 may be present because of the presence of other reactor wastes, but has not been specifically identified in this area.

No information is available on possible RCRA Constituents.

3.1.3.8. Area J

Area J, also known as the hillside disposal area (RFA 1988), is located in the eastern portion of Mound Plant, at the west edge of SM/PP Hill south of Areas D (OU6) and 12 (Figure 3.6.). Area J also includes three shallow ponded areas that are located just down the slope of the hill from where materials were dumped (DOE 1993a). Currently, Area J includes an area of approximately 4 acres. The volume of spoils material buried on the hillside exceeds 100,000 yd^3.

This area was used from the early 1970s to the early 1980s for the disposal of construction residues, such as excavated soils, pieces of concrete, piping, metal banding, plumbing fixtures, and roofing materials, which were either dumped or bulldozed over the side of the hill. Area J was also used for placement of construction spoils from the early 1950s to the early 1980s (DOE 1986).

Although records and interviews indicate that no hazardous substances were discarded at the hillside, Area J is an uncontrolled area and could have received contaminated materials. Several 55-gallon drums have been removed from the hillside for the geophysical survey in 1992. At Areas 12 and D, plutonium and thorium are potential contaminants because of their usage and disposal at those areas. Portions of Area J, including the ponds, are in a position to receive runoff from Areas 12 and D. Suspected contaminants at Area J are plutonium-238, paint, and paint thinners.

Twelve core locations and nine surface locations were sampled, either within or near Area J, as part of the Mound Site Survey Project. The sampling locations around Area J are shown on Plate A.2 (1 of 2). For more information on the analyses, please refer to Table X.2. of the OU9 Site Scoping Report, Volume 3 (DOE 1993a). Contaminants identified were plutonium-238, thorium, and cobalt-60. The maximum plutonium-238 concentration measured in these samples was 71.30 pCi/g in the sample taken at a depth of 18 inches at core location 0156. The maximum thorium activity measured was 30.42 pCi/g in a sample taken at a depth of 13.5 feet at core location 0160. The maximum concentration of cobalt-60 detected was 3.0 pCi/g.

Of the nine surface locations sampled, four (0634, 0635, 0636, and 0639) appear to have been located on the slope of the SM/PP Hill. The other five surface locations and the 12 core locations were probably located in the more level area at the top of the hill. The maximum depth of the core locations in Area J was 19.5 feet (0152 and 0156), and most were sampled at 4.5 to 6 feet. Mound Plant drawing #FSE 16472 (DOE 1992d) indicates that the depth to bedrock in this flat area is approximately 3 feet, but this depth varies greatly (up to 40 feet) due to the presence of fill material. It is likely that the Area J core locations were sampled to bedrock, but drilling logs are not available to confirm this.

The upper, relatively flat portion of Area J was historically used to stage soils contaminated with thorium and plutonium. Soils and possible other debris were placed in the area as part of excavation projects, including a water line repair below the adjacent water tower, and possible plutonium-contaminated soils from the construction of the overflow pond in the mid-1970s. The area may have also been referred to as the dredged materials disposal area (Area 11a) in the map of Hot Waste Burial Sites, reproduced in the OU9, Site Scoping Report: Volume 7 (DOE 1993c).

In 1988, 150 half-size low specific activity boxes (approximately 150 yds^3) of soil were removed from the area. Subsequent screening by the Mound Plant soil screening facility indicated levels of thorium and

plutonium-238 below 2 and 147 pCi/g, respectively (Rader 1988). Suspected hazardous contaminants at Area J are paint, thinners, and asbestos.

All but the northwest quadrant of Area J was covered by a geophysical survey (DOE 1993e) performed in late 1992. Extensive large and small objects were located throughout the area. Drums, some buried and semi-buried were also found during this survey project. The drums were removed but no sampling was performed.

A soil gas survey was performed around Area J in 1992 with the objective to provide sufficient data to enhance the planning of site characterization activities, specifically to identify areas containing VOC contamination within the subsurface soils. Based on previous contaminant characterization, the soil gas samples were initially collected for the analysis of six target compounds: trichloroethene, trans- and cis-1,2-dichloroethene, 1,1,1-trichloroethane, toluene, and trichlorofluoromethane (Freon 11). The list was expanded to include 1,1,2-trichloro-1,2,2-fluoroethane (Freon 113) and tetrachloroethane (DOE 1992e).

A total of 26 samples were taken from Area J. No groundwater was sampled or encountered during the field effort. Five of the eight target compounds were detected. Freon 11 was detected at three locations at concentrations ranging from 2 to 46 ppb. 1,1,1-trichloroethane was detected at two locations ranging from 7 to 37 ppb. Tetrachlorethene was detected at one location at 15 ppb. Trichloroethene was detected at one location at 13 ppb. Toluene was detected at three locations ranging from 5 to 11 ppb (DOE 1992e).

3.2. SITE CONCEPTUAL MODEL

The site conceptual model developed in the OU9, Site-Wide Work Plan (DOE 1992a) for Mound Plant is shown in Figure 1.2., Section 1. There are five primary sources at Mound Plant OU5 from which contaminants have entered or may continue to enter the environment. These are:

- drums and tanks;
- landfills, the old cave, and other covered disposal sites;
- retention basins/wastewater treatment system;
- surface disposal sites; and,
- operations or buildings.

Each of these primary sources may have contaminated surrounding soils through primary release mechanisms that include spills or leaks, leaching, infiltration, overflow, and runoff. These primary releases have all led to contaminated soil as a secondary source for further contaminant releases and potential exposures.

Contaminated soil represents a potential direct route of exposure to humans and biota through incidental ingestion, dermal contact, and direct radiation. Secondary routes of exposure may occur due to uptake by plants, resuspension of dust, vapor transfer into the air, and surface and groundwater contamination. Both flora and fauna incorporate contaminants from soil and provide a route of exposure to humans and other terrestrial biota through ingestion.

Air exposure pathways result from contaminated soil that may be resuspended into air by the natural action of wind or by human actions. Activities such as plowing and other agricultural field work can raise significant amounts of dust, as can such current activities as vehicle traffic, construction, and mowing. Additionally, certain contaminants such as VOCs, tritium, or radon may directly enter the breathing zone. These vapors or gases may pass through an environmental medium first (e.g., soil), or they may enter air directly from the source.

Groundwater can become contaminated by the leaching and further percolation of hazardous material from contaminated soil. Contamination in the groundwater represents potential exposure pathways, including ingestion, inhalation (i.e., from showering), and dermal contact, from use of current on site and off-site wells and from hypothetical future development of on-site residential wells. Terrestrial biota are not considered receptors in this scenario since they do not have access to groundwater from existing sources. Surface water and associated sediments can become contaminated as a result of runoff and erosion from areas of contaminated soil, from seepage of contaminated groundwater, or historically from direct spills and effluent releases. Surface water exposure routes to be considered include ingestion of fish that have fed in contaminated areas, incidental ingestion of sediment, dermal contact with surface water and sediments, direct radiation from contaminated sediments and canal banks, and ingestion of livestock (beef and milk) watered with contaminated surface water.

Potential exposure routes for terrestrial biota are ingestion of contaminated surface water, including water from seeps, and ingestion of biota from contaminated surface water. Exposure of aquatic biota can occur

through contact with contaminated water and sediments and through bioaccumulation from other organisms lower in the food chain.

It is important to understand the relationships expressed in the site conceptual model in order to identify sampling and analysis plans that adequately define the site conditions and test the accuracy (validity) of the conceptual site model. The relationship between source (i.e., drums), media (i.e., soil). pathway (i.e., groundwater), exposure route (i.e., ingestion) and receptor (i.e., site worker) are important to every step in the RI/FS process.

3.2.1. Extent of Known On-Site Contamination

The soil and groundwater laboratory analytical results discussed in this section (radiological and chemical) comprise both Contract Laboratory Program (CLP) and non-CLP data. Although the data are not all CLP, they will be used for scoping purposes and are all assumed to be of a quality of Level III or better (EPA 1989a).

VOC data were collected according to the requirements of EPA Method 8010/8020. The reason for selection of Method 8010/8020 rather than the equivalent CLP method, was to lower detection limits for the contaminants of concern. Although 8010/8020 is not CLP, data packages generated from the CLP lab are in CLP form in order to perform data validation.

Soil data used consist of samples collected from OU6 during reconnaissance sampling (July 24 through August 8, 1989), Area 14 verification sampling (August 27-28, 1991), and Area 17 verification sampling (September 3-4, 1991). Additional soil data were obtained from samples taken during four phases of sampling of OU3 sites: June 26-12, 1991; August 28-29, 1991; October 28-20, 1991; and January 13-20, 1992, as well as Comprehensive Environmental Assessment Response Program (CEARP) Phase II data. The OU6 soil data have all been validated; whereas, only a portion of the OU3 data has been validated to date.

Groundwater data consists of samples collected from wells on a site wide basis (OU9). Samples were collected from February 1986 to December 1991, with most of the samples collected in 1990 and 1991. Groundwater samples were not filtered. Validation of groundwater data is only partially complete to date.

The contaminant information currently available for OU5 AOCs is limited to soil and groundwater data, which has been generated by other operable unit investigations.

3.2.1.1 Soil

1) Chemical Contaminants

Comprehensive characterization of chemical soil contamination has not been performed at the site. Limited field investigations have been conducted in order to support the scoping of the RI/FS and to provide data for D&D remedial action cost estimates.

No trends were evident in chemical data in past sampling events. Detected inorganic chemicals are shown in Table III.2. with their site wide maximum levels of detection and their background ranges. These background ranges were based on literature values for surface soils in the United States from various references (Kabata-Pendias 1992; Logan 1983; ATSDR 1990; and Dragun 1988).

The following classes of organic compounds were detected at Mound Plant sites:

- Pesticides: 4,4'-DDT, 4,4'-DDE, endrin, ketone, and dieldrin were reported near or below laboratory quantitation limits. These pesticides were identified sporadically, not necessarily indicating pesticide usage. Beta-BHC, a degradation product of lindane, was also detected at low levels above the limit of detection in two samples.

- Trihalomethanes: Bromodichloromethane and dibromochloromethane were detected at concentrations near or below laboratory quantitation limits. These compounds are often found in chlorinated drinking water.

- Polynuclear Aromatic Hydrocarbons (PAHs): PAHs were the most widespread compounds found in sample results; however, PAHs were seldom above quantitation limits but were detected in significant concentrations near the waste oil drum field and the fire-fighting pits. These compounds are found in asphalt and are produced by combustion of diesel, fuel oil, and coal. The widespread distribution, without any noted areas of high concentration, indicates the compounds were probably byproducts of routine use of combustion engines.

- Phthalates: These compounds are commonly found in plastics and are often found as laboratory contaminants.

- Polychlorinated Biphenyls (PCBs): Aroclor mixtures of PCBs were reported at two locations, but were detected at levels below quantitation limits.

- Aromatic Hydrocarbons: Benzene, toluene, ethylbenzene, and xylenes, components of gasoline, were detected below quantitation limits at sporadic locations but were detected in significant concentrations near the waste oil drum field and the fire-fighting pits.

Table III.2. Inorganic Soil Constituent Concentrations and Background Ranges

Inorganic Constituents	Soil Concentrations Background Range (mg/kg)	Maximum Detected Onsite Soil Concentrations (mg/kg)
Aluminum	700-100,000	23,200
Antimony	0.25-0.6	53.3
Arsenic	<1-93	18.6
Barium[a]	200-1,500	687
Beryllium	0.04-2.5	1.9
Cadmium[b]	ND-2.9	12.7
Chromium[b]	4-23	38
Cobalt	3-50	26.1
Copper[b]	11-37	50.7
Cyanide[c]	0.1-0.8	2.4
Iron[d]	7,000-550,000	128,000
Lead[b]	9-39	105
Lithium	0.7-64	48
Manganese	20-3,000	1,320
Mercury	0.01-1.5	1.4
Nickel[b]	9-38	247
Silver	0.01-8	19.6
Thallium	0.02-2.8	2.4
Vanadium	0.7-150	62
Zinc[b]	47-138	1,180

Reference: Kabata-Pendias 1992
[a]Reference: ATSDR 1990
[b]Reference: Logan 1983
[c]Reference: MCEQ 1990
[d]Reference: Dragun 1988

(developed by Roy F. Weston, Inc.)

- Chlorinated solvents: Low levels of trichloroethene were detected at several locations. 1,1,1-trichloroethane and tetrachloroethene were also detected, but were found in blanks as well as samples.

- Common laboratory solvents: The compounds found included acetone, 2-butanone, trichloromethane, dichloromethane, and toluene. They were also found as contaminants in laboratory blanks. The concentrations were seldom found above the blank levels. Only valid data will be used in the future BRA. Laboratory data validation is ongoing for portions of the data referenced in this report.

- Miscellaneous compounds: Phenol and 4-methylphenol (common components of combustion of conventional fuels), carbon disulfide, and benzoic acid were detected sporadically. The explosive RDX was detected once at a low concentration in Area 4. N-nitroso-diphenylamine was detected several times,but also identified in laboratory blanks.

Detected organic chemicals are shown in Table III.3. with their site wide maximum levels of detection and their background ranges.

2) Radionuclide Contaminants

There were two sampling events for radionuclides in the surface soils on-site at Mound Plant. Measurements made in 1980 constitute the first data set. Field and laboratory measurements for plutonium-238, thorium-232, tritium, cobalt-60, cesium-137, radium-226, and americium-241 were taken in the surface soil. Laboratory measurements of the same radionuclides were also taken for segments of cores taken from the site.

A second data set comes from measurements for these same radionuclides taken in 1989. These measurements were taken to improve the characterization of radionuclide contamination made in 1980 and to provide a basis for ongoing clean-up activities at the site. The two sets of data are consistent in identifying similar areas of elevated activity levels of plutonium-238 and thorium-232. Contour maps of the surface soil data and the surface components of soil cores were made to identify areas having elevated levels of plutonium-238 (See Plate A.3.) and thorium (See Plate A.4.) in the surface soil. The subsurface portion of the cores and the few samples whose locations were not defined were not considered nor were they plotted on these maps. Five areas of elevated concentrations of plutonium-238 were identified. Data for cobalt-60, tritium, cesium-137, radium-226, or americium-241 do not indicate areas of elevated activity levels (i.e., samples with elevated activity levels are not surrounded by other samples with elevated activity levels), although there are some isolated points of elevated activity levels of cobalt-60 and cesium-137. Table III.4. lists the summary statistics for radiological parameters for Mound Plant OU5 AOCs.

Table III.3. Organic Soil Constituent Concentrations and Background Ranges
page 1 of 2

Compounds	Soil Concentration Background Range (µg/kg)	Maximum Detected Onsite Soil Concentration (µg/kg)
1,1,1-Trichlorethane	NA	41
2-Butanone	NA	13
2-Hexanone	NA	3
2-Methylnaphthalene	NA	760
4,4'-DDE	NA	54
4,4'-DDT	NA	27
4-Methylphenol	NA	410
4-Methyl-2-pentanone	NA	7
Acenaphthylene	NA	230
Acetone	NA	96
Anthracene	NA	147
Aroclor 1248	NA	290
Aroclor 1254	NA	66.4
Aroclor 1260	NA	79
Benzoic acid	140 - 350,000	280
Benzo(a)anthracene	0 - 10	1,500
Benzo(a)pyrene	0 - 8,000	1,600
Benzo(b)fluoranthene	0 - 30	2,600
Benzo(g,h,i)perylene	0 - 20	310
Benzo(k)fluoranthene	0 - 15	1,800
Beta-BHC	NA	50
Bis(2-ethylhexyl)phthalate	150,000 - 925,000	14,000
Bromodichloromethane	NA	5
Butyl benzyl phthalate	0 - 48,000	1,000
Carbon disulfide	NA	9
Chrysene	0 - 5,000	1,500
Dibenz(a,h)anthracene	NA	130

Table III.3. Organic Soil Constituent Concentrations and Background Ranges
page 2 of 2

Compounds	Soil Concentration Background Range (µg/kg)	Maximum Detected Onsite Soil Concentration (µg/kg)
Dibromochloromethane	NA	1
Dichloromethane	NA	8.5
Dieldrin	NA	16
Di-n-butylphthalate	19,000 - 56,000	180
Di-n-octylphthalate	0 - 13,000	410
Endrin ketone	NA	39
Ethylbenzene	1,000 - 5,000	3
Fluoranthene	0 - 40	21,000
Indeno(1,2,3-c,d)pyrene	0 - 15	270
Isophorone	NA	780
N-nitroso-diphenylamine	NA	1,400
Pentachlorophenol	NA	190
Phenanthrene	NA	1,400
Phenol	NA	320
Pyrene	0 - 15	5,000
RDX	NA	6.85
Tetrachloroethene	NA	30
Toluene	1,000 - 5,000	10
Trichloroethene	NA	21
Trichloromethane	NA	24
Xylenes	1,000 - 5,000	6

Reported values include concentrations detected below reported quantitation limits ("J" values).
Reference: Dragun 1988
NA - not available (developed by Roy F. Weston, Inc.)

Table III.4. OU5 Summary Statistics for Radiological Parameters
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Location	Parameter	N	MIN	MEAN	MAX	STD
Area 10	Plutonium-238	2	0.69	6.25	11.8	7.86
Area 12	Americium-241	2	0.25	0.25	0.25	0.00
	Cesium-137	2	0.25	0.25.	0.25	0.00
	Cobalt-60	2	0.25	0.25	0.25	0.00
	Plutonium-238	60	0.02	14.05	313.00	46.64
	Radium-226	2	0.80	0.95	1.10	0.21
	Thorium	31	0.30	25.61	189.90	51.91
Area 13	Plutonium	5	0.08	1.43	5.74	2.42
Area 21	Americium-241	16	0.25	0.25	0.25	0.00
	Cesium-137	20	0.25	8.56	31.00	10.87
	Cobalt	16	0.25	0.25	0.25	0.00
	Plutonium	7	0.18	0.58	1.12	0.32
	Radium	16	0.70	0.89	1.20	0.15
	Tritium	4	0.15	0.56	0.77	0.28
Area 3	Plutonium-238	63	0.01	6.66	50.6	11.35
	Thorium	4	2.56	3.84	5.3	1.13
Area 6	Americium-241	10	0.25	0.25	0.25	0.00
	Cesium-137	10	0.25	0.25	0.25	0.00
	Cobalt-60	10	0.25	0.25	0.25	0.00
	Radium-226	10	0.40	0.62	0.90	0.17
Area 22	NDA	NDA	NDA	NDA	NDA	NDA
Area 7	Actinium-227	7	10.00	287.14	1400.00	502.78
	Americium-241	33	0.25	0.25	0.25	0.00
	Cesium-137	33	0.25	0.28	1.20	0.16
	Cobalt-60	33	0.25	0.25	0.25	0.00
	Plutonium-238	121	0.01	0.61	7.40	1.28
	Radium-226	33	0.09	0.85	2.00	0.35
	Thorium	25	2.05	4.76	20.52	4.56
	Tritium	2	0.69	2.96	5.23	3.21

Table III.4. OU5 Summary Statistics for Radiological Parameters
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Location	Parameter	N	MIN	MEAN	MAX	STD
Area 8	Americium-241	2	0.25	0.25	0.25	0.00
	Cesium-137	2	0.25	0.25	0.25	0.00
	Cobalt-60	2	0.25	0.25	0.25	0.00
	Plutonium-238	22	0.03	3.15	24.40	5.30
	Radium-226	2	1.00	2.15	3.30	1.63
	Thorium	153	0.30	17.90	254.30	28.12
	Tritium	1	1.12	1.12	1.12	---
Area 9	Plutonium-238	15	0.04	1.14	8.15	2.03
	Thorium	3	5.62	7.95	12.00	3.52
Area J	Americium-241	5	0.25	0.25	0.25	0.00
	Cesium-137	5	0.25	0.25	0.25	0.00
	Cobalt-60	5	0.25	0.80	3.00	1.23
	Plutonium-238	70	0.06	5.58	71.30	11.45
	Radium-226	5	0.20	0.75	1.00	0.33
	Thorium	10	2.02	7.69	30.42	8.99
	Tritium	2	3.09	4.96	6.84	2.65

- NDA = No Data Available
- N = number of samples
- MAX = maximum value
- MIN = minimum value
- MEAN = mean value
- STD = standard deviation

3.2.1.2. Air

Mound Plant actively monitors the ambient concentration of plutonium-238 and tritiated water vapor in the air at the five on-site locations. Air sampling data reported over the past five years show a marked downward trend over time in the activity levels of plutonium-238, probably reflecting both reduction in releases of plutonium-238 from operations at Mound Plant and the weathering of previously deposited plutonium into the soil. The rate of decrease in air concentrations over the past five years has averaged about 40% per year. Thus, the 1991 data (the latest full year of data available) were selected as being most representative of current conditions. Stack emissions in 1991 contained 1.5×10^{-5} Ci of plutonium-238, ranging from 3.8×10^{-7} Ci in 1988 to the 1991 low of 5.5×10^{-8} Ci. The 59 samples ranged from 1.2×10^{-18} µCi/mL to 69.36×10^{-18} µCi/mL, with an average of 13.88×10^{-18} µCi/mL. Stack emissions in 1991 also contained 1232 Ci of tritium, ranging from a high in 1989 of 41,534 Ci (due to an accidental release) to the 1991 low of 1232 Ci. The 252 samples ranged from below the environmental level to 112.61×10^{-12} µCi/mL, with an average of 15.95×10^{-12} µCi/mL (EG&G 1992).

3.2.1.3. Groundwater

1) Chemical Contaminants

Contaminants detected in groundwater samples are listed in the OU9, Site-Wide Work Plan (DOE 1992a). Trichloroethene is the most prevalent organic groundwater contaminant. In the vicinity of Area B, trichloroethene has occurred in more groundwater samples at significantly elevated concentrations than any other constituent and extends west of the overflow pond, west of the site sanitary landfill, and along the southern edge of the overflow pond. The highest trichloroethene concentrations are directly south of the sanitary landfill in wells 0305 and 0063.

Data collected in 1990 indicate that contamination extends as far south as production well 0076 and as far west as the Mound Plant boundary. Samples from two wells north of Area B, wells 0137 and 0315, show trichloroethene throughout sampling during 1990. Assuming that groundwater in the unconsolidated deposits flows in a southwest direction, trichloroethene contamination in the upgradient wells (wells north of Area B) appears be from a source other than Area B. Well 0063 is likely to be the well closest to and apparently downgradient from the source. Additional information is presented and discussed in the OU1, Area B Technical Memorandum 3 (DOE 1991b). Additional field tasks will verify the assumed groundwater flow direction. The contaminant may be following an impermeable layer, being heavier than water, and actually migrating in a direction other than that of groundwater.

Trichloroethene and *cis*-1,2-dichloroethene with their degradation product chloroethene have also been detected in Area B. The maximum concentrations of these chemicals have been detected near the overflow pond, indicating another contaminant source is possible. Again, the geology and groundwater flow in this area will be researched further during early RI field work.

A tetrachloroethene plume exists coincidentally with the trichloroethene plume. As with trichloroethene, the highest concentrations of tetrachloroethene were measured in samples from well 0063. Both trichloroethene and tetrachloroethene concentrations increase in response to a rise in the water level, particularly in the shallower wells. This suggests that the contaminant sources may be concentrated at the top or just above the water table.

Trichloroethene and tetrachloroethene have migrated into the shallow bedrock below Area B, as indicated by samples collected in wells screened across the bedrock/unconsolidated interface and wells screened in bedrock. Also, trichloroethene and tetrachloroethene contamination is present in the Main Hill bedrock, as indicated by the presence of these contaminants in the discharge from the seeps along the Main Hill.

Other VOCs were detected sporadically in the groundwater, including styrene, benzene, toluene, 1,1,1-trichloroethane, trichloromethane, ethylbenzene, trichlorofluoromethane, 1,1-dichloroethane, acetone, 2-butanone, and carbon tetrachloride. Styrene has been detected north of Area B at well 0137 (up to 6 µg/L). 1,1,1-Trichloroethane was detected in many wells throughout Area B at levels up to 650 µg/L. Benzene was detected from samples collected at wells 0046 and 0071, but levels were below the reporting limit. Toluene has been detected several times at Area B and in the groundwater north of Area B at concentrations from 7 to 17 µg/L, though its occurrence is sporadic. Ethylbenzene has been detected in four wells, but only once above the reporting limit. Benzene, toluene, and ethylbenzene are components of gasoline.

Trichloromethane (chloroform) was detected in many wells in and around Area B at levels up to 33 µg/L at well 0063. Trichlorofluoromethane has also been reported at several wells in Area B at levels up to 4.2 µg/L. Both compounds are commonly found in chlorinated waters as disinfection byproducts. 1,1-Dichloroethane has been detected in several wells surrounding Area B, with a maximum concentration of 3.5 µg/L at Mound Plant production well 0271. Acetone has been detected in several wells surrounding Area B and elsewhere on-site. The maximum concentration of 200 µg/L was reported northeast of Area B on the Main Hill slope at well 0034. Acetone is a common lab contaminant and after data has been

validated, reported hits will be reevaluated. 2-Butanone, like acetone, is a common lab contaminant and after validation, reported hits will also be reevaluated. The maximum hit for 2-butanone was 100 µg/L at off-site well 0907, west of Mound Plant. Carbon tetrachloride has been detected repeatedly in wells surrounding and to the north of Area B, with a maximum concentration of 7 µg/L at well 0137.

2) Radionuclide Contaminants

Tritium has been detected in water from wells on-site and off-site at Mound Plant. For 135 on-site well samples in 1991, tritium ranged from 0.4×10^{-3} pCi/mL to 4.6×10^{-3} pCi/mL, with an average of 2.5×10^{-3} µCi/mL. For 37 off-site well samples in 1991, tritium ranged from 0.1×10^{-3} pCi/mL to 4.47×10^{-3} pCi/mL, with an average of 1.9×10^{-3} pCi/mL. Plutonium-238 was also detected in wells on-site and off-site at Mound Plant. For 33 on-site well samples in 1991, plutonium-238 ranged from 8.08×10^{-9} pCi/mL to 11.17×10^{-9} pCi/mL, with an average of 1.15×10^{-9} pCi/mL. For 24 off-site well samples in 1991, plutonium-238 ranged from 0.1×10^{-3} pCi/mL to 4.47×10^{-3} pCi/mL, with an average of 1.9×10^{-6} pCi/mL (EG&G 1992). While these numerical values were reported, it should be noted that these are "estimated" values and could be reported as below detection limit.

3.2.2. Screening of Contaminants

In addition to the contaminants that have already been detected on-site and off-site, there are many additional chemicals that may be of concern based on historic records of their use. This complete list of chemicals was developed for the OU9, Site Scoping Report: Volume 7 (DOE 1993c) and is summarized in Table III.5. This list includes over 230 chemicals, of which only 63 have a risk estimator (RfD or slope factor) developed by the EPA. Of the 27 radionuclides, 24 have a risk estimator developed by EPA. The list of COCs developed in OU9 is inclusive of chemical expected on all of Mound Plant. As a comprehensive list, it will be used as a starting point in development of an OU5-specific list of COCs. As more information and data is generated during OU5 investigations, the list of COCs will be refined and reduced to reflect those COCs detected in OU5 AOCs.

3.3. BASELINE RISK ASSESSMENT

An OU5-specific RA will be conducted to evaluate the current and potential threats to human health posed by contaminants present in, or mitigating to, groundwater, surface water, sediment and soils at OU5. The OU5-specific (RA) will provide the basis for determining whether or not remedial action is necessary for OU5. In addition, information generated through the OU5 field investigation and (RA) will be used in the development of the OU9 site wide BRA.

Table III.5. List of Possible Chemicals, Radionuclides, and Metals of Concern
page 1 of 2

Volatile Organic Compounds
1-Chlorohexane
1,1-Cichloroethane
1,1-Dichloroethane
1,1-Dichloroethene
1,1,1-Trichloroethane
1,1,1,2-Tetrachloroethane
1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane
1,2-Dichlorobenzene
1,2-Dichloroethane
1,2-Dichloroethene (total)
1,2-Dichloropropane
1,2,3-Tyrichloropropane
1,2,4-Trichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2-benzyl-4-chlorophenol
2-chloroethyl vinyl ether
2-Chloronaphthalene
2-Chlorophenol
2-Methylnaphthalene
2-Methylphenol
2-Nitroaniline
2-Nitrophenol
2,2'-Oxybis (1-Chloropropane)*
2,4-Dichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,6-Dinitrotoluene
3-Nitroaniline
3,3'-Dichlorobenzidine
4-Bromophenyl-phenylether
4-Chloro-3-methyphenol
4-Chloroaniline
4-Chlorophenyl-phenyl ether
4-Methylphenol
4-Nitroaniline
4-Nitrophenol
4,6-Dinitro-2-methylphenol
Acenaphthene
Acenaphthylene
Acetone
Acetonitrile
Acrylonitrile
Anthracene
Benzene
Benzo(A)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i,)perylene
Benzo(k)fluoranthene
Benzoic acid
Benzyl alcohol
bis(2-chloroethoxy) methane
bis(2-chloroethyl) ether
Bis(2-chloroisopropyl)ether
bis(2-Ethylhexyl)phthalate
Bromodichloromethane
Bromoform
Bromomethane
Butylbenzylphthalate
Carbazole
Carbon disulfide
Carbon Tetrachloride
Chlorobenzene
Chloroethane
Chloroform
Chloromethane
Chlorotoluene
Chrysene
Cis-1,2-dichloroethene
Cis-1,3-dichloropropene
Di-n-butylphthalate
Di-n-octylphalate
Dibenz(a,h)anthracene
Dibenzofuran
Dibromochloromethane
Diethylbenzene
Diethylphthalate
Dimethyphthalate
Ethylbenzene
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene[5]
Hexachloroethane
Hexane
Hexanone
Indeno (1,2,30cd)pyrene
Iodomethane
Isophorone
Methyl-2-pentanone
Methylene chloride
Methylethyl ketone
Methylisobutyl ketone
N-nitroso-di-n-dipropylamine
N-nitrosodiphenylamine
Naphthalene
Nitrobenzene
Pentachlorophenol
Phenanthrene
Phenol
Phenyl bromide
Pyrene
Styrene
Tetrachloroethene
Toluene
Trans-1,2-dichloroethene
Trans-1,3-dichloropropene
Tribromomethane
Trichloroethene
Trichlorofluoromethane
Trichloromethane
Trichlorotrifluoroethane
Vinyl Acetate
Vinyl Chloride
Xylenes

Pesticides and PCBs
4,4'-DDE
4,4'DDD
4,4'DDT
Aldrin
Alpha-BHC
Apha-Chlordane
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254

Table III.5. List of Possible Chemicals, Radionuclides, and Metals of Concern
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Aroclor-1260
Beta-BHC
Delta-BHC
Dieldrin
Endosulfan sulfate
Endosulfan II
EndosulfanI
Endrin aldepyde
Endrin ketone
Endrin
Gamma-BHC (Lindane)
Gamma-Chlordane
Heptachlor
Heptachlor epoxide
Methoxychlor
Toxaphene

Metals
Aluminum
Antimony
Arsenic
Barium
Beryllium
Bismuth
Cadmium
Calcium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Tin
Vanadium
Zinc

Explosives
1,3-DNB
1,3,5-TNB
2,4-DNT
2,6-DNT
2A,4,6-DNT
HMX
NB
PETN
RDX
Tetryl
TNT

Radionuclides
Americum-241
Bismuth-207
Bismuth-210 metastable
Cesium-137
Cobalt-60
Plutonium Isotopes
Potassium-40
Radium-226
Radium-226 (soils)
Strontium-90
Thorium Isotopes
Tritium[3]
Uranium Isotopes

TAL metals and Cyanide (residental well samples)
Aluminium
Antimony
Arsenic
Barium
Beryllium
Bismuth
Cadmium
Calcium
Chromium
Cobalt
Copper
Cyanide
Iron
Lead
Lithium
Magnesium
Manganese
Mercury
Molybdenum
Nickel
Potassium
Selenium
Silver
Sodium
Thallium
Tin
Vanadium
Zinc

Lanthanides
Cerium
Dysprosium
Erbium
Europium
Gadolinium
Holmium
Lanthanum
Lutetium
Neodymium
Praseodymium
Samarium
Terbium
Thulium
Ytterbium

The OU9 BRA will provide a comprehensive evaluation of the risks posed by contaminated media at Mound Plant. All media, including groundwater, air, surface water, sediments, soils, and the food chain will be evaluated in the OU9 BRA.

3.4. PRELIMINARY EVALUATION OF REMEDIAL ACTION ALTERNATIVES

A major goal of the PERAT completed by DOE (DOE 1991a) for OU5 is early identification of candidate remedial actions and the associated technology process options and of the data needs associated with those candidate technologies. At this preliminary stage, the remedial action objectives, technologies, process options, and alternatives can only be based upon the initially identified potential routes of exposure and associated receptors (Figure 1.1., Section 1). The process of developing remedial action alternatives involves a series of analytical steps making successively more specific definitions of potential remedial activities (EPA 1988a). Because these definitions are updated continually as new information becomes available from the RI process, the inability to fully complete a step due to the lack of available data does not restrict the efforts being made on remaining steps. Remedial action alternatives are developed by combining technologies and the media to which they apply into categories that address contamination on a site wide basis or for an identified operable unit. The process of developing alternatives consists of the following six steps:

1. Develop remedial action objectives.
2. Develop general response actions.
3. Identify volumes or areas of media.
4. Identify and screen remedial technologies and process options.
5. Evaluate process options.
6. Assemble alternatives.

The range of remedial alternatives that meet the ARARs and to be considered (TBC) information should include the following:

- treatment options that minimize or eliminate the need for long term management;
- treatment options that reduce toxicity, mobility, or volume of wastes;

- options involving excavation and shipment off-site;
- containment options that use little or no treatment; and,
- the no action alternative.

3.4.1. Potential Remedial Objectives for Each Contaminated Medium

Remedial action objectives are focused on protecting human health and the environment. Ideally, remedial action objectives for protecting human receptors involve consideration of the exposure route(s) in addition to the contaminant level(s) since protection may be achieved by reducing exposure (such as capping an area, limiting access, or providing an alternate water supply) as well as by reducing contaminant levels. On the other hand, protection of environmental receptors typically involves preserving or restoring a resource (e.g., groundwater) by reducing contaminant levels; therefore, remedial action objectives are expressed in terms of target clean-up levels for the medium of interest.

As shown by the conceptual site model (Figure 1.2., Section 1), the affected media in OU5 include; soil, sediment, groundwater, surface water, aquifer materials, and air. Remedial action objectives, migration pathways, and potential receptors are listed in Table III.6. for each environmental media. The air pathway will be addressed under the OU9 Site-Wide investigation. Although several sources and pathways exist for Mound Plant OU5, remediation of contaminated soils and sediments directly impacts the secondary source and effectively prevents further dispersion of contaminants. Surface water and air act mainly as pathways for dispersion of contaminated soil sources so that clean-up of the contaminated source media will immediately and substantially reduce surface water and air contamination.

3.4.2. General Response Actions

General response actions are media-specific actions based upon previous RIs and on background information that satisfy the remedial action objectives (EPA 1988a). There are six types of general response actions: no action, institutional, containment, collection, treatment and disposal actions. In the development of alternatives for the remediation of OU5, the general response actions may be combined. For example, one alternative may include institutional controls that already exist at the site, such as restricting site access, groundwater monitoring and excavation with off-site disposal of radioactively contaminated materials. Treatment alternatives include collection and disposal.

Table III.6. Mound Plant Operable Unit 5 Remedial Action Objectives

Media	Pathway	Receptor	Remedial Action Objectives
Surface Soils and Sediments	Infiltration of precipitation through contaminated surface soils contaminates deeper soils, sediments, and groundwater. Wind, surface water, plants, animals, and activities of man disperse contaminants.	The Buried Valley Aquifer is used for drinking water and for process water by Mound Plant, by the city of Miamisburg and by private homeowners. Terrestrial and aquatic biota may be affected by ingestion or direct contact.	Inhibit contaminant migration to groundwater. Reduce external gamma radiation from surface soils to acceptable levels. Prevent ingestion, inhalation or contact with soils having an excess risk from carcinogens and from non-carcinogens.
Surface Water	Stormwater runoff and surface water flow may transport contaminated soils and sediments through erosion, stream transport, and infiltration or percolation. Surface water contacting contaminated soils and sediments may dissolve hazardous or radioactive constituents.	Human, terrestrial and aquatic biota may be affected by ingestion or direct contact. Infiltration of contaminated surface water could contaminate the Buried Valley Aquifer which is used for drinking water and for process water by Mound Plant, by the city of Miamisburg and by private homeowners.	Inhibit contaminant migration to surface soils and to groundwater. Prevent ingestion, inhalation or contact with surface water having an excess risk from carcinogens and from non-carcinogens.
Bedrock System	Infiltration of contaminated surface water could contaminate bedrock materials. Flow of contaminated groundwater from the bedrock could contaminate the Buried Valley Aquifer.	The Buried Valley Aquifer is used for drinking water and for process water by Mound Plant, by the city of Miamisburg and by private homeowners. Terrestrial and aquatic biota may be affected.	Prevent ingestion of contaminated groundwater and secondary ingestion of contaminants through stock and crops. Restore groundwater source to applicable standards.
Buried Valley Aquifer Materials	Infiltration of contaminated surface water can contaminate aquifer materials.	The Buried Valley Aquifer is used for drinking water and for process water by Mound Plant, by the city of Miamisburg and by private homeowners. Terrestrial and aquatic biota may be affected.	Prevent ingestion of contaminated groundwater and secondary ingestion of contaminants through stock and crops. Restore groundwater source to applicable standards.
Groundwater	Ground coming in contact with contaminated aquifer materials can transport contamination downgradient.	The Buried Valley Aquifer is used for drinking water and for process water by Mound Plant, by the city of Miamisburg and by private homeowners.	Prevent ingestion of contaminated groundwater and secondary ingestion of contaminants through stock and crops. Restore groundwater source to applicable standards.

3.4.3. Volumes and Areas of Media

RAs, design of alternative remedial processes and selection of the appropriate remedial action(s) for each medium require information about the type of contaminant(s), contaminant concentration(s), lateral and vertical extent of contamination, and transport pathways specific to each contaminated medium. The OU5 Work Plan and the OU9, Site-Wide Work Plan give preliminary estimates of the types, surface concentrations, and lateral extent of surface radioactive contamination for OU5 AOCs. Lateral and vertical extent of contamination and concentration profiles (depths) are needed to calculate the volume and bulk concentration of these contaminated areas. Where transport/attenuation models can be used to place bounds on the extent of contamination in unsaturated and saturated soils and sediments, additional information regarding transport properties of the various contaminants (aqueous solubility, adsorption properties, volatility) and of the media (permeability, porosity, transmissivity, degree of water saturation, clay content, organic carbon content, etc.) is required. These models can be useful in interpreting and predicting the dispersion and transport of contaminants resulting from episodic releases of contaminants (such as combinations of organic solvents and radioactive metals) or from transient phenomena such as rainfall.

The development of alternatives for the OU5 AOCs is complicated by the potential existence of organic contamination that is separated or mixed with known radioactive contamination. Defining the areas or volumes of media requires careful judgement and should include a consideration of not only site conditions and the nature and extent of contamination, but also acceptable exposure levels and potential exposure routes.

3.4.4. Preliminary Identification of Potential Remedial Technologies and Associated Process Options

Remedial technologies and technology process options that satisfy the general response actions outlined above are listed in Table III.7. The remedial technology types listed are general categories of technologies, such as "chemical treatment" or "capping." Specific process options within each technology type may include a variety of technologies. For example, physiochemical methods for treating contaminated groundwater include a variety of separation processes that might be considered depending on the specific medium and contaminant(s) being treated: carbon adsorption, precipitation, ion exchange, reverse osmosis, air stripping, and radioanalysis. The applicability of the various process options for radioactive, hazardous, and mixed wastes is also presented in the table.

Table III.7. General Response Actions, Technologies, and Process Options Potentially Applicable to Mound Plant Operable Unit 5
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Environmental Media	General Response Action	Remedial Technology Type	Process Option	Waste Applicability		
				Radioactive	Hazardous	Mixed
Surface soils and sediments	No action	None	Not applicable	X	X	X
	Institutional actions	Monitoring	Groundwater and soil monitoring	X	X	X
		Restrictive access	Fencing	X	X	X
	Containment actions	Capping	Synthetic membranes	X	X	X
			Low-permeability soils	X	X	X
			Multilayer	X	X	X
			Surface sealing -soil admixtures -asphalt -concrete	X	X	X
		Vertical barriers	Slurry wall	X	X	X
		Surface controls	Storm water management -regrading -revegetation -diversion -collection ditches -sedimentation basins	X	X	X
	Collection actions	Soil excavation	Selective removal of soils to remove any remaining source contamination or hot spots	X	X	X
		Solution mining	Chemical soil washing/extraction	X	X	X
		Vapor extraction	Gas extraction wells		X	X

Table III.7. General Response Actions, Technologies, and Process Options Potentially Applicable to Mound Plant Operable Unit 5
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Environmental Media	General Response Action	Remedial Technology Type	Process Option	Waste Applicability		
				Radioactive	Hazardous	Mixed
Surface soils and sediments (cont.)	Treatment actions	In situ treatment	Biological -enhanced biodegradation		X	X
			Chemical -immobilization	X	X	X
			-detoxification		X	X
			Physical -fixation	X	X	X
			-volatilization		X	X
			Thermal -vitrification	X	X	X
			-RF heating		X	X
		On-site treatment	Biological -land farm treatment		X	X
			Chemical -soil washing/extraction	X	X	X
			-oxidation		X	X
			Physical -volatilization		X	X
			-solidification or stabilization	X	X	X
			-microencapsulation	X	X	X
			-gravimetric separation	X		X

Table III.7. General Response Actions, Technologies, and Process Options Potentially Applicable to Mound Plant Operable Unit 5
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Environmental Media	General Response Action	Remedial Technology Type	Process Option	Waste Applicability		
				Radioactive	Hazardous	Mixed
Surface soils and sediments (cont.)	Treatment Actions (cont.)	On-site treatment (cont.)	Thermal -low-temperature stripping		X	X
			-incineration		X	
			-vitrification	X	X	X
		Off-site treatment	Thermal -incineration		X	
	Disposal actions	On-site disposal -untreated soil -treated soil -treatment residuals	On-site landfill		X	
		Off-site disposal -untreated soil -treated soil -treatment residuals	Off-site landfill	X	X	X
Groundwater aquifers	No action	None	Not applicable	X	X	X
	Institutional actions	Monitoring	Groundwater monitoring	X	X	X
		Restrictive use	Access or deed restrictions	X	X	X
		Alternative water supply	Public water supply	X	X	X
			New uncontaminated wells	X	X	X
	Containment actions	Vertical barriers	Slurry wall	X	X	X
		Hydraulic barriers	Pumping wells	X	X	X

Table III.7. General Response Actions, Technologies, and Process Options Potentially Applicable to Mound Plant Operable Unit 5
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Environmental Media	General Response Action	Remedial Technology Type	Process Option	Waste Applicability		
				Radioactive	Hazardous	Mixed
Groundwater aquifers (cont.)	Collection actions	Groundwater extraction	Pumping wells -deep wells	X	X	X
			-ejector wells	X	X	X
			Well points	X	X	X
			Subsurface drains	X	X	X
		Vapor extraction	Gas extraction wells		X	X
	Treatment actions	In situ treatment	Biological -enhanced biodegradation	X	X	X
			Chemical -groundwater pretreatment	X	X	X
			-immobilization	X	X	X
			-detoxification		X	X
			Physical -fixation	X	X	X
		On-site treatment	Biological -conventional methods	X	X	X
			Chemical -oxidation		X	X
			-reduction		X	X
			-neutralization		X	X
			-ultraviolet photolysis w/ozone		X	X

Table III.7. General Response Actions, Technologies, and Process Options Potentially Applicable to Mound Plant Operable Unit 5
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Environmental Media	General Response Action	Remedial Technology Type	Process Option	Waste Applicability		
				Radioactive	Hazardous	Mixed
Groundwater aquifers (cont.)	Treatment Actions (cont.)	On-site treatment (cont.)	Physical -filtration	X	X	X
			-gravimetric separation	X	X	X
			-sedimentation	X	X	X
			-evaporation	X	X	X
			Thermal -vapor recompression or distillation	X	X	X
			-incineration	X	X	X
			-wet or supercritical oxidation		X	
			Physiochemical -carbon adsorption		X	X
			-precipitation or flocculation	X	X	X
			-coagulation	X	X	X
			-ion exchange	X	X	X
			-reverse osmosis	X	X	X
			-air stripping		X	X
			-high-energy radiolysis		X	X
		Off-site treatment	Publicly owned treatment works(POTW)	X[a]	X	
		Point-of-use treatment	Physical/chemical treatment		X	

Table III.7. General Response Actions, Technologies, and Process Options Potentially Applicable to Mound Plant Operable Unit 5
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Environmental Media	General Response Action	Remedial Technology Type	Process Option	Waste Applicability		
				Radioactive	Hazardous	Mixed
Groundwater aquifers (cont.)	Disposal actions	On-site disposal				
		-untreated water	Evaporation pond	X	X	X
		-treated water	On-site treatment plant	X	X	X
			Evaporation pond	X	X	X
		-treatment residuals	On-site landfill			
		Off-site disposal				
		-treated water	POTW	X	X	X
			Miami River	X	X	X
		-treatment residuals	Off-site landfill	X	X	X

Evaluation of technologies and process options will continue to be refined as additional data are collected concerning the nature and extent of contamination and exposure pathways. The various technologies will be considered, alone or in combination, in relation to specific aspects of contamination at the Mound Plant OU5.

3.4.5. Evaluation of Process Options

The fifth step of alternative development is the detailed evaluation of process options to focus on the most promising options for each medium. This simplifies the subsequent development and evaluation of alternatives without limiting flexibility during remedial design. Process options are evaluated using the same criteria (effectiveness, implementability and cost) that are used to screen alternatives prior to the detailed analysis. An important distinction is that these criteria are presently applied only to technologies and the general response action they are intended to satisfy and not to the site as a whole. Furthermore, the evaluation should focus on effectiveness factors at this stage with less effort directed at the implementability and cost evaluation. The evaluation of each criteria is further described as follows:

- effectiveness will rely more on how proven and reliable the process option is than on its ability to handle the estimated volumes of media;
- implementability includes both technical and administrative feasibility of implementing a process option; and,
- cost analysis is performed on the basis of engineering judgement and each process option is evaluated according to whether costs are high, medium, or low relative to other process options in the same technology type.

As stated in the FFA, implementation of this step will be performed as part of the FS.

3.4.6. Assembly of Broadly Defined Alternatives

To assemble alternatives, general response actions should be combined using different technology types, different volumes of media, different waste types, and different areas of the site. Often, more than one general response action is applied to each medium. For example, alternatives for remediating surface soils will depend on the type and distribution of contaminants and may include treatment of soil from some OUs and capping of others.

The assembly of alternatives is most affected by the following:

- the range of remedial alternatives required by the FFA;
- the media of concern; and,
- the type of waste.

Given these considerations, a list of broadly defined alternatives is given in Table III.8. The alternatives are segregated primarily by media with technical considerations listed by waste type. As required by the FFA, each medium contains the no action and institutional (limited action) remedial action alternatives in addition to containment options with and without treatment and/or disposal. This required information is one step in the goal of fulfilling the information needs to comply with the NEPA as the RI/FS process is followed.

3.5. APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The FFA between the DOE and the EPA requires the determination of ARARs and describes the process for ARAR determination, including a meeting of the DOE and the EPA remedial project managers. Although the following is not a final ARAR determination, it is presented because potential ARARs affect the rationale for field sampling.

The DOE must generally comply with all provisions of federal environmental statutes and regulations, as well as applicable state and local requirements. The DOE is acting under the authority and in compliance with CERCLA. Therefore, any further action required under CERCLA would require DOE to comply with all ARARs.

The National Contingency Plan (NCP) (Section 300.5) defines "applicable requirements" as:

> "...those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

The NCP also defines "relevant and appropriate requirements" as:

> "... those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address

Table III.8. Mound Plant Operable Unit 5 Broadly Defined Remedial Action Alternatives
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Environmental Media	Alternative Number	Remedial Action Alternative	Remedial Technology Considerations by Waste Type		
			Radioactive	Hazardous	Mixed
Surface Soils and Sediments	1a	No action	None	None	None
	1b	Institutional (limited)	Monitoring and restricted access	Monitoring and restricting access	Monitoring and restricting access
	1c	Containment w/institutional controls	Integrated cap and slurry wall applicable to a deeply contaminated unit and not to widely dispersal hot spots	Integrated cap and slurry wall applicable to a deeply contaminated unit and not to widely dispersed hot spots	Integrated cap and slurry wall applicable to a deeply contaminated unit and not to widely dispersed hot spots
	1d	Containment, in situ treatment w/institutional controls	Applicable to a deeply contaminated unit and not to widely dispersed hot spots. Only process options that immobilize or fixate are applicable. Due to incomplete reliability containment is still required.	Applicable to a deeply contaminated unit and not to widely dispersed hot spots. More process options are applicable for organics than metals. Due to incomplete reliability containment is still required.	Applicable to a deeply contaminated unit and not to widely dispersed hot spots. Perform process options applicable only to hazardous organics before immobilization or fixation options. Due to incomplete reliability containment is still required.
	1e	Collection, on-site disposal, containment w/institutional controls	Not applicable. No on-site disposal of radioactive wastes	Useful to consolidate materials but on-site disposal probably not allowed without further treatment	Not applicable. No on-site disposal of radioactive wastes
	1f	Collection, on/off-site treatment, on/off-site disposal, w/institutional controls	Useful to consolidate materials, most likely treatment is waste minimization with off-site disposal. On-site disposal of radioactive waste not allowed	Useful to consolidate materials, most likely treatment is organic waste destruction and on-site disposal	Useful to consolidate materials. Preferred treatment is first organic waste destruction and then minimize volume of remaining radioactive waste. On-site disposal of radioactive waste is not allowed

Table III.8. Mound Plant Operable Unit 5 Broadly Defined Remedial Action Alternatives
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Environmental Media	Alternative Number	Remedial Action Alternative	Remedial Technology Considerations by Waste Type		
			Radioactive	Hazardous	Mixed
Groundwater Aquifers	2a	No action	None	None	None
	2b	Institutional (limited)	Monitoring and restricting access	Monitoring and restricting access	Monitoring and restricting access
	2c	Containment w/institutional controls	Slurry wall is applicable if continued surface water infiltration is eliminated. Additional treatment is preferable	Slurry wall is applicable if continued surface water infiltration is eliminated. Additional treatment is preferable	Slurry wall is applicable if continued surface water infiltration is eliminated. Additional treatment is preferable
	2d	Collection, in situ/on-site treatment, on/off-site disposal w/institutional controls	Most likely treatment will be on-site waste minimization with off-site disposal of waste residue. On-site disposal of radioactive waste not allowed.	Some in situ treatments require collection and reinjection. Both on-site and in situ treatments may be performed simultaneously. Destruction of organic waste is preferred	Preferred treatment is first organic waste destruction and then minimize volume of remaining radioactive waste with off-site disposal of waste residue. On-site disposal probably not allowed

problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent that federal requirements may be relevant and appropriate."

There is more flexibility and discretion in making relevant and appropriate determinations than in determining the applicability of a requirement. Only those requirements that are both relevant and appropriate are ARARs. A requirement may be relevant, but not appropriate, because of the site circumstances. Such a requirement would not be considered an ARAR. Relevant and appropriate requirements are intended to carry the same weight as applicable requirements. Examples of federal statutes specifically cited in CERCLA from which requirements may apply include the TSCA, Safe Drinking Water Act (SDWA), CAA, and CWA.

In the absence of federal- or state-promulgated regulations, there are many nonpromulgated criteria, advisories, guidance values, and proposed standards that, while not legally binding, may serve as useful guidelines for setting protective clean-up levels. These are not potential ARARs, but are classified as TBC by EPA; their use is discretionary. In general, TBCs are not formally promulgated criteria or standards and are developed, using best professional judgement, on the basis of the latest available information.

3.5.1. Type of ARARs

There are, in general, three different types of ARARs, although some requirements do not fit neatly into these categories. These are:

- chemical-specific requirements;
- location-specific requirements; and,
- action-specific requirements.

Ambient or chemical-specific ARARs are usually health- or risk-based numerical values or methodologies that establish acceptable concentrations of chemicals or discharge limits for particular chemicals; for example, MCLs that establish safe levels in drinking water (EPA 1989b). Only a limited number of this type of ARAR has been promulgated.

The results of an RA are used in establishing clean-up goals that are health-based. The total carcinogenic risk or hazard index for all chemicals of concern in a medium is calculated in this RA. As a starting point for setting clean-up goals, the risk calculations are developed using chemical-specific requirements. If

there are no chemical-specific ARARs, then specified federal or state TBC values are used in the calculations.

Initially, during the RI work plan stage, chemical-specific ARARs may be identified based on a limited amount of data. At this point, chemical-specific ARARs have meaning only in that they may be used to establish appropriate detection limits, so that data collected will be amenable for comparison to ARAR standards. These proposed chemical-specific ARARs are not necessarily representative of the final ARARs that will ultimately define clean-up standards.

Location-specific ARARs are restrictions placed on the concentrations of hazardous substances or the conduct of activities solely because they occur in special locations. Examples of areas regulated under various federal laws include floodplains, wetlands, and locations where endangered species or historically significant cultural resources are present. Location-specific ARARs have been identified so that information may be gathered to determine if restrictions have been placed on the concentration of hazardous substances or on the conduct of an activity solely because it occurs in a special location.

Action-specific ARARs are usually technology-based requirements or limitations on actions taken with respect to waste management and site clean-up. Examples include the RCRA Subtitle C requirements for hazardous waste management and the land disposal restrictions. Action-specific ARARs are usually identified during or just prior to the detailed analysis of alternatives.

3.5.2. Regulatory Authority for ARARS of Operable Unit 5

In accordance with current EPA guidance, ARARs are to be progressively developed and applied as information concerning a given site becomes available. The initial step in the process entails the listing of all potential ARARs for the remedial actions proposed at the subject site. A comprehensive listing of potential ARARs for all of the operable units for the Mound Plant was completed as part of the OU9, Site-Wide Work Plan (DOE 1992a).

The following sections present a review of potential ARARs that may be applied to OU5. These ARARs are not all-inclusive, but they do present the federal and state requirements that may be considered as ARARs. This list of potential ARARs will be modified and refined as additional information concerning OU5 is obtained.

Regulation of exposures to ionizing radiation in the United States is primarily the responsibility of the EPA. The United States Nuclear Regulatory Commission (NRC) is responsible for regulating commercial users of radioactive materials in a manner that assures that the limits imposed by the EPA are not exceeded. Similarly, DOE is responsible for establishing policies and procedures to ensure compliance with EPA limits at DOE facilities. It should be noted that DOE orders are not promulgated requirements and fall under the category of TBCs; however, compliance with them is fundamental at Mound Plant.

3.5.3. Preliminary Remediation Goals

PRGs are initial remedial action objectives that are designed to be protective of human health and the environment and comply with ARARs [RAGs, Part B (EPA 1989a)]. ARARs themselves are set to be protective of human health and the environment, and can serve as initial PRGs. As more information is gathered, PRGs are expected to be modified and refined. Initial PRGs for OU5 will be the detection limits developed in the OU9, Site-Wide Work Plan (DOE 1992a). The detection limits represent the smallest concentration of a contaminant that can be detected, and as PRGs are very conservative. CERCLA Section 121 also specifically requires attainment of ARARs, and that remedies selected be protective of human health and the environment. In order to attain all ARARs, a remedial action must comply with the most stringent requirement, which then ensures attainment of all other ARARs (55 FR 8741).

3.5.4. Chemical-Specific ARARs For Operable Unit 5

A potential list of contaminants of concern has been developed for OU5 and is part of the OU5 QAPjP. These lists and the results of analyses carried out during site characterization have provided the information needed to prepare the preliminary - Phase I SAPs on an AOC-specific basis. The AOC-specific SAPs describe any specific analytical requirements not identified in this work plan or the OU5 QAPjP. In this case, where new analytical requirements are determined from Phase I information, a QAPjP addendum will be written to provide the accompanying quality assurance information. Using the OU9 list of potential contaminants, lists of potential chemical/radionuclide-specific ARARs have been prepared based upon three different types of media: surface water, groundwater, and soils/sediment. These potential chemical/radionuclide-specific ARARs/TBCs are presented in the OU9, Site-Wide Work Plan, Tables XVI.1. through XVI.6.

3.5.4.1. Operable Unit 5 Surface Water ARARs/TBCs

OU5 surface water activities are limited to standing water found in AOCs at the time of soil sampling and are included in samples for completeness. These waters are of very limited extent and do not lead to other

surface water areas. The list of potential chemical-specific ARARs/TBCs for surface water was developed by examining the following proposed and promulgated standards:

- SDWA MCLs;
- CWA Ambient Water Quality Criteria;
- EPA Health Advisories (EPA 1990c); and,
- Ohio Administrative Code Title 3745-1-21 (OEPA 1990).

As previously discussed, SDWA MCLs are used for drinking water sources. Since surface water in the Great Miami River is a potential source of drinking water, they were included as potential surface water ARARs/TBCs. In addition, the RCRA 40 Code of Federal Regulations (CFR) 264 Subpart S water standards have also been identified as potential ARARs/TBCs. Groundwater MCLs will be considered as potential ARARs for the groundwater investigation as groundwater is located beneath OU5 in the bedrock and BVA.

CERCLA Section 121 states that "hazardous substances, pollutants, or contaminants left on-site at the conclusion of the remedial action shall attain federal water quality criteria where they are relevant and appropriate under the circumstances of the release or threatened release" (EPA 1989a). CERCLA Section 121(d)(2)(B)(i) requires that this determination is to be based on the designated or potential use of the water, the media affected, the purposes of the criteria, and current information.

To determine if water quality criteria are relevant and appropriate depends on the use or uses designated by the state of Ohio, based on existing and attainable uses and whether the water quality criteria are intended to be protective of those uses. Water quality criteria for protection of human health identify protective levels from two routes of exposure: exposure from drinking the water and consuming aquatic organisms (primarily fish) and exposure from fish consumption alone. OU9, Site-Wide Work Plan Table XVI.1. presents the federal water quality criteria for the potential contaminants of concern in OU5. Ohio EPA adopted new water quality standards effective May 1990, and these are included as potential ARARs (OEPA 1990). The new standards were completed as part of Ohio's triennial review process required by the EPA under the CWA. In addition, Ohio EPA is planning to review water quality for nine river basins, including the Great Miami River. Selected streams within these river basins will be reviewed based on stream use designations. Any information resulting from this review will be added to these tables as potential ARARs.

The last set of standards that were included in OU9, Site-Wide Work Plan ARARs Tables as TBCs were federal Health Effects Advisories (HEAs) (EPA 1990c). Although these advisories are not legally binding standards, and may not be fully current, they may provide the best available standard for chemical protection for which no binding standard exists. HEAs provide information on the health effects, analytical methods, and treatment technology useful for dealing with drinking water contamination. HEAs describe nonregulatory concentrations of drinking water contaminants at which adverse health effects would not be anticipated to occur over specific exposure durations. As additional information is compiled on OU5, the HEAs should be evaluated using the procedures outlined in the Superfund Public Health Evaluation Manual; and if the standard is necessary to achieve a protective remedy, it should be used.

Additional chemical-specific ARARs/TBCs may also include NRC Regulations (10 CFR Section 20) and DOE Order 5400.5.

3.5.4.2. Operable Unit 5 Soil ARARs/TBCs

One medium for which chemical-specific ARARs do not currently exist is soils; however, EPA's proposed requirements under RCRA for corrective action levels have been included as a potential TBC. In addition, as the RI/FS proceeds, information may become available to perform a BRA which would allow a determination of acceptable contaminant concentrations in the soils to ensure environmental "protectiveness." Potential chemical-specific ARARs and TBCs include:

- Uranium Mill Tailings Radiation Control Act (40 CFR 192);
- RCRA (40 CFR sections 286, 261.2, 261 Appendix 11, and 240-257);
- Occupational Safety and Health Act (OSHA);
- TSCA;
- NRC Regulations; and,
- DOE Orders, as applicable (see subsection 3.5.7).

3.5.5. Location-Specific ARARs

A site's location is a fundamental determinant of its impact on human health and the environment. The following is a list of location-specific requirements, established under several statutes, that are potential ARARs.

- RCRA
  Fault zone
  Floodplain
  Salt dome formation

- National Historic Preservation Act
- Endangered Species Act
- CWA
  Wetlands
- Wilderness Act
- Fish and Wildlife Coordination Act
- Coastal Zone Management Act
- National Ambient Air Quality Standards (NAAQS)

Based upon existing background information at Mound Plant, this list of potential ARARs has been reviewed to develop Mound Plant site-specific tables of potential ARARs, OU9, Site-Wide Work Plan Tables XVI.3. and XVI.4. At present, these tables contain requirements established under a number of different federal and state environmental statutes. As additional information becomes available on OU5, these tables will be revised to eliminate action criteria as ARARs; or, as additional requirements are identified, these tables will be expanded to include these new location-specific requirements.

3.5.6. Performance, Design, or Other Action-Specific ARARs/TBCs for Operable Unit 5

Performance, design, or other action-specific requirements set controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes. These ARARs are listed in OU9, Site-Wide Work Plan Tables XVI.5. and XVI.6.

3.5.7. DOE Orders

Compliance with DOE Orders is a requirement for DOE internal organizations, and compliance is a contractual requirement for contractors. Table III.9. lists the historical and current DOE Orders commonly used at Mound Plant. The requirements stated in the Orders come from a number of sources and together form a set of management guidance and technical directives to be used under a broad set of situations. DOE Orders, although not promulgated at the same level as federal regulations, pass on and provide for the implementation of a wide range of federal regulations. As examples, work was historically done in accordance with DOE Order 5480.2 "Hazardous and Radioactive Mixed Waste Management," which responded to 40 CFR 116, 261, and 761 and DOE Order 8480.14, which responded to 40 CFR 300 Appendix A and Public Law 96 - 510. DOE Order 5480.2 has been superseded by 5400.3, and DOE

Table III.9. DOE and DOE/AL Orders
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Number	Title	Date of Current Order	Status
DOE 1324.2A	Records Disposition	09/13/88	Current
DOE 1332.1A	Uniform Reporting System	10/15/85	Current
DOE 2250.1C	Cost and Schedule Control Systems Criteria (CSCSC)	12/21/88	Current
DOE 4010.1	Value Engineering	02/17/89	Current
DOE 4240.1J	Designation of Major System Acquisitions and Major Projects	03/18/91	Current
DOE 4300.1B	Real Property and Site Development Planning	07/01/87	Current
DOE 4300.2A	Non-DOE Funded Work	12/19/86	Current
DOE 4320.1B	Site Development Planning	01/07/91	Current
DOE 4330.2C	In-House Energy Management	03/23/88	Current
DOE 4700.1	Project Management System	03/06/87	Current
DOE 5000.3A	Occurrence Reporting and Processing of Operations Information	05/30/90	Current
DOE 5100.3	Field Budget Process	08/23/84	Current
DOE 5400.5	Radiation Protection of the Public and the Environment	02/08/90	Current
DOE 5440.1D	NEPA	02/22/91	Current
DOE 5480.10	Contractor Industrial Hygiene Program	06/25/85	Current
DOE 5480.11	Radiation Protection for Occupational Workers	12/21/88	Current
DOE 5480.1B	Environment, Safety, and Health (ES&H) Program for DOE Operations	09/21/86	Current
DOE 5480.2	Hazardous and Radioactive Mixed Waste Management	12/13/82	Replaced by 5400.3
DOE 5400.3	Hazardous and Radioactive Mixed Waste Program	02/22/89	Current
DOE 5480.4	Environment Protection Safety and Health Protection Standards	08/20/91	Current
DOE 5480.3	Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and for Hazardous Work	07/09/85	Current
DOE 5480.5	Safety of Nuclear-Facilities	09/23/88	Current
DOE 5480.6	Safety of DOE-Owned Nuclear Reactors	09/23/86	Current
DOE 5480.7	Fire Protection	11/16/87	Current
DOE 5480.14	CERCLA Requirements	04/26/85	Replaced by 5400.4

Table III.9. DOE and DOE/AL Orders
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Number	Title	Date of Current Order	Status
DOE 5400.4	CERCLA Requirements	10/06/89	Current
DOE 5480.9	Construction Safety and Health Program	11/18/87	Current
DOE 5480.19	Conduct of Operations Requirements for DOE Facilities	07/09/90	Current
DOE 5481.1B	Safety Analysis and Review System	09/23/86	Current
DOE 5483.1A	Occupational Safety and Health Program for Government-Owned, Contractor-Operated Facilities	06/20/83	Current
DOE 5484.1	Environmental Protection, Safety and Health Protection Information Reporting Requirements	02/24/81	Current
DOE 5560.1A	Priorities and Allocations Programs	05/08/85	Current
DOE 5700.2C	Cost Estimating, Analysis and Standardization	11/02/84	Current
DOE 5700.6B	Quality Assurance	09/23/86	Replaced by 5700.6C
DOE 5700.6C	Quality Assurance	08/21/91	Current
DOE 6430.1A	General Design Criteria Manual	04/06/89	Rescinded
AL 1324.2	Records Disposition	05/10/84	Rescinded
AL 1330.2B	Uniform Contractor Reporting System	03/02/83	Rescinded
AL 2250.1C	CSCSC for Contract Performance Measurement	07/07/89	Rescinded
AL 4010.1	Value Engineering	02/20/90	Rescinded
AL 4300.1B	Real Estate Management	07/30/90	Rescinded
AL 4320.1	Site Development and Facility Utilization Planning	05/17/82	Rescinded
AL 4330.2C	AL Energy Management Program	09/13/88	Rescinded
AL 4700.1	AL Project Management System	07/02/90	Rescinded
AL 5440.1B	Implementation of the NEPA	11/12/82	Rescinded
AL 5480.1A CHP.XI	Requirements for Radiation Protection	02/19/87	Rescinded
AL 5480.1B	ES&H Program for AL Operations	07/29/88	Rescinded
AL 5480.4	ES&H Production Standards	07/29/88	Rescinded
AL 5480.5	Safety of Nuclear Facilities	07/17/87	Rescinded
AL 5480.6	Safety of DOE-Owned Reactors	04/17/87	Rescinded
AL 5480.9	Construction Safety and Health Program	01/26/89	Rescinded
AL 5481.1B	Safety Analysis and Review System	01/27/88	Rescinded
AL 5482.1A	AL ES&H Appraisal Program	04/30/84	Rescinded

Table III.9. DOE and DOE/AL Orders
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Number	Title	Date of Current Order	Status
AL 5483.1A	Occupational Safety and Health Program for Government-Owned, Contractor-Operated Facilities	10/19/84	Rescinded
AL 5700.2C	Independent Cost Estimating and Cost Standardization	07/08/88	Rescinded
AL 5700.6B REV.2	General Operations Quality Assurance	07/07/89	Rescinded
AL 5820.2A	Radioactive Waste Management	09/26/88	Rescinded
AL 5484.1	ES&H Protection Information Reporting Requirement	02/24/81	Rescinded
AL 5482.1B	ES&H Protection Appraisal Program	09/23/85	Rescinded
AL 5000.3	Unusual Occurrence Reporting System	11/02/84	Rescinded
AL 5481.1B	Safety Analysis and Review System	09/23/86	Rescinded
AL 5480.11	Radiation Protection for Occupational Workers	12/21/86	Rescinded
AL 5400.5	Radiation Protection for Public and Environment	02/08/90	Rescinded

Order 5480.14 has been superseded by 5400.4. When additional information or interpretation is needed or where local issues arise, DOE operations offices may issue local level orders for use in their activities. DOE takes the option of developing and using stronger requirements than those promulgated by other organizations.

4. WORK PLAN RATIONALE

The OU5 Work Plan rationale presented in this section will address three specific questions, identify the data needs to support those questions, and develop the sampling program necessary to fill the data needs. The ultimate goal of this OU5 Work Plan under CERCLA is a ROD approved by the regulators and public. The ROD will identify a remedial alternative that is protective of human health and the environment. The three specific questions addressed in this OU5 Work Plan are the following:

- Are the identified AOCs in OU5 contaminated?
- Are other areas in OU5 not presently identified as AOCs (denoted non-AOCs) contaminated?
- What remedial action will be taken if any OU5 area is contaminated?

To accomplish the data collection goals, the RI and FS objectives supporting these three questions are developed. All available physical site and contaminant information is assembled and DQOs are developed. The DQOs allow the available data to be reviewed for data needs (completeness) by establishing the following:

- Contaminants of Concern (COC);
  (What contaminant is being investigated?)
- Level of Concern for a specific contaminant;
  (Above what concentration is the AOC considered contaminated?)
- Prioritized Data Use(s); and,
  (Describe how the collected data will be used to support objective(s).)
- Critical Samples.
  (What samples are needed to fill any known data gaps including: sample types, depth, location, and quantity?)

In addition, the DQOs establish the appropriate analytical and detection limits to assure the precision of results. The generation of specific DQOs allows for the testing of each hypothesis used in the decision-making process when developing the conceptual site model (Figure 1.2., Section 1). As data is collected and analyzed, each assumption will be reviewed and changed as appropriate. This method will allow the most probable model prior to entering the FS and remedial design stages of the clean-up.

The following sections will review existing data and identify any gaps in the necessary data required to support each question addressed by this OU5 Work Plan.

4.1. DATA NEEDED FOR DETERMINATION OF CONTAMINATION IN AOCs

Based on a review of available information presented in Section 2. Physical Setting, and Section 3. Initial Evaluation, the following subsections identify the data needed to determine if any identified AOC is contaminated. Each defined supporting objective is discussed and evaluated against the available data with needed data identified. The supporting objectives consist of the following:

1. Determination of contaminant type and concentration (nature); and,
2. Support of the RA by determination of the mechanics of the source/pathway interface and development of clean-up goals in conjunction with ARARs/TBCs by investigation of:

   - Distribution of contaminants (extent); and,
   - Specific concentration of OU5-defined COCs for each media.

4.1.1. Contaminant Type and Concentration (Nature)

The initial supporting objective in determining if an AOC is contaminated is to evaluate the area for radiological and non-radiological constituents. To focus this search from all possible constituents to a subset that would be expected at Mound Plant, the list of COCs from the OU9, Site-Wide Work Plan (DOE 1992a) will be used. This list will be screened for the contaminants applicable to OU5 AOC's.

Preliminary work has been done in the identified AOCs of OU5, as discussed in Section 3. Ongoing research into Mound Plant history and waste management practices continues to refine the current knowledge database regarding possible contamination within OU5. Data obtained prior to the FFA was not collected using an EPA-approved sampling and analysis plan and will be used as scoping information only. The site characterization and remediation is now regulated with guidance from the CERCLA program. The DQOs used in the earlier studies were insufficient to meet the scope and objectives defined for this new program. As such, there is information available regarding specific radioactive contamination within some OU5 soils (Section 3) and limited data regarding chemical contamination in soils, surface water, sediments, and groundwater. Appendix A contains an accumulation of data from historical reports that may impact OU5 AOCs. The OU9, Preliminary Risk Analysis (September 1992) has site-wide chemical results. Several areas were addressed that are now within the geographic boundaries of OU5. Both OU6 and OU3 analytical results (chemical and radiological) can be used to scope portions of OU5.

The Plates in Appendix A are representative of this approach. Based on the limited amount of available data, a complete characterization of the nature and extent of contamination within OU5 can only be accomplished after additional data is generated.

A major unknown in OU5 continues to be the type of radiological and chemical (non-radiological) contamination present in each area. For example, it is not known whether mixed wastes or chemical compounds derived from explosives are present in some areas. Historical data indicate the use of organic solvents, oils, and other chemical materials in some processes. It is possible that these chemicals, or that materials contaminated with these chemicals, were disposed of in OU5.

The AOCs where landfilling of debris has occurred (Areas 7, 22, and J) should contain the greatest diversity of contaminants. Area 3 will also be included in this group due to the diversity of contaminants historically present in this staging area. The Phase 2 sampling in these areas will consist of analysis for the laboratory parameters as specified in the DQOs presented in this section and the quality objectives of the OU5 QAPjP. The samples will also be analyzed for RCRA listed and/or characteristic waste. Locations to be sampled under Phase 2 activities will be specified by the Phase 1, Reconnaissance survey results. After statistical analysis of contaminant distributions (or non-distribution in OU5) is complete, a selected subset of the complete OU9 COC list will be used for subsequent investigations in other OU5 AOCs.

Each contaminant will be analyzed to the appropriate analytical level specified in the OU5 Work Plan DQOs and the quality objectives of the OU5 QAPjP. This level is the preliminary concentration that is protective of human health and the environment mandated by regulations or orders, or as a risk-based estimate of such concentration when no ARAR or TBC is available.

4.1.2. Risk Assessment Support

To support the RA, the OU5 field work will need to determine the chemical nature and extent of contamination at each AOC. Chemical nature is identified by characterizing the type of contamination and the contaminant concentration (the most important variable for assessment purposes) of each OU5 COC in each media of concern. Extent is used to determine the quantity of contamination and also to show pathways by which migration has or can happen. For OU5, the media of concern include soil, sediments, surface water, and groundwater (if contamination is found in the groundwater).

Additional input information for the OU5 RA can be supplied from activities in the other OUs. For example: the OU9 investigation will provide background levels and OU1 may provide some ground or surface water

contaminant transport data. These inputs, and that derived from the OU5 RI work, will be used to support the OU9 site-wide BRA and the OU5-specific RA to evaluate remedial action alternatives.

4.1.2.1. Determination of Distribution of Contamination (Extent)

Distribution (extent) of contamination is determined by first locating the contamination. After the location of the "hot spot" is known, subsequent sampling is done to create a concentration map of the contamination. Phase 2 of the work may provide sufficient information to make this determination for some AOCs.

However, it is more likely that an additional sampling round (Phase 3) will be required to locate the outer ring of lower contamination concentrations needed to calculate the anticipated extent. After analysis is complete for a given AOC, the results are analyzed statistically to determine if the concentration gradients are sufficient to postulate the boundaries. Both vertical and horizontal components are reviewed to insure the quantity of contamination can be calculated with a certain level of confidence.

4.1.2.2. Determination of Specific Concentration of OU5 COCs For Each Media

As a continuation of the process of finding the COCs, as subsection 4.1. describes, this process must be done for each media of concern. This need is due to the inputs required for the OU5 specific RA where media-specific routes of contact (pathways and exposure routes) and media specific receptors can cause significant impacts on the risk calculation. A similar program, as described above, for contaminant(s) location and then extent determination is required on a media by media basis. The following subsections briefly describe the medias of concern and a historical perspective of existing data.

Surface Soils/Subsurface Soils and Bedrock

Within OU5, little data are available for the identified AOCs (Section 3). For the identified AOCs, surface and subsurface soil sampling will be performed as outlined in Section 4.4. of this Work Plan and the FSP. Prior to initiating any soil borings in suspected or historic burial areas, geophysical surveys will be conducted to better define near-surface and subsurface drilling hazards (e.g., buried metal). The samples will identify any chemical and radionuclide contaminant that may be present. The samples will be analyzed for contaminant type and specific concentration based on the OU5-defined COC parameter list. The resultant data will be used to determine contaminant distribution, if any, and the determination of the ability to meet the defined clean-up goals. The specific DQOs for contaminant characterization are summarized in tabular form for Surface Soils (Table IV.1.) and Subsurface Soils and Bedrock (Table IV.2.).

Table IV.1. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterization
Surface Soils
page 1 of 2

Objectives	• Determination of contaminant type and concentration (nature) • Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs by determination of: - Distribution of contaminants (extent), and - Specific concentration of OU5-defined COCs for each media • Characterize contaminant properties to support the engineering data required for the FS evaluation of alternatives
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine the horizontal surface area affected by the identified contaminants within the OU5 AOCs; 3. Determine how concentrated the identified contaminants are within the OU5 surface soils; 4. Refine the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in the surface pathway fate and transport modeling for BRA and FS alternative evaluation RAs; and 6. Provide sufficient FS engineering data for development and screening of remedial action alternatives (e.g., appropriateness of a specific treatability technology and waste volumes to be treated).

Table IV.I. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterization
Surface Soils
page 2 of 2

Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Gamma soil screening		I	2 and 5
	- HNu soil screening		I	2 and 5
		- VOCs	IV	1 through 6
		- SVOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Lithium	IV	1 through 6
		- Molybdenum	IV	1 through 6
		- Fluoride	IV	1 through 6
		- USATHAMA explosives	V	1 through 6
		- Nitrate/nitrite	IV	1 through 6
		- Chloride	IV	1 through 6
		- Sulfate	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Actinium-227	V	1 through 6
		- Strontium-90	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- tritium	V	1 through 6
		- total organic carbon	III	1 through 6
		- SVOCs and VOCs using Petrex Samplers	II	(partially) 1,2,4
Constituents of Concern	Until the OU5-specific COC list is developed after Phase II remedial investigation efforts, the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits. During the Phase I field sampling program, any sampling point exceeding the lower detection limits of the FIDLER, or HNu (as specified in the FSP), the petrex tube analysis will constitute a level of concern.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No specific sample location has been determined to be a critical sample. However, the specified sample locations are required as part of an overall Phase I program to meet the reconnaissance objectives. - Phase II: The critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs: Indeterminant.			

Table IV.2. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterization
Subsurface Soils and Bedrock
page 1 of 2

Objectives	• Determination of contaminant type and concentration (nature) • Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs by determination of: - Distribution of contaminants (extent), and - Specific concentration of OU5-defined COCs for each media • Characterize contaminant properties to support the engineering data required for the feasibility study evaluation of alternatives
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine how far the identified contaminants have spread within the OU5 subsurface soils and bedrock; 3. Determine how concentrated the identified contaminants are within the OU5 subsurface soils and bedrock; 4. Refine the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in the subsurface pathway fate and transport modeling for BRA and FS alternative evaluation RAs; and 6. Provide sufficient FS engineering data for development and screening of remedial action alternatives (e.g., appropriateness of a specific treatability technology and waste volumes to be treated).

Table IV.2. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Subsurface Soils and Bedrock
page 2 of 2

Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Gamma soil screening		I	2 and 5
	- HNu soil screening		I	2 and 5
		- VOCs	IV	1 through 6
		- SVOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- USATHAMA explosives	V	1 through 6
		- Nitrate/nitrite	IV	1 through 6
		- Chloride	IV	1 through 6
		- Sulfate	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Actinium-227	V	1 through 6
		- Strontium-90	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- tritium	V	1 through 6
		- total organic carbon	III	1 through 6
		- SVOCs and VOCs using Petrex Samplers	III	(partially) 1,2,4
Constituents of Concern	Until the OU5-specific COC list is developed after Phase II remedial investigation efforts, the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits. During the Phase I field sampling program, any sampling point exceeding the lower detection limits of the FIDLER, HNu (as specified in the FSP), or the petrex tube analysis will constitute a level of concern.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No specific sample location has been determined to be a critical sample. However, the specified sample locations are required as part of an overall Phase I program to meet the reconnaissance objectives. - Phase II: The critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs Indeterminant.			

Groundwater/Surface Water and Sediments

The OU9, Site-Wide Work Plan (DOE 1992a) activities will conduct regional background sampling and integrate all groundwater investigations for Mound Plant to provide a regional picture of the hydrogeology and the impact of Mound Plant on this system. Some of the OU5 AOCs are probably hydraulically linked to the BVA (e.g., Area 3 and Area 7) and thus are potential contributors to any contaminant migration. The distribution of existing OU9, Site-Wide Work Plan (DOE 1992a) groundwater monitoring locations suggest that water quality data from these locations, combined with information from soil borings, will be sufficient to determine whether the AOC is contributing to groundwater contamination.

However, if groundwater is encountered during an AOC soils investigation, OU5 will sample the groundwater. The groundwater will be analyzed for contaminant type and specific concentration based on the OU9 groundwater analytical parameters list and the OU5-defined COC list. In conjunction with the soils, the resultant data will be used to determine the contaminant distribution, if any, and directly support the determination whether defined clean-up goals are met. Specific DQOs are summarized for contaminant characterization in Groundwater in Table IV.3. In addition, a similar table was prepared for Surface Water and Sediments should these media be encountered in an identified AOC (Table IV.4.).

Air

Airborne contamination will be addressed by OU9 in conjunction with the OU5 soils analysis. Available monitoring and meteorological data will be used to model potential airborne exposures and to determine the ability of the AOC to meet the defined clean-up goals.

4.2. DATA NEEDED FOR DETERMINATION OF CONTAMINATION IN NON-AOC AREAS

The same two supporting objectives as delineated for existing AOC investigations are needed for the non-AOC areas. One preliminary step is needed, which is to locate any "hot spot" within the land boundaries. This initial step is described below with a brief lead-in for following the same procedure as outlined for the AOC investigations (Section 4.1.). In addition, other media will be addressed in this subsection that were not included in the discussion on existing AOCs. These media types include surface water, sediments, and seeps.

4.2.1. Locating Hot Spots Within Non-AOC Areas of OU5

The method to be used to locate hot spots within the non-AOC areas of OU5 is described in the OU5 FSP. It entails the use of grids to locate sampling points throughout the land area of OU5. These sampling points will initially be used for screening (Phase 1) surveys to locate any possible elevated levels of

Table IV.3. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterization
Groundwater
page 1 of 2

Objectives	• Determination of contaminant type and concentration (nature) • Support the risk assessment to determine risks to human health and/or the environment and to support the development of clean up goals in conjunction with ARARs/TBC's by determination of: - Distribution and migration (transport) of contaminants, and - Specific contaminant type and concentration of OU5-defined COCs for each media • Characterize the contaminant properties to support the engineering data required for the FS evaluation of alternatives.			
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine how far the identified contaminants have migrated through the natural hydrogeologic system of the OU5; 3. Determine how concentrated the identified contaminants are within OU5 groundwater; 4. Define the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in pathway fate and transport modeling for the BRA and FS alternative evaluation RAs; 6. Provide sufficient FS engineering data for development and screening remedial alternatives (e.g., treatability technology information, waste volumes, etc.)			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- VOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- Semivolatile organic compounds	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Cyanide	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Actinium-227	V	1 through 6
		- Radium-226	V	1 through 6
		- Strontium-90	V	1 through 6
		- Americium-241	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- Tritium	V	1 through 6
		- Nutrients (TKN, TP)	IV	1 through 6
		- Nitrate/nitrite	IV	1 through 6
		- Chloride	IV	1 through 6

Table IV.3. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterization
Groundwater
page 2 of 2

Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- Sulfate	IV	1 through 6
		- Total suspended solids	III	1 through 6
		- Total dissolved solids	III	1 through 6
		- USATHAMA explosives	V	1 through 6
		- Total organic carbon	III	1 through 6
		- Alkalinity	III	1 through 6
Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits			
Required Detection Limits	The OU9 required detection limits will be used			
Critical Samples	- Phase I: No borings or wells will be installed during the Phase 1 field efforts except for Area 7 (see OU5 FSP). - Phase II: Critical samples and sampling locations are dependent on the results of the Phase 1 reconnaissance field sampling program. - Higher Phase Programs: Indeterminant.			

Table IV.4. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterization
Surface Water and Sediments
page 1 of 3

Objectives	• Determination of contaminant type and concentration (nature) • Support the risk assessment to determine risks to human health and/or the environment and to support the development of cleanup goals in conjunction with ARARs/TBCs by determination of: - Distribution and migration (transport) of contaminants, and - Specific contaminant type and concentration of OU5-defined COCs for each media. • Characterize the contaminant properties to support the engineering data required for the FS evaluation of alternatives.			
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine how far the identified contaminants have migrated by surface water transport; 3. Determine how concentrated the identified contaminants are within OU5 surface water and sediments; 4. Refine the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in surface water pathway fate and transport modeling for the BRA and FS alternative evaluation; and 6. Provide sufficient FS engineering data for development and screening of remedial alternatives (e.g., treatability technology information, waste volumes, etc.).			
Appropriate Analytical Levels (Sediments)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- VOCs	IV	1 through 6
		- SVOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Lithium	IV	1 through 6
		- Molybdenum	IV	1 through 6
		- Cyanide	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Strontium-90	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- Tritium	V	1 through 6
		- USATHAMA Explosives	V	1 through 6

Table IV.4. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterization
Surface Water and Sediments
page 2 of 3

Appropriate Analytical Levels (Sediments) (cont'd)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- Nitrate/Nitrite	IV	1 through 6
		- Chloride	IV	1 through 6
		- Sulfate	IV	1 through 6
Appropriate Analytical Levels (Surface Water)		- VOCs	IV	1 through 6
		- SVOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Cyanide	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Actinium-227	V	1 through 6
		- Isotopic Plutonium (238, 239/240)	V	1 through 6
		- Isotopic Thorium (228, 230, 232)	V	1 through 6
		- Isotopic Uranium (234/236, 238)	V	1 through 6
		- Radium-226	V	1 through 6
		- Strontium-90	V	1 through 6
		- Americium-241	V	1 through 6
		- Gamma Spectrometry	V	1 through 6
		- Tritium	V	1 through 6
		- Nutrients (TKN, TP)	IV	1 through 6
		- Nitrate/Nitrite	IV	1 through 6
		- Chloride	IV	1 through 6
		- Sulfate	IV	1 through 6
		- USATHAMA explosives	V	1 through 6
		- Ammonia	III	1 through 6
		- TOC	III	1 through 6
		- Alkalinity	III	1 through 6
		- Total suspended solids	III	1 through 6
		- Total dissolved solids	III	1 through 6

Table IV.4. Data Quality Objectives
Determination of Contamination in AOCs
Contaminant Characterizations
Surface Water and Sediments
page 3 of 3

Constituents of Concern	Until the OU5 specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.
Level of Concern	Until the OU5 preliminary remediation goals are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.
Required Detection Limits	The OU9 required detection limits will be used.
Critical Samples	- Phase I: No samples will be collected during Phase I field sampling efforts. - Phase II: Critical sampling locations will be determined through a walk-over survey of the OU5 property and preliminary OU9 surface water/drainage study and identified in the Phase 2 SAP. - Higher Phase Programs: Indeterminant.

radiological activity and organic compounds. The same screening techniques will be used to find these hot spots as those used to define RI sampling locations within the existing AOCs. Once an area is found by using the Phase 1 methods, the remainder of the investigation activities are the same as for the existing AOCs.

OU5 has been separated into two major parts; the operational area (which includes all areas north of the east-west plant road, located through Area 1) and the New Property. This separation will allow different grid-sizing due to the anticipated possible contamination levels to be found. The operational area will be gridded on a 100 foot by 100 foot pattern. The New Property area will use a 200 foot by 200 foot grid. As an overview, the operational area may have smaller areas of contamination as shown by the size of some of the existing AOCs. The 100 foot grid will allow the location of an area with a diameter of 100 foot with a confidence level (alpha error) of 95 percent. This diameter was chosen because it is approximately the size of the smallest existing AOC. The New Property grid size was chosen on the basis of 200 feet being approximately the average size of all of the existing AOCs. The average was chosen as acceptable after reviewing the history of this area not being used for operations and the one contaminated area found (Area 1) being of extensive size.

4.2.2. Determination of Contamination for Each Media

Once a new AOC is located by the use of the screening techniques (used in Phase 1 activities) in the non-AOC areas, these new AOCs will be investigated in the same manner as the existing AOCs. Section 4.1. Data Needed for Determination of Contamination in AOCs describes the steps which will be followed to ascertain the nature and extent of contamination and provide the data needed to prepare the OU5 RA.. Each contaminant in each media will be assessed to evaluate its risk or possible future risk. Tables IV.5. and IV.6. show the DQOs for contaminant characterization in non-AOCs for Surface Soils media and Subsurface Soils and Bedrock media. Table IV.7. is a similar table for the Groundwater media in non-AOCs.

4.2.3. Surface Water and Sediments

The physical characterization of surface water and sediments is necessary to assess contaminant fate and transport. Surface water transport is one of the major mechanisms for movement of contamination from AOCs to other areas within OU5 and off-plant. Surface water can transport contaminants as well as contaminated sediments. The investigation of physical properties of surface water and sediment media consists of identifying surface water pathways, stream flow characteristics, sediment deposition, and properties of the sediments. These investigations need to accurately map ephemeral drainage, associated

Table IV.5. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Surface Soils
page 1 of 2

Objectives	• Determination of contaminant type and concentration (nature) • Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs by determination of: - Distribution of contaminants (extent), and - Specific concentration of OU5-defined COCs for each media • Characterize contaminant properties to support the engineering data required for the FS evaluation of alternatives.
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine the horizontal surface area affected by the identified contaminants within the OU5 Non-AOCs; 3. Determine how concentrated the identified contaminants are within the OU5 surface soils; 4. Refine the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in the surface pathway fate and transport modeling for BRA and FS alternative evaluation RAs; and 6. Provide sufficient FS engineering data for development and screening of remedial action alternatives (e.g., appropriateness of a specific treatability technology and waste volumes to be treated).

Table IV.5. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Surface Soils
page 2 of 2

Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Gamma soil screening - HNu soil screening		I I	2 and 5 2 and 5
		- VOCs - SVOCs - TCL pesticides/PCBs - TAL inorganics - Bismuth - Fluoride - Lithium - Molybdenum - Cyanide - USATHAMA explosives - Nitrate/nitrite - Chloride - Sulfate - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Actinium-227 - Strontium-90 - Gamma spectrometry - tritium - total organic carbon - SVOCs and VOCs using Petrex Samplers	IV IV IV IV IV IV IV IV IV V IV IV IV V V V V V V V III II	1 through 6 (partially) 1,2,4
Constituents of Concern	Until the OU5-specific COC list is developed after Phase II remedial investigation efforts, the OU9 site-wide COC list will be used			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits. During the Phase I field sampling program, any sampling point exceeding the lower detection limits of the FIDLER, HNu (as specified in the FSP), or the petrex tube analysis will constitute a level of concern.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No surface soil samples will be collected in the Non-AOCs during Phase I field sampling - Phase II: The critical samples and sampling locations are partially dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs: Indeterminant.			

Table IV.6. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Subsurface Soils and Bedrock
page 1 of 2

Objectives	• Determination of contaminant type and concentration (nature) • Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs by determination of: - Distribution of contaminants (extent), and - Specific concentration of OU5-defined COCs for each media • Characterize contaminant properties to support the engineering data required for the FS evaluation of alternatives.
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine how far the identified contaminants have spread within the OU5 subsurface soils and bedrock; 3. Determine how concentrated the identified contaminants are within the OU5 subsurface soils and bedrock; 4. Refine the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in the surface pathway fate and transport modeling for BRA and FS alternative evaluation RAs; and 6. Provide sufficient FS engineering data for development and screening of remedial action alternatives (e.g., appropriateness of a specific treatability technology and waste volumes to be treated).

Table IV.6. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Subsurface Soils and Bedrock
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Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Gamma soil screening		I	2 and 5
	- HNu soil screening		I	2 and 5
		- VOCs	IV	1 through 6
		- SVOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Lithium	IV	1 through 6
		- Molybdenum	IV	1 through 6
		- Cyanide	IV	1 through 6
		- USATHAMA explosives	V	1 through 6
		- Nitrate/nitrite	IV	1 through 6
		- Chloride	IV	1 through 6
		- Sulfate	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Strontium-90	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- tritium	V	1 through 6
		- total organic carbon	III	1 through 6
		- SVOCs and VOCs using Petrex Samplers	II	(partially) 1,2,4
Constituents of Concern	Until the OU5-specific COC list is developed after Phase II remedial investigation efforts, the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits. During the Phase I field sampling program, any sampling point exceeding the lower detection limits of the FIDLER, HNu (as specified in the FSP), or the petrex tube analysis will constitute a level of concern.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No borings or wells will be installed during the Phase 1 effort except for Area 7 (see the OU5 FSP) - Phase II: The critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs: Indeterminant.			

Table IV.7. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Groundwater
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Objectives	• Determination of contaminant type and concentration (nature) • Support the risk assessment to determine risks to human health and/or the environment and to support the development of clean up goals in conjunction with ARARs/TBC's by determination of: - Distribution and migration (transport) of contaminants, and - Specific contaminant type and concentration of OU5 defined COCs for each media • Characterize the contaminant properties to support the engineering data required for the FS evaluation of alternatives.			
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine how far the identified contaminants have migrated through the natural hydrogeologic system of OU5; 3. Determine how concentrated the identified contaminants are within OU5 groundwater; 4. Define the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in pathway fate and transport modeling for the BRA and FS alternative evaluation RAs; 6. Provide sufficient FS engineering data for development and screening remedial alternatives (e.g., treatability technology information, waste volumes, etc.)			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- VOCs	IV	1 through 6
		- Cyanide	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- Semivolatile organic compounds	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Radium-226	V	1 through 6
		- Strontium-90	V	1 through 6
		- Americium-241	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- Tritium	V	1 through 6

Table IV.7. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Groundwater
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Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- Nutrients (TKN, TP)	III	1 through 6
		- Nitrate/nitrite	IV	1 through 6
		- Chloride- Sulfate	IV	1 through 6
		- Total suspended solids	IV	1 through 6
		- Total dissolved solids	III	1 through 6
		- USATHAMA explosives	III	1 through 6
		- Total organic carbon	V	1 through 6
		- Alkalinity	III	1 through 6
			III	1 through 6
Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No borings or wells will be installed during the Phase I field effort except for Area 7 (see the OU5 FSP). - Phase II: Critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase Programs: Indeterminant.			

seeps, watersheds, and to describe the horizontal and vertical extent of waterborne sediments within the drainage. Further investigation of the stream channels may include monitoring discharge and water quality at a few locations using weirs if contamination is found during initial sampling. OU9 is tasked to perform preliminary surface water and sediment sampling of the plant drainage ditch and natural drainage systems in the south half of the New Property. Based on these results, OU5 will initiate additional field sampling, if so warranted.

Based on the approved OU9 sampling program, biased sampling will be performed along drainage channels and surface impoundments (locations where surface water collects). Drainage channels and impoundments act as concentration points for surface runoff and sediment deposition. They provide valuable information regarding the presence of contaminants in upgradient areas and on the potential contaminant movement pathways. At the locations for the collection of samples for the characterization of media, additional samples would be collected for chemical and radionuclide analysis of surface water, suspended sediments, and deposited sediments.

The resultant data will be used to support the determination of the distribution and migration (transport) of contaminants, contaminant type, and specific concentration of OU5-defined COCs for the surface water and sediments. In addition, the sampling results will assist in the determination of the presence or absence of contaminated seep/surface water on the SM/PP Hill and New Property, as well as supporting the determination of the surface waters' ability to meet the defined clean-up goals. A summary of the DQOs for contaminant characterization for Surface Water and Sediments can be found in Table IV.8.

4.2.4. Seeps

After the initial round of sampling in OU5, a seep survey and mapping task will have located any surface water, drainage paths and seeps in OU5. This survey will be undertaken in the wet season to ensure the best opportunity to make all possible locations known. These found seeps will then be modeled by OU9 as part of the groundwater system. Should either the OU9 program indicate seep contamination or OU5 contaminant extent sampling show seep contamination, the OU5 program will prepare a sampling plan for seep characterization. A preliminary table of DQOs for contaminant characterization for Seeps can be found in Table IV.9.

4.3. EVALUATION OF REMEDIAL ALTERNATIVES

This section will discuss the data requirements necessary to support the evaluation of remedial alternatives for OU5 areas determined to be contaminated. The data requirements are primarily driven by the need

Table IV.8. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Surface Water and Sediments
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Objectives	• Determination of contaminant type and concentration (nature) • Support the risk assessment to determine risks to human health and/or the environment and to support the development of cleanup goals in conjunction with ARARs/TBCs by determination of: - Distribution and migration (transport) of contaminants, and - Specific contaminant type and concentration of OU5-defined COCs for each media. • Characterize the contaminant properties to support the engineering data required for the FS evaluation of alternatives.			
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine how far the identified contaminants have migrated by surface water transport; 3. Determine how concentrated the identified contaminants are within OU5 surface water and sediments; 4. Refine the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in surface water pathway fate and transport modeling for the BRA and FS alternative evaluation; and 6. Provide sufficient FS engineering data for development and screening of remedial alternatives (e.g., treatability technology information, waste volumes, etc.).			
Appropriate Analytical Levels (Sediments)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- VOCs	IV	1 through 6
		- SVOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Lithium	IV	1 through 6
		- Molybdenum	IV	1 through 6
		- Cyanide	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Actinium-227	V	1 through 6
		- Strontium-90	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- Tritium	V	1 through 6
		- USATHAMA Explosives		

Table IV.8. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Surface Water and Sediments
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Appropriate Analytical Levels (Sediments) (cont'd)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- Nitrate/Nitrite	IV	1 through 6
		- Chloride	IV	1 through 6
		- Sulfate	IV	1 through 6
Appropriate Analytical Levels (Surface Water)		- VOCs	IV	1 through 6
		- SVOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Cyanide	IV	1 through 6
		- Isotopic Plutonium (238, 239/240)	V	1 through 6
		- Isotopic Thorium (228, 230, 232)	V	1 through 6
		- Isotopic Uranium (234/236, 238)	V	1 through 6
		- Actinium-227	V	1 through 6
		- Radium-226	V	1 through 6
		- Strontium-90	V	1 through 6
		- Americium-241	V	1 through 6
		- Gamma Spectrometry	V	1 through 6
		- Tritium	V	1 through 6
		- Nutrients (TKN, TP)	IV	1 through 6
		- Nitrate/Nitrite	IV	1 through 6
		- Chloride	IV	1 through 6
		- Sulfate	IV	1 through 6
		- USATHAMA explosives	V	1 through 6
		- Ammonia	III	1 through 6
		- TOC	III	1 through 6
		- Alkalinity	III	1 through 6
		- Total suspended solids	III	1 through 6
		- Total dissolved solids	III	1 through 6

Table IV.8. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterizations
Surface Water and Sediments
page 3 of 3

Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.
Required Detection Limits	The OU9 required detection limits will be used.
Critical Samples	- Phase I: No samples will be collected during Phase I field sampling efforts. - Phase II: Critical sampling locations will be determined through a walk-over survey of the OU5 property and preliminary OU9 surface water/drainage study and identified in the Phase 2 SAP. - Higher Phase Programs: Indeterminant.

Table IV.9. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Seeps
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Objectives	• Determination of contaminant type and concentration (nature) • Support the risk assessment to determine risks to human health and/or the environment and to support the development of clean up goals in conjunction with ARARs/TBC's by determination of: - Distribution and migration (transport) of contaminants, and - Specific contaminant type and concentration of OU5 defined COCs for each media.			
Prioritized Data Use(s)	The data will be used to: 1. Determine what radiological and/or chemical contaminants are present (if any); 2. Determine how far the identified contaminants have migrated through the hydrogeologic system of the SM/PP Hill; 3. Determine how concentrated the identified contaminants are within OU5 Seep water; 4. Define the OU5 COC list through the identification of contaminants specific to OU5; 5. Support the development of the contaminant data used in pathway fate and transport modeling for the BRA and FS alternative evaluation risk assessments; 6. Provide sufficient FS engineering data for development and screening remedial alternatives (e.g., treatability technology information, waste volumes, etc.)			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- VOCs	IV	1 through 6
		- TCL pesticides/PCBs	IV	1 through 6
		- Semivolatile organic compounds	IV	1 through 6
		- TAL inorganics	IV	1 through 6
		- Bismuth	IV	1 through 6
		- Fluoride	IV	1 through 6
		- Cyanide	IV	1 through 6
		- Isotopic plutonium (238, 239/240)	V	1 through 6
		- Isotopic thorium (228, 230, 232)	V	1 through 6
		- Isotopic uranium (234/235, 238)	V	1 through 6
		- Actinium-227	V	1 through 6
		- Radium-226	V	1 through 6
		- Strontium-90	V	1 through 6
		- Americium-241	V	1 through 6
		- Gamma spectrometry	V	1 through 6
		- Tritium	V	1 through 6
		- Nutrients (TKN, TP)	III	1 through 6
		- Nitrate/nitrite	IV	1 through 6
		- Chloride	IV	1 through 6

Table IV.9. Data Quality Objectives
Determination of Contamination in Non-AOCs
Contaminant Characterization
Seeps
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Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
		- Sulfate	IV	1 through 6
		- Total suspended solids	III	1 through 6
		- Total dissolved solids	III	1 through 6
		- USATHAMA explosives	V	1 through 6
		- Ammonia	III	1 through 6
		- Total organic carbon	III	1 through 6
		- Alkalinity	III	1 through 6
Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No samples will be collected during Phase I field sampling efforts - Phase II: Sampling locations will be determined through a walk-over survey of the OU5 property with the survey focus placed on the SM/PP Hill and historical knowledge. The sampling locations will be based on known, and suspected seep locations and will be identified in the Phase II SAP. - Higher Phase Programs: Indeterminant.			

to determine the nature and extent of contamination and to assess the physical/chemical characteristics and transport properties of the media within each area. The data collection objectives will support the nine criteria against which each alternative is screened, as well as the associated technologies and process options including treatability studies. The nine criteria used to evaluate the alternatives include:

1. Overall protection of human health and the environment;
2. Compliance with ARARs;
3. Long-term effectiveness and permanence;
4. Reduction of toxicity, mobility, and volume through treatment;
5. Short-term effectiveness;
6. Implementability;
7. Cost;
8. State acceptance; and,
9. Community acceptance.

The data collected to meet the objectives for characterization of media and contamination will fill the data collection objectives stated above and evaluation criteria 1, 2, 3, and 5. However, additional surface soil, subsurface soil, and groundwater sampling may be required for refinement of localized physical characteristics. This data (as outlined in Section 4.4.1 and the DQO tables) will allow estimates of receptor exposure through fate and transport modeling for each alternative in relation to each contaminant pathway (groundwater, surface water/sediment, and air).

In addition, the data collected to meet the objectives when incorporated into engineering FSs will support the evaluation criteria 3, 4, 5, and 6 as well as development of preliminary design criteria for selected remedial alternatives. Tables IV.10., IV.11., IV.12., and IV.13. give summaries of the DQOs for Physical Characterization of the different medias found in the existing AOCs. Tables IV.14., IV.15., IV.16., IV.17., and IV.18. show corresponding DQOs for each media in the non-AOCs.

Many remedial action technologies are affected by contaminant types, concentration levels, volumes, and depth. The chemistry of the groundwater or surface water alone or in combination with contaminants has a major impact on some treatment technologies. The physical and chemical soil properties are necessary to assess not only treatment technologies but also containment or collection options. In addition, the stratigraphy and *in situ* hydrogeologic conditions can determine the success of *in situ* treatment and also containment or collection options. Most of the data requirements listed above are also presented as data

Table IV.10. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterization
Surface Soils
page 1 of 2

Objectives	• Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives			
Prioritized Data Use(s)	The data will be used in the event contamination is found in the AOC, as follows: 1. Support development of the physical parameters (soil type, stratigraphic data) used in the pathway fate and transport model for BRA and FS alternative evaluation risk assessment; and 2. Physically characterize the surface soils to support the engineering data required for the FS evaluation and screening of alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Location - Soil Type - Stratigraphic Data		I I I	1 and 2 1 and 2 1 and 2
		- pH - particle size distribution - clay mineralogy - cation exchange capacity - permeability test - relative minimum density - relative maximum density - insitu density determination - moisture content - organic content - specific gravity - Atterberg limits	III III III III III III III III III III III III	1 1 and 2 1 1 1 and 2 2 2 1 and 2 1 and 2 1 1 and 2 2
Constituents of Concern	Constituents of concern are not applicable for the physical characterization parameters			
Level of Concern	Level of concern is not applicable for the physical characterization parameters			
Required Detection Limits	Required detection limits are not applicable for the physical characterization parameters,			

Table IV.10. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterization
Surface Soils
page 2 of 2

Critical Samples	- Phase I: No specific sample location has been determined to be a critical sample. However, the OU5-FSP specified sample locations are required as part of an overall Phase I program to meet the reconnaissance objectives. - Phase II: The critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs: Indeterminant.

Table IV.11. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterization
Subsurface Soils and Bedrock
page 1 of 2

Objectives	• Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives. • Characterization of the natural hydrogeologic system within the OU5 area in the event contaminated groundwater is found.			
Prioritized Data Use(s)	The data will be used in the event contamination is found in the AOC, as follows: 1. Support development of the physical parameters (geologic/geotechnical data) used in the pathway fate and transport model for BRA and FS alternative evaluation risk assessment; and 2. Physically characterize the subsurface soils and bedrock to support the engineering data required for the FS evaluation and screening of alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Lithologic logs		I	1 and 2
	- Standard Penetration Tests (blow counts)		I	1 and 2
	- Geophysical		I	1 and 2
		- pH	III	1
		- particle size distribution	III	1 and 2
		- clay mineralogy	III	1
		- cation exchange capacity	III	1
		- permeability test	III	1 and 2
		- relative minimum density	III	2
		- relative maximum density	III	2
		- $\overline{cu}$ triaxle test with pore pressure readings	III	2
		- one - dimensional consolidated test	III	1 and 2
		- insitu density determination	III	1 and 2
		- moisture content	III	1 and 2
		- organic content	III	1
		- specific gravity	III	1 and 2
		- Atterberg limits	III	2
Constituents of Concern	Constituents of concern are not applicable for the physical characterization parameters			
Level of Concern	Level of concern is not applicable for the physical characterization parameters			

Table IV.11. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterization
Subsurface Soils and Bedrock
page 2 of 2

Required Detection Limits	Required detection limits are not applicable for the physical characterization parameters,
Critical Samples	- Phase I: No specific sample location has been determined to be a critical sample. However, the OU5-FSP specified sample locations are required as part of an overall Phase I program to meet the reconnaissance objectives. No borings or wells will be installed during the Phase I effort, except for Area 7 (see OU5 FSP). - Phase II: The critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs: Indeterminant.

Table IV.12. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterization
Groundwater
page 1 of 2

Objectives	• Determine contaminant fate and transport migration pathways • Support the risk assessment to determine risks to human health and/or the environment and to support the development of clean-up goals in conjunction with ARARs/TBCs. • Physically characterize the media to support the engineering data required for the FS evaluation of alternatives. • Support characterization of the natural hydrogeologic system within the OU5 Area in the event contaminated groundwater is found.			
Prioritized Data Use(s)	The date will be used in the event contamination is found, as follows: 1. Support development of physical parameters (flow rate and patterns) used in the pathway fate and transport model for the BRA and FS remedial alternatives evaluation RA; and 2. Support the engineering data required for the FS evaluation and screening of remedial alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Dissolved Oxygen		II	1 and 2
	- Temperature		II	
	- pH		II	1 and 2
	- Specific conductivity		II	1 and 2
	- Redox potential		II	1 and 2
	- Water Level		I	1 and 2
	- Aquifer Tests		I	1 and 2
	- Pumping data		I	1 and 2
	- Precipitation data		I	1 and 2
			I	1 and 2

Table IV.12. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterization
Groundwater
page 2 of 2

Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.
Required Detection Limits	The OU9 required detection limits will be used.
Critical Samples	- Phase I: No borings or wells will be installed during the Phase I field effort except for Area 7 (see OU5 FSP). - Phase II: Critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase Programs: Indeterminant.

Table IV.13. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterization
Surface Water and Sediments
(page 1 of 2)

Objectives	• Support of the risk assessment to determine risks to human health and/or the environment and to support the development of clean-up goals in conjunction with ARARs/TBCs. • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives. • Characterization of the surface water transport system (pathway) in OU5 (e.g., direction, flow rates, ability to transport sediment, and erosiveness to surface soils).			
Prioritized Data Use(s)	The data will be used in the event contamination is found, as follows: 1. Support development of physical parameters (flow rate and patterns) used in the pathway fate and transport model for the BRA and FS alternative evaluation risk assessment; and 2. Support the engineering data required for the FS evaluation and screening of remedial alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels (Sediments)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Volume (depth, area) - Stratigraphic data		I I	1 and 2 1 and 2
		- Particle size distribution - pH - Specific gravity - Cation exchange capacity - Moisture content - Relative minimum density - Maximum density - Atterberg limits	III III III III III III III III	1 and 2 2 1 and 2 2 2 1 and 2 1 and 2 2

Table IV.13. Data Quality Objectives
Determination of Contamination in AOCs
Physical Characterizations
Surface Water and Sediments
(page 2 of 2)

Appropriate Analytical Levels (Surface Water)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Flow rate (high and low flow)		II	1 and 2
	- pH		II	1 and 2
	- Temperature		II	
	- Specific conductivity		II	1 and 2
	- Redox potential		II	1 and 2
Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No samples will be collected during Phase I field sampling efforts. - Phase II: Critical sampling locations will be determined through a walk-over survey of the OU5 property and preliminary OU9 surface water/drainage study and identified in the Phase II SAP. - Higher Phase Programs: Indeterminant.			

Table IV.14. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Surface Soils
page 1 of 2

Objectives	• Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs. • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives (e.g., the erodibility of surficial soils).			
Prioritized Data Use(s)	The data will be used in the event contamination is found in the Non-AOC, as follows: 1. Support development of the physical parameters (soil type, stratigraphic data) used in the pathway fate and transport model for BRA and FS alternative evaluation risk assessment; and 2. Physically characterize the surface soils to support the engineering data required for the FS evaluation and screening of alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Location - Soil Type - Stratigraphic Data		I I I	1 and 2 1 and 2 1 and 2
		- pH - particle size distribution - clay mineralogy - cation exchange capacity - permeability test - relative minimum density - relative maximum density - insitu density determination - moisture content - organic content - specific gravity - Atterberg limits	III III III III III III III III III III III III	1 1 and 2 1 1 1 and 2 2 2 1 and 2 1 and 2 1 1 and 2 2
Constituents of Concern	Constituents of concern are not applicable for the physical characterization parameters.			
Level of Concern	Level of concern is not applicable for the physical characterization parameters.			
Required Detection Limits	Required detection limits are not applicable for the physical characterization parameters.			

Table IV.14. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Surface Soils
page 2 of 2

Critical Samples	- Phase I: No surface soil samples will be collected during the Phase 1 field program. - Phase II: The critical samples and sampling locations are partially dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs: Indeterminant.

Table IV.15. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Subsurface Soils and Bedrock
page 1 of 2

Objectives	• Support of the risk assessment to develop clean-up goals in conjunction with ARARs/TBCs. • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives. • Characterization of the natural hydrogeologic system within the OU5 area in the event contaminated groundwater is found.			
Prioritized Data Use(s)	The data will be used in the event contamination is found in the Non-AOC, as follows: 1. Support development of the physical parameters (geologic/geotechnical data) used in the pathway fate and transport model for BRA and FS alternative evaluation risk assessment; and 2. Physically characterize the subsurface soils and bedrock to support the engineering data required for the FS evaluation and screening of alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Lithologic logs		I	1 and 2
	- Standard Penetration Tests (blow counts)		I	1 and 2
	- Geophysical		I	1 and 2
		- pH	III	1
		- particle size distribution	III	1 and 2
		- clay mineralogy	III	1
		- cation exchange capacity	III	1
		- permeability test	III	1 and 2
		- relative minimum density	III	2
		- relative maximum density	III	2
		- $\overline{cu}$ triaxle test with pore pressure readings	III	2
		- one - dimensional consolidated test	III	1 and 2
		- insitu density determination	III	1 and 2
		- moisture content	III	1 and 2
		- organic content	III	1
		- specific gravity	III	1 and 2
		- Atterberg limits	III	2
Constituents of Concern	Constituents of concern are not applicable for the physical characterization parameters.			
Level of Concern	Level of concern is not applicable for the physical characterization parameters.			

Table IV.15. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Subsurface Soils and Bedrock
page 2 of 2

Required Detection Limits	Required detection limits are not applicable for the physical characterization parameters.
Critical Samples	- Phase I: No borings or wells will be installed during the Phase 1 effort, except for Area 7 (see OU5 FSP). - Phase II: The critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase programs: Indeterminant.

Table IV.16. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Groundwater
page 1 of 2

Objectives	• Determine contaminant fate and transport migration pathways • Support the risk assessment to determine risks to human health and/or the environment and to support the development of clean-up goals in conjunction with ARARs/TBCs. • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives. • Support characterization of the natural hydrogeologic system with the OU5 Area in the event contaminated groundwater is found.			
Prioritized Data Use(s)	The date will be used in the event contamination is found, as follows: 1. Support development of physical parameters (flow rate and patterns) used in the pathway fate and transport model for the BRA and FS remedial alternatives evaluation risk assessment; and 2. Support the engineering data required for the FS evaluation and screening of remedial alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Dissolved Oxygen		II	1 and 2
	- Temperature		II	
	- pH		II	1 and 2
	- Specific conductivity		II	1 and 2
	- Redox potential		II	1 and 2
	- Water Level		I	1 and 2
	- Aquifer Tests		I	1 and 2
	- Pumping data		I	1 and 2
	- Precipitation data		I	1 and 2
			I	1 and 2

Table IV.16. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Groundwater
page 2 of 2

Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.
Level of Concern	Until the OU5 PRGs are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.
Required Detection Limits	The OU9 required detection limits will be used.
Critical Samples	- Phase I: No borings or wells will be installed during the Phase I field effort except for Area 7 (see OU5 FSP). - Phase II: Critical samples and sampling locations are dependent on the results of the Phase I reconnaissance field sampling program. - Higher Phase Programs: Indeterminant.

Table IV.17. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Surface Water and Sediments
page 1 of 2

Objectives	• Support of the risk assessment to determine risks to human health and/or the environment and to support the development of clean-up goals in conjunction with ARARs/TBCs. • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives. • Characterization of the surface water transport system (pathway) in OU5 (e.g., direction, flow rates, ability to transport sediment, and erosiveness to surface soils).			
Prioritized Data Use(s)	The data will be used in the event contamination is found, as follows: 1. Support development of physical parameters (flow rate and patterns) used in the pathway fate and transport model for the BRA and feasibility study alternative evaluation risk assessment; and 2. Support the engineering data required for the FS evaluation and screening of remedial alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels (Sediments)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Volume (depth, area) - Stratigraphic data		I I	1 and 2 1 and 2
		- Particle size distribution - pH - Specific gravity - Cation exchange capacity - Moisture content - Relative minimum density - Maximum density - Atterberg limits	III III III III III III III III	1 and 2 2 1 and 2 2 2 1 and 2 1 and 2 2

Table IV.17. Data Quality Objectives
Determination of Contamination in Non-AOC's
Physical Characterization
Surface Water and Sediments
page 2 of 2

Appropriate Analytical Levels (Surface Water)	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Flow rate (high and low flow)		II	1 and 2
	- pH		II	1 and 2
	- Temperature		II	
	- Specific conductivity		II	1 and 2
	- Redox potential		II	1 and 2
Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.			
Level of Concern	Until the OU5 preliminary remediation goals are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.			
Required Detection Limits	The OU9 required detection limits will be used.			
Critical Samples	- Phase I: No samples will be collected during Phase I field sampling efforts. - Phase II: Critical sampling locations will be determined through a walk-over survey of the OU5 property and preliminary OU9 surface water/drainage. study and identified in the Phase II SAP. - Higher Phase Programs: Indeterminant			

Table IV.18. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Seeps
page 1 of 2

Objectives	• Determine contaminant fate and transport migration pathways. • Support the risk assessment to determine risks to human health and/or the environment and to support the development of clean-up goals in conjunction with ARARs/TBCs. • Physically characterize the media to support the engineering data required for the feasibility study evaluation of alternatives. • Characterization of the hydrogeologic system of the SM/PP Hill, if contaminated groundwater is found.			
Prioritized Data Use(s)	The date will be used in the event contamination is found, as follows: 1. Support development of physical parameters (flow rate and patterns) used in the pathway fate and transport model for the BRA and FS remedial alternatives evaluation risk assessment; and 2. Support the engineering data required for the FS evaluation and screening of remedial alternatives (e.g., appropriateness of a specified treatability technology).			
Appropriate Analytical Levels	Parameters		Analytical Level	Prioritized Data Use Reference
	Field	Laboratory		
	- Flow rate	I		1 and 2
	- Temperature	II		
	- pH	II		1 and 2
	- Specific conductivity	II		1 and 2
	- Redox potential	II		1 and 2

Table IV.18. Data Quality Objectives
Determination of Contamination in Non-AOCs
Physical Characterization
Seeps
page 2 of 2

Constituents of Concern	Until the OU5-specific COC list is developed (after Phase II remedial investigation efforts), the OU9 site-wide COC list will be used.
Level of Concern	Until the OU5 preliminary remediation goals are developed, the OU5 level of concern for contaminants will be the same as the OU9 specified required detection limits.
Required Detection Limits	The OU9 required detection limits will be used.
Critical Samples	- Phase I: No samples will be collected during Phase I field sampling efforts. - Phase II: Sampling locations will be determined through a walk-over survey of the OU5 property with the survey focus placed on the SM/PP Hill and historical knowledge. The sampling locations will be based on known, discovered, and suspected seep locations and will be identified in the Phase II SAP. - Higher Phase Programs: Indeterminant.

collection needs in EPA's guidance, "Remedial Actions for Contaminated Groundwater" (EPA 1988b). With regard to contaminated soil, wastes must be categorized by certain fundamental characteristics. The two principal waste characteristics are waste matrices and waste constituents. Further screening is also possible using other waste characteristics. When evaluating a waste matrix, moisture content is a key factor in distinguishing how soils, sludges, or liquids can be treated and handled. The chemical nature of the waste constituents becomes the second basis for characterizing waste treatability for screening. Other waste characteristics affecting treatability for soils treatment include: grain size, organic content, inorganic content, pH, and soil/solvent reactions. As examples, grain size affects most soil washing technologies whereas organic content can affect the performance of stabilization/solidification processes.

The first seven of the nine criteria can be assessed for each remedial alternative by using a ranking system. Under the ranking system each alternative is given a numerical value for each criteria. The total of these values is then the alternative score. The alternative with the highest score should be the first alternative to be considered. It would then be reviewed for State and Community acceptance prior to generation of a ROD.

4.4. SAMPLING PROGRAM

This section summarizes the necessary steps to be taken to gather the data required by the previous sections. Specifics for each AOC can be found in the appendices to the FSP.

4.4.1. General Rationale

The supporting data objectives identified earlier in this section will be met by using the controls delineated in the OU9 and OU5 QAPjPs. The OU5-specific priority data uses and critical samples guidance for each AOC can be found in the OU5 FSP. The FSP exhibits sampling point locations on AOC maps, as well as types and quantities of samples needed to fulfill those objectives. Typical physical and chemical characteristics of contaminants to be analyzed as field measurements include:

- physical form (solid, liquid, gas);
- temperature;
- pH; and,
- general chemical class (e.g., acid, base, solvent).

Typical physical and chemical characteristics of contaminants to be determined by lab analysis include:

- molecular weight;

- density;
- boiling point;
- viscosity;
- solubility in water;
- cohesiveness of the waste;
- vapor pressure;
- flash point;
- identification of potential degradation products; and,
- properties of separate radioisotopes.

In addition, the physical characteristics of the surface soil, sub-surface soil, bedrock, and sediments must be determined to provide pathway analysis of any detected contaminants. Table IV.19. lists these parameters which are proposed for Phase 2 sampling. Additional characteristics may be added for Phase 3 sampling to further identify specific characteristics or for FS data needs gaps.

Information needs to be obtained about the migration and disposal characteristics of the contaminants in each media. The listing and level of documentation of the contaminant characteristics is determined by DOE, as defined by the FFA. Calculations must be made to show not only the velocity and direction of contaminant movement, but also an extrapolation of future movements.

The critical samples will be collected in a multiple-round sampling program consisting of a reconnaissance sampling (Phase 1) and RI sampling (Phase 2) sequence. These are progressively tailored to each OU5 AOC and OU5 non-AOC location and will be sampled under a Phase 2 program requiring two or more sampling rounds depending on the previous sampling round results for various media and investigated areas.

Reconnaissance Sampling (Phase 1) provides data to focus and enhance site characterization activities. Field-screening techniques are part of the initial phase of an exploratory study. The data obtained from field-screening techniques are a qualitative screen that can be used to determine a strategy for directing sampling in areas of greater probable contamination and acquire data needed to prepare refined DQOs for an additional round of sampling. The following field screening techniques will be utilized.

- Gamma Surveys: The initial phase of the exploratory study will be a systematic gamma survey. The equipment that will be used in this survey is a FIDLER. The surveys will be conducted at AOCs and non-AOCs to identify areas of suspected radioactivity contamination.

Table IV.19. Proposed Physical Parameters and Analytical Methods for Basic Soil and Sediment Characterization

Physical Parameters[a,b]	Analytical Method
Moisture Content	ASTM D-2216
Organic Content	ASTM D-2974
Particle-size Distribution	ASTM D-422 and D-1140
Hydrogen Ion Content (pH)[c]	
Porosity by Phase Relation	
Hydraulic Conductivity	ASTM D-2434
Relative Density	ASTM D-4253 and D-4254
Specific Gravity	ASTM D-854-83
Bulk Density[d]	
CEC[e]	SW-846 9080/90811[f,g]
Atterburg Limits[h]	ASTM D-4318
Mineralogy	

[a]Refer to Operable Unit 9 Quality Assurance Project Plan.

[b]Soil physical parameters for soil sorptive capacity, infiltration, evapotranspiration, storage capacity, and vertical flow rate are not addressed for the background soil sampling program. These parameters will be determined as necessary on a site-specific basis for Mound Plant soils.

[c]"Method of Soil Analysis, Part 2 Chemical and Microbiological Properties", Second Edition, edited by A.L. Page, R. H. Miller, and D. R. Keeney. 1982.

[d]*The bulk density is the unit (mass) weight of a unit volume of dry soil (Brady 1974).*

[e]Cation exchange capacity (CEC) is expressed as milliequivalents per 100g of soil. Determination is made after the mineralogy of the soil is determined (Tan 1982).

[f]"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, 3rd Edition, U.S. EPA. November 1986.

[g]If soils are acidic, CEC will be analyzed by "Method of Soil Analysis, Part 2 Chemical and Microbiological Properties", Second Edition, Edited by A.L. Page, R.H. Miller, and D.R. Keeney. 1982.

[h]Atterburg Limits are a measurement of the water content at three states of soil consistency: the shrinkage limit (arbitrary limit between the solid and semisolid states), plastic limit (arbitrary limit between the plastic and semisolid states of consistency of a soil), and liquid limits (arbitrary limit between the liquid and plastic states of consistency of a soil).

- Soil Gas Surveys: The surveys are conducted for specified AOCs to screen the site for volatile and semi-volatile compounds in the soil. The soil gas technique to be used is a passive-time integrative method using carbon absorption with compound identification by mass spectrometry (MS) and verification by gas chromatography/mass spectrometry (GC/MS).

- Geophysical Surveys: The surveys are conducted in AOCs which have been used as burial sites. The primary objectives of the survey are to locate the boundary of fill material and any near-surface and subsurface objects that could impact subsequent intrusive investigations. Both magnetometer/gradiometer and electromagnetic surveys will be conducted as part of the geophysical investigations.

RI Sampling (Phase 2) provides data of sufficient and consistent quality to define areas of contamination. Samples for the various media (soils, sediments, surface water, and groundwater) will be obtained and analyzed according to the Standard Operating Procedures (SOP) and specifications contained in the OU9 and OU5 QAPjPs. The following sampling will be performed:

- Soils will be sampled after locations are determined by field screening methods from the first round of the reconnaissance study (Phase 1).

- Sediments will be sampled from all areas of deposition by surface water and determined by field-screening methods and preliminary results of the OU9 sediment sampling program.

- Surface water sampling locations will be determined by a seep survey and with the results of the OU9 preliminary plant drainage ditch and South Property drainage system (ephemeral stream channels) investigation.

- Groundwater samples will be determined in two rounds. The first round will involve sampling from OU9 wells should additional analyses be necessary to track contaminant flow from an OU5 source. The second round will commence after subsurface soil analytical results identify specific groundwater concerns. Additional monitoring well locations may be identified as the result of the soil borings encountering groundwater.

Both AOCs and non-AOCs will be subject to the phased sampling program. The sampling program identified in the FSP will perform reconnaissance sampling on all AOCs. Area 7 will also be sampled at a Phase 2 level, due to the availability of qualitative chemical data. Based on the Phase 1 survey program, if any "hot spots" exist (e.g., detection greater than the field equipment's lower detection limits), those spots would be a starting point for a Phase 2 contamination nature and extent investigation. However, all AOCs will be subject to a Phase 2 investigation. The reconnaissance sampling will consist of a gamma survey conducted using a grid layout of the site or, a yet to be determined, state-of-the-art detection technology. The RI sampling will also be performed on the surface water (facility and natural drainage systems) and associated sediments using the analytical parameters specified in this section of the Work Plan and the quality objectives of the OU5 QAPjP.

4.4.2. General Sampling Strategy

The general sampling strategy is to gather from an appropriate location an appropriate number and type (grab or composite) of samples. However, increased sample numbers entail greater sampling time and analytical costs. One way to accomplish this objective is to use statistically valid sampling strategies so that the appropriate sampling number can be estimated and the sampling locations can be chosen without bias. Often, non-statistical (judgement) sampling strategies are used to select the appropriate sampling locations and to estimate how many samples are needed. However, in some sampling situations, the use of non-statistical methods can lead to inaccurate results. Strategies to be used are specified for each AOC in the FSP.

Every sampling strategy must take into consideration the decision of whether to use grab or composite samples, sample location, sample number, and duration and frequency of sampling. The following subsections discuss these factors, as applicable to the RI/FS sampling activities for OU5.

4.4.2.1. Grab Versus Composite Sampling

A grab sample is a discrete aliquot which is representative of a specific location at a given point in time. It is collected all at once at a particular point in the sample medium and is not intended to give an average value for the entire medium. This is the standard sample to be taken in the OU5 RI/FS program.

Composite samples are composed of more than one specific aliquot collected at various sampling locations and/or different points in time. This type of sample produces an average value when analyzed. Compositing can mask problems by diluting to below detection limits isolated concentrations of some hazardous compounds. Chemical changes may occur in a composite sample due to mixing of multiple samples. However, it is a useful method for general screening and is often used as a cost reduction measure. If required by EG&G Mound, compositing will be done in the field only if screening procedures produce similar results within a large area. Phase 2 sampling for the large non-AOC area may use this technique to cover areas where screening techniques were inconclusive or failed to locate any hot spots.

4.4.2.2. Sampling Locations

The sampling locations will depend on the site conditions and the goals (DQOs) of the sampling effort. The specific locations may be determined by non-statistical or statistical means. A discussion on the basis for selecting sample locations follows.

Non-statistical or judgement sampling relies upon the sampler's experience and knowledge of the waste distribution to determine the locations that will provide the most representative sampling. The validity of such sampling depends on the accuracy of this knowledge. The data can be biased intentionally or because of inadequate knowledge of waste distribution. Because judgement sampling is subject to bias, its validity can be questioned in legal hearings and prosecutions. When judgement is used, the degree of bias introduced (e.g., sampling error) cannot be estimated since the equations for estimating error are based on the assumption that the probability of a location being included as a sampling point is known. Thus, documentation of why a particular sampling location is chosen is critical when judgement is used. Judgement sampling will be used along drainage areas within OU5. Statistical or random-based methodologies will be employed in all other areas. This will be specified in the sampling discussion within the appropriate sampling plan for that area and verified in field logbook notations. All other areas within OU5 (other than drainage and roadways) will utilize statistical sampling methods.

Statistical sampling strategies (i.e., random sampling) can often produce increased data accuracy while eliminating sampler bias. Random sampling depends on the theory of random chance probabilities to choose the most representative sample. Little or no knowledge of waste distribution is needed. Unlike judgement sampling, the error in data accuracy of a random sampling scheme can be objectively measured thereby eliminating any bias of the sample collector.

A number of statistical sampling strategies are available to produce an unbiased, representative sampling plan. Among these are the simple random, the systematic random, and the stratified random strategies. The principles behind these and the situation in which each would be useful are discussed in the following paragraphs.

Simple Random Sampling is a statistical sampling method that requires little or no prior knowledge of waste distribution. This strategy relies on random chance probability theory wherein each sampling location has an equal and known probability of being selected. Because the probability of selection is known, sampling error can be accurately estimated. Generally, the area of interest is partitioned into either a 2- or 3- dimensional grid pattern and random coordinates are selected for sampling. This method will be used for areas where AOCs have not been previously identified (in the non-AOC areas). The goal here will be to "find" any contaminated hot spots.

Systematic Random Sampling is a refinement of simple random sampling that can produce a more efficient sampling survey in certain circumstances. The use of a systematic random scheme can improve

the efficiency by reducing the sampling error while maintaining the same sample number, or by reducing the number of samples required to achieve a specified sampling error.

Like simple random sampling, systematic random sampling requires little or no knowledge of the waste distribution; however, bias and imprecision may be introduced if unrecognized trends or cycles exist. Two examples of selecting sampling locations using systematic sampling are: (1) randomly selecting a transect (an arbitrary dividing line) or transects and then sampling at a preselected interval; and (2) preselecting both the transect(s) and the sampling interval and then beginning the sampling from a random starting point. This system will be used for newly found hot spots where very little information on the extent or concentration of contaminants in known, or when screening techniques don't specify hot spot locations within existing AOCs.

Stratified Random Sampling requires some prior knowledge of the waste distribution. When the waste is known or assumed to be stratified, for example when an oil layer is thought to overlie a lower aqueous layer of a lagoon, the sampling efficiency can be improved by dividing the area to be sampled into strata that are more homogeneous than the total area. Simple random sampling techniques can then be used to sample each stratum independently. Each stratum is subdivided into grids and then the sampling locations are selected randomly. If the area is known to be vertically stratified, the sampling locations within each stratum are selected randomly, and then selected depths are sampled.

If the area is known or assumed to be horizontally stratified, the sampling locations within each stratum are also selected randomly, but the total depth is sampled.

When the analytical results have been obtained, an analysis of variance will be performed to determine if the strata differ significantly and therefore whether the assumption that stratification exists was correct, and thus whether the use of stratified random sampling was statistically valid. When the volume of each stratum differs or when the number of samples taken within each stratum differs, the results must be weighed accordingly to avoid bias. Several of the existing AOCs have sufficient information available to allow this method to be used, especially where a cover layer of "clean" fill was placed over a burial site.

4.4.3. Field Sampling Program Summary List

The following section summarizes the multiple-round, phased, sampling program proposed in this work plan and formalized in the OU5 FSP (first round only).

Two items must be noted prior to reviewing the summary list: 1), sediment and surface water sampling is weather dependent and may not readily fit into a first or second round of sampling schedule; 2), a Phase 3 sampling designation is an extended Phase 2 program performed to provide data for the determination of extent of contamination. Table IV.20. is provided to assist the reader's interpretation of the following text.

- First field sampling round: All AOC surface soil and subsurface soil will be screened using reconnaissance sampling techniques (Phase 1). Area 7 will also be sampled at a Phase 2 level of effort. Any groundwater encountered during the Area 7 investigation will be sampled for laboratory analysis.

- Second field sampling round: Surface soil, subsurface soil, sediment, surface water (streams, ditches and seeps) and groundwater media for all AOCs will be investigated under Phase 2 sampling with Area 7 proceeding to an extended Phase 2 sampling (i.e., Phase 3) program, if so warranted. In non-AOCs, a Phase 1 program will be conducted on surface soils and subsurface soils.

- Third field sampling round: Based on the results of the second field sampling round, all identified contaminated media within non-AOC locations will be sampled under a Phase 2 program with further extent of contamination determination conducted for the original AOCs under a Phase 3 program.

4.4.4. Field Sampling Plan Rationale

A review of historical data and previous studies conducted in the OU5 area of Mound Plant was made and all available and relevant chemical and radiological data was used to develop the OU5 Work Plan rationale. Unfortunately, the review of historical data revealed very few studies that contained sufficient information to develop detailed DQOs. The studies that contained relevant data included:

- Operable Unit 9, Site Scoping Report; Volume 7, Waste Management, February 1993.

- Reconnaissance Sampling Report: Soil Gas Survey and Geophysical Investigations, Mound Plant Main Hill and SM/PP Hill, December 1992.

- Operable Unit 9, Site Scoping Report: Volume 3, Radiological Site Survey , December 1992.

- Reconnaissance Sampling Report: D&D Area, OU6, April 1992.

- Operable Unit 9, Site Scoping Report: Volume 6, Photo History Report, February, 1992.

- Letter Report: Preliminary Results of Reconnaissance Magnetic Survey - Mound Areas 2, 6, 7, and C, November 1990, Working Draft.

Table IV.20. Field Sampling Program Summary

Media Sampled	Field Sampling Rounds						
	Round 1		Round 2			Round 3	
	Phase 1	Phase 2[a]	Phase 1	Phase 2	Phase 3[b]	Phase 2	Phase 3
Surface Soil	AOCs	Area 7	non-AOCs	AOCs	Area 7	non-AOCs	AOCs
Subsurface soil/ Bedrock	AOCs	Area 7	non-AOCs	AOCs		non-AOCs	AOCs
Groundwater[c]		Area 7		OU5-wide		non-AOCs	
Surface Water			seeps only	OU5-wide			
Sediment				OU5-wide		OU-wide	

[a] Area 7 excluded from Phase 1 sampling.

[b] Phase 3 warranted only for the further refinement of the extent of contamination.

[c] Groundwater sampled, if encountered during a Phase 2 or Phase 3 boring activity.

Phase 1 = Reconnaissance Sampling

Phase 2 = RI Sampling

Phase 3 = Extended Phase 2 Sampling

At this time, there is no qualitative chemical data known for any of the AOCs at OU5 designated areas. Soil gas survey data exists at Areas 3, 7, and J. Soil gas survey data provides a qualitative screen for possible chemical contamination at a site and is useful in devising sampling strategy and locations. However, soil gas survey data does not meet EPA protocol standards for analytical data (RI quality) and cannot be used for RA determinations. Before final DQOs can be determined for any AOC at OU5, chemical analysis of soil and, if encountered, groundwater samples must be performed from an appropriate number of sample locations.

Significant radiological surface soils sampling has taken place at OU5 AOCs. Table IV.1. displays summary statistics for all known radiological data available in OU5 designated areas. There is a good understanding of radiological contamination. However, the distribution of sampling points within the various areas and the quality of the previous data are not adequate to meet DQOs.

Since the site conceptual model (Figure 1.2.) cannot be adequately confirmed for any AOC at this time, a multiple-round, phased sampling approach will be carried out for each AOC in OU5. This sampling effort would be conducted by the Observational Approach process. The Observational Approach provides a framework for managing uncertainty and planning decision-making throughout the environmental restoration process. This process was developed by geotechnical engineers who dealt with uncertainty of physical properties in soil and foundation engineering. The Observational Approach would provide a phased approach toward exploration, assessment of conditions and reasonable deviations, design based on probable conditions, and contingency plans for action.

The key concept of the Observational Approach is data sufficiency. If there is not manageable uncertainty at an AOC, then data collection will be done to develop a site conceptual model. Uncertainty would be considered manageable when selected actions can be modified to address a range of potential conditions and remain effective. Deviations can then be considered and actions can be planned if a low potential for unreasonable deviation is determined.

The multiple-round approach for OU5 involves FIDLER surveys, passive-time integrative soil gas surveys, and geophysical surveys as Phase 1 studies. The FIDLER and soil gas surveys will provide a reconnaissance screening to be used for a qualitative soil sampling that will be conducted in each AOC. Geophysical surveys will be conducted in AOCs known to have histories of landfill activities.

Under Phase 2 exploratory studies, subsurface soil borings will be sampled at each AOC to obtain quantitative data for chemical and radiological constituents to meet DQOs specified in this work plan and the QAPjP. The data collected will determine if any areas have contaminant levels greater than the laboratory detection limits ("hot spots"). The data acquired will be combined with historical radiological data to develop statistical parameters for selection of numbers of samples and sampling sites for Phase 3 soil boring after results of groundwater/seep water sample analyses have been reviewed. Based upon the results of various OU9 preliminary surface water and sediment sampling efforts and South Property seep(s) analysis, additional surface water and sediment sampling may be required under a Phase 2 program. As an additional quality control step, all Phase 2 and Phase 3 samples shipped from Mound must be radiologically tested by the Mound Plant Soils Screening facility prior to being released.

As discussed earlier, each AOC will have a site specific FSP prepared. Because of the lack of chemical data, most of the AOCs will start with Phase 1 studies. However, Area 7 has already been partially screened to assess qualitative chemical contamination. Efforts at this area will also consist of a Phase 2 effort with soil sampling analyzed under EPA protocols.

4.4.4.1 FIDLER Surveys

Site reconnaissance for the Phase 1 study would begin with a FIDLER radioactivity screen. Each AOC would have surface readings collected according to SOP 6.7 on a 25 foot grid, beginning at one corner of a grid block and progressing in a serpentine pattern over the entire block, ending in the diagonally opposite corner of the block. Randomly selected locations will be analyzed in duplicate by the Mound Plant Soils Screening facility to verify the field readings.

4.4.4.2. Soil Gas Surveys

Site reconnaissance for the Phase 1 study would continue with passive-time integrated soil gas survey. The soil gas collectors will be placed in a 25 foot grid system throughout an AOC. After the soil gas collectors are retrieved, the collectors will be analyzed and the identified compounds will be mapped. The resulting soil gas flux maps will be reviewed and used to determine locations for the sampling effort for the Phase 2 study conducted during the second round of sampling. The soil gas survey procedure is outlined in the OU5 QAPjP.

4.4.4.3. Geophysical Surveys

Geophysical surveys will be conducted in AOCs that have a history of landfill and burial activities. The purpose of these surveys is to detect buried objects and the boundaries of the buried materials.

Magnetometer/gradiometer surveys will be placed on a grid of traverse lines 20 feet apart. Electromagnetic (EM) surveys will be conducted on the same grid pattern described above. Results will be mapped and taken into account when determining Phase 2 sample locations. The geophysical survey SOPs are outlined in the OU5 QAPjP, Appendix A.

4.4.4.4. Soil Characterization

Soil sampling will be conducted as part of Round 2 (Phase 2) and, possibly, a third round of sampling (Phase 3). Mound ER Program SOPs 4.1, 5.1, and 5.3 for soil samples will be followed as part of the effort for sampling at each AOC. All samples will be analyzed for the OU5 COC list as specified in the OU5 QAPjP. Site specific sampling procedures for each AOC are located in the FSP.

4.4.4.5. Groundwater Characterization

The characterization of groundwater associated with each OU5 AOC will be conducted in a phased manner and in coordination with the site-wide (OU9) groundwater characterization project. The initial phase of groundwater characterization will concentrate on collecting groundwater samples from existing OU9 monitoring wells located in the proximity of the AOCs. The second phase of groundwater characterization will commence after the results of the AOC soil borings have been analyzed and specific groundwater concerns have been identified. The results of soil borings (e.g., identification of any perched water tables) will be used to efficiently locate any monitoring wells. Any wells will be located and the screens will be set to address lithology and contaminant profiles (soil and groundwater).

Eleven OU9 monitoring wells have been identified (Table IV.21.) for sampling during the first phase of the groundwater characterization. The wells will be sampled for the OU5 project if OU9 analysis is insufficient for characterization. Groundwater samples will be analyzed for a suite of analytes and parameters consistent with the OU5 COC list. Groundwater sampling will be performed according to Mound ER Program SOPs 2.1 and 2.8.

4.4.4.6. Surface Water Characterization

The surface water characterization will be performed on surface water derived from seeps, the plant drainage ditch, and ephemeral stream channels. The sample activity will be conducted under a second sampling round, Phase 2 program. Ideally, seeps identified down gradient of OU5 AOCs should provide a first approximation of contamination contributed from the AOCs. However, the critical seep sample location will be based on a seep survey on the flanks of the SM/PP Hill and preliminary OU9 plant drainage ditch/ephemeral stream sampling results. The critical sample locations for the plant drainage

Table IV.21. OU9 Groundwater Monitoring Wells to be Sampled for OU5 Investigations

Well Number	OU5 AOC[1]	Well Location	Screened Depth (ft.)[2]	Zone Screened[3]
0137	Area 3	Downgradient	54-56	UBV
0312	Area 3	Within site (West edge; downgradient)	22-32	UBV
0315	Area 3	Downgradient	43-53	UBV
0347	Area 3	Within site (downgradient)	57-67	UBV
0112	Area 7	Downgradient (in drainage)	25-35	BR
0318	Area 7	Within site (NE corner; side gradient)	18-28	BR
0395	Area 7	Within site	60-70	LBV
0111	Areas 8 and 9	Downgradient (in drainage)	57-67	UBV
0345	Area 13	Within site (NE corner; side gradient	35-40	LBV
0325	Area 21	Downgradient	20-30	BR
0326	Area J	Within site (east edge; upgradient)	23-33	BR

Notes: [1] AOC: Area of Concern.
[2] Screened interval measured in feet below land surface.
[3] Hydrogeologic zone in which well is screened:
UBV: Upper Buried Valley Aquifer
LBV: Lower Buried Valley Aquifer
BR: Bedrock Aquifer

ditch and ephemeral stream channel have not been selected at this time, due to lack of information from the OU9 sampling program.

The seep survey on the SM/PP Hill will be scheduled to maximize the likelihood of finding seeps. The most likely time to find wet weather seeps is during the late winter/early spring when plant activity and evapotranspiration are minimized and meltwater/rainwater infiltration is maximized. Seeps identified during the survey will be marked and evaluated from the standpoint of whether flow is sufficient to provide a required sample volume. All suitable seeps will be sampled at least once (during the period of optimum flow). Seeps will be revisited periodically, especially after storm events, to estimate flow and collect samples. Samples will be analyzed for a suite of analytes and parameters that is consistent with the OU9 program. Surface water from seeps will be collected under Mound ER Program SOP 2.9.

4.4.4.7. Sediment Characterization

Sediment sampling will be conducted as part of Round 2 (Phase 2) and, possibly, another round of sampling (Round 3). Locations for sediment sampling will be determined using the results of the seep survey and OU9 preliminary sampling results of the plant drainage ditch and the New Property drainage systems.

Mound ER Program SOPs 4.1, 5.1, and 5.3 for soil samples will be followed as part of the sediment sampling effort. All samples will be analyzed for the OU5 COC list as specified in the OU5 QAPjP.

5. RI/FS TASKS

Because of the size and complexity of the Mound Plant RI/FS, the site has been divided into OUs for ease of management. Each of the 14 tasks (except Enforcement Support, as stated below) identified by the EPA as standard for federally led RI/FS work plan tasks (EPA 1988a) will be performed for OU5 as part of the overall RI/FS process at Mound Plant. The level of detail used in completing each task depends upon the interaction between OU5 and OU9. Some tasks, such as the ecological RA and the site wide BRA, will be addressed as part of the OU9 site-wide work for the Mound Plant as a whole with input from each of the individual OUs.

There are two site-specific considerations for the identification of RI/FS tasks:

- EPA guidance for CERCLA typically assumes that the RI/FS is going to be performed by the EPA, whereas for the Mound Plant the DOE is the lead federal agency; and,
- the FFA between the DOE and the EPA includes specific requirements for RI/FS tasks that supersede those normally in CERCLA clean-ups.

Accordingly, the following 13 sections (5.1.-5.13.) are modified from the 14 tasks identified by the EPA as standard to fulfill the requirements for the RI/FS in OU5 with the enforcement support task not discussed because the EPA is not the lead agency and, therefore, not necessary.

As first described in the OU9, Site-wide Work Plan (DOE 1992a), there are some specific comments that apply to the RI/FS tasks for OU5:

- Tasks include both draft and final versions of deliverables unless otherwise noted.
- The RI/FS for OU5 will be monitored and reported separately. However, many of the tasks identified for OU5 will be performed in other operable units as well.
- Costs are not discussed in this section. Because the DOE, rather than the EPA, is the lead agency, the more detailed cost information required for Superfund-led RI/FS is not included.
- Cost management and reporting is the responsibility of the DOE, not the Superfund, and will not follow EPA guidance.
- The preparation of each deliverable document incorporates an internal DOE process of review and revision.

5.1. TASK 1: SCOPING

All activities associated with this task have been accomplished under the site wide scoping documents developed under the OU9, Site-Wide Work Plan (DOE 1992a). No additional general scoping efforts, including those related to the development of a conceptual site model, will be accomplished for OU5.

5.2. TASK 2: PROJECT PLANNING

This task typically includes efforts related to initiating an operable unit-specific RI/FS after the scope of work is issued. The project planning task is defined as complete when the work plan and the supplemental plans [FSP, QAPjP, HSP and community relations plan (CRP)] are approved in whole or in part.

5.3. TASK 3: COMMUNITY RELATIONS

This task will be conducted under the auspices of the Operable Unit 9, Site-Wide Work Plan (DOE 1992a). The OU9, Site-Wide Work Plan (DOE 1992a) Community Relations Plan for CERCLA activities has been prepared for Mound Plant and is included as a companion document to the Operable Unit 9, Site-Wide Work Plan. The FFA between the DOE and EPA directs that public relations shall be implemented to fulfill RCRA requirements as well. See Appendix D of the Operable Unit 9, Site-Wide Work Plan for a discussion of the NEPA requirements.

5.4. TASK 4: FIELD INVESTIGATIONS

This task involves efforts related to field work in conducting the RI. The task begins when any element, as outlined in the work plan, is approved (in whole or in part) and field work is authorized. Field investigation is defined as complete when the contractor and subcontractors are demobilized from the field (analysis and data management functions can continue past this time frame). The following activities are planned as part of the activities to be accomplished under the OU5 Work Plan:

- field screening/analyses;
- soil sampling;
- sediment sampling;
- geologic/hydrogeologic investigations including well installation, as necessary;
- geophysics; and,
- water sampling at seeps and surface water impoundments on the SM/PP Hill and the New Property.

Field activities will be performed according to the OU5 FSP. Investigations will be performed according to Mound Plant ER Program SOPs (DOE 1993d). The SOPs applicable to OU5 activities are described in the OU5 QAPjP and HSP, and are presented in the OU9 Site-wide QAPjP (DOE 1993d). The OU9 Site-wide QAPjP provides the standard SOPs for any field work undertaken under the Operable Unit 9, Site-wide Work Plan (DOE 1992a) RI. The OU5 QAPjP will contain only those SOPs not included in the Operable Unit 9, Site-wide QAPjP (DOE 1993d).

Although field investigations are intended to be flexible in order to achieve the objectives of the RI/FS, a detailed FSP is provided with this work plan. The field investigation in OU5 is summarized in the following paragraphs. The sample parameters for these investigations can be found in the DQO Tables IV.1. through IV.18.

Sampling in the AOCs will be used to determine the nature and extent of radiological and chemical contaminants present including; volatile organic compounds, semivolatile organic compounds, pesticides/PCBs, metals, radionuclides, and United States Army Toxic and Hazardous Materials Agency (USATHAMA) high explosives as shown in the OU9 Work Plan. The sampling strategy in the AOCs will be based upon a statistical analysis of existing data and any additional Phase I (screening) data acquired under the OU5 RI/FS necessary to develop an appropriate sampling strategy, using the guidance contained in "Appendix A, Statistical Considerations, Data Quality Objectives for Remedial Response Activities", (EPA 1987).

Groundwater samples will be collected from existing and proposed (OU9) monitoring wells near OU5 AOCs. Most existing groundwater monitoring wells are located in the valley and thus will be used to evaluate the contribution of contaminants from OU5 AOCs to the BVA. The proposed OU9 monitoring wells that will supply data for OU5 AOCs are primarily bedrock wells located around the SM/PP Hill and the New Property. These wells will also supply data for the groundwater quality in the BVA tributary valley. A phased approach is proposed for those AOCs on the SM/PP Hill and overlaying the tributary valley that cannot be adequately evaluated by existing and proposed groundwater monitoring locations. The phased approach is based on the current conceptual model for bedrock groundwater flow. Based on that model, shallow groundwater in the SM/PP Hill bedrock flows down through interconnected vertical fractures until it reaches one of several laterally continuous, thick shale layers. These layers serve as the base of perched aquifer discharges at localized seeps where the shale beds crop out.

Using stratigraphic information generated during installation of OU9 bedrock wells, the hypothesized elevation of the shale beds will be identified. A comprehensive survey (Phase 2) of the flanks of the SM/PP Hill will focus on appropriate elevation contours, as determined by stratigraphy, during wet periods in the late fall or early spring. During these times, infiltration to a perched water table will be minimally impacted by plant uptake and evapotranspiration. Wet weather seeps will be identified and selected seeps will be sampled.

Subsequent phase (Phase 3, etc.) activities would be initiated if the seep investigation can not delineate groundwater flow. If identified seeps are inappropriately located (e.g. flow direction is directly downslope from an AOC) or if flow rates are insufficient to warrant sampling, monitoring wells may be installed. Monitoring well installation and construction will be guided by the results of soil borings (e.g. depth of contamination, nature of contamination, indications of water bearing zones) in and around the subject AOC.

5.5. TASK 5: SAMPLE ANALYSIS AND VALIDATION

Based upon specified detection limits in the OU5 QAPjP, the samples will be analyzed according to CLP and other reference methods cited in the OU5 QAPjP and/or the OU9 Site-Wide QAPjP. These methods have been established by EPA, the American Society for Testing and Materials (ASTM), or other agencies. Parameters assigned an analytical level IV will be analyzed using USEPA's CLP Statement of Work (SOW). Other analytes of interest, such as chloride, nitrate-nitrite, and tritium, will be analyzed by EPA methodologies. Radionuclides of interest will be analyzed according to EPA methods, as described in the OU9 and OU5 QAPjPs. The planned analytical methodologies and sample preparation techniques for each parameter group, as well as the quality control procedures to be implemented for these analyses, is presented in the OU5 QAPjP.

Data validation will be accomplished for all CLP data received from the laboratories in accordance with "Laboratory Data Validation - Functional Guidelines for Evaluation of Inorganic Analyses, July 1, 1988", and "Laboratory Data Validation - Functional Guidelines for Evaluation of Organic Analyses, February 1, 1988", published by EPA, as specified in the OU9 Site-Wide QAPjP. All non-CLP data (e.g., for radionuclides) received from the laboratory will be validated as specified in the OU5 QAPjP, using formal, structured procedures to ensure the data meets the precision, accuracy, representativeness, comparability and completeness (PARCC) parameters specified in the QAPjPs (OU5 and OU9).

5.6. TASK 6: DATA EVALUATION

This task includes efforts related to the analysis of data once it has been verified that the data are of acceptable accuracy and precision. The task begins on the date that the first set of validated data is received by the project team and ends during preparation of the RI report when it is deemed that no additional data are required. Guidance on data evaluation is provided in the FFA between the DOE and EPA. Recommended activities include:

- data reduction and tabulation using the ER Program data management system; and,
- environmental fate and transport modeling/evaluation.

As the data are validated, the process of evaluating the data collected for OU5 will begin. The goals of the OU5 RI are to:

- refine the conceptual model for OU5;
- determine the nature and extent of contamination;
- determine whether interim remedial actions can be implemented to mitigate existing contamination;
- gather sufficient data to develop a RA for OU5; and,
- collect sufficient data to evaluate remedial action technologies.

The following data evaluation tasks have been identified to fulfill the goals of the OU5 RI. As work progresses in OU5 and additional data are collected, the list of data evaluation activities may change.

5.6.1. Literature Review and Personnel Interviews

Part of the data evaluation will be a review of existing Mound Plant files and records and an extensive review of data collected in other OUs. The information gathered from OUs 1, 2, 3, 4, 6, and 9 efforts need to be evaluated at each phase of the OU5 Field Program. Several of the data collection activities in the other OUs are specifically designed or will be used to augment the data collected in OU5. For instance, OU9 will be installing deep wells, conducting geophysical surveys and obtaining soil samples, on the SM/PP Hill and the South Property. These data will augment the data obtained during the RI/FS in OU5.

Personnel interviews to obtain historical process information and other related data regarding past operations at the Mound Plant are being conducted as part of the Site Wide RI/FS activities under OU9. No personnel interviews are planned as part of the RI/FS activities under OU5. However, as the RI/FS for OU5 proceeds, questions may arise that can only be addressed through the personnel interview process. Under these circumstances, additional personnel interviews, if needed, will be accomplished by or coordinated with the appropriate OU9 RI/FS task manager.

5.6.2. Geologic/Hydrogeologic Description

Data collected during the RI will be used to generate or revise the following figures:

- geologic cross sections through the SM/PP Hill and the New Property;
- bedrock surface map;
- unconsolidated sediment isopath map;
- water level contours in the bedrock system; and,
- hydrographs for the bedrock wells.

Water level measurements in any shallow OU5 wells will be correlated with measurements made in the wells installed for OU9 to determine, if possible, a relationship between the water levels and local recharge/discharge.

5.6.3. Soils Investigations

The soils data will be used to characterize the geotechnical and geochemical characteristics of the soil conditions on OU5. These data will be used to develop a soils map and evaluate potential remedial actions which may be constrained or otherwise impacted by the soil characteristics.

5.6.4. Numerical Modeling

Numerical modeling will be used to integrate the data collected during the RI to evaluate contaminant movement within surface runoff. The greatest potential for off-site movement of the known contamination at OU5 is in surface water and sediments transported during runoff events. The only modeling identified at this time is a watershed model to evaluate contaminant transport in overland flow, stream channel flow and sediment movement. Once the field investigation is in progress, a public domain program will be selected based upon data availability and preliminary data results. The program must be able to predict sediment transport within the watershed as well as flow within the stream channel. Stream channel routing

is also important. Other requirements include the ability to model contaminant movement in water and sediment, and the ability to model surface flows over time. The goal is to be able to model events such as a 100-year storm, as well as average annual conditions over time. By better defining probable flow paths, the results from modeling can be used to refine the field sampling plan for OU5 within new AOCs that are located in those pathways. If the necessity arises for modeling contaminant transport within the soil, a separate task could be initiated due to the complexity of such an endeavor.

It is not anticipated that a groundwater model will be developed during the OU5 RI/FS activities. This expectation is based upon the knowledge that a regional water surface has not been identified in the shallow bedrock beneath OU5. No artificial source of recharge appears to be available beneath OU5 to provide a water source. Consequently, the detailed level of data needed to develop a fracture flow model will not be obtained during the OU5 RI/FS. Should groundwater become a prime concern in OU5, a model compatible with the OU9 model will be used.

5.6.5. Nature and Extent of Contamination

The data collected from the soil borings and the field instruments will be collated into a two-dimensional map showing areal extent and three-dimensional fence diagrams showing concentrations with depth. These figures will be used to evaluate volumes of contaminated media and average concentrations for evaluation of remedial alternatives. The conceptual model described in the OU9 Work Plan will be used to evaluate probable contaminant paths to better define the areal extent of the contamination. The assumption that the non-radiological contamination will occur in the same areas as the radiological contamination will also be evaluated to determine whether this assumption is valid.

5.7. TASK 7: ASSESSMENT OF RISKS

A comprehensive BRA will be conducted as part of the OU9 RI/FS. The OU9 BRA will characterize site wide current and potential (future-use) threats to human health and the environment posed by radiological and non-radiological contaminants preset in, or migrating to, groundwater, surface water, sediment, soil, air and the food chain. The OU9 BRA will also evaluate exposure pathways that may result from contaminants migrating off-site.

Once sufficient field data is available, an OU5 specific RA will be conducted to evaluate the risks to human health posed by contaminants present in, or migrating from, the OU. The OU5 specific remedial action will only address contaminants and associated exposure routes within the OU5 boundaries and will focus on risks to human health. Ecological risks will be evaluated in the OU9 BRA.

5.8. TASK 8: TREATABILITY STUDY/PILOT TESTING

Treatability studies are conducted primarily to:

- provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis;
- reduce cost and performance uncertainties for treatment alternatives to acceptable levels so that a cost effective remedy can be selected; and,
- to support the remedial design of a selected alternative.

Data collected during site characterization may not always be adequate for assessing the feasibility of remedial technologies. However, the proven effectiveness of a developed technology will primarily determine the need for conducting treatability testing. When treatment performance is difficult to predict, an actual testing of the process may be the only means of obtaining the necessary data.

Alternatives that involve treatment or destruction typically require some form of treatability testing depending on the uniqueness of the situation. Testing may involve bench tests that are performed in a laboratory or pilot studies that simulate the physical as well as the chemical parameters of a full-scale process. Pilot studies, however, are not usually necessary for well-developed technologies when bench studies are sufficient to evaluate performance. The decision process for treatability investigations consists of the following steps:

- determine data needs;
- review existing site data/technology literature;
- perform a treatability study; and,
- evaluate data to ensure that DQOs are met.

Existing site data is currently limited in extent; therefore, no assumptions are being made concerning actual treatability testing needs. The geotechnical parameter specified in this work plan will provide enough data for a preliminary evaluation of potential treatability technologies. However, an evaluation of state of the art literature, in addition to the OU5 Phase 1 field data collection specified by this work plan, and data available from the other OUs should provide a sufficient determination of any additional

data needs that could only be met by conducting a treatability study. A recommended source of literature is the "Technology Screening Guide for Treatment of CERCLA Soils and Sludges" (EPA 1988c).

5.9. TASK 9: REMEDIAL INVESTIGATION REPORTS

This task covers all efforts related to the preparation of the findings once the data have been evaluated. The task covers all draft and final RI reports as well as task management and quality control. The task ends when the last RI document is approved by the regulators.

5.10. TASK 10: FEASIBILITY STUDY REPORTS

The FS can be viewed as occurring in three phases: development, screening, and detailed analysis of alternatives. However, in actual practice, the specific point of separation between the first two phases is not so distinct. Therefore, the development and screening of alternatives are combined to better reflect their interrelatedness.

5.10.1. Remedial Alternatives Development/Screening

The steps involved in this phase of the FS are discussed in Section 3.4. A list of broadly defined alternatives was developed on the basis of the preliminary conceptual site model of potential routes of exposure and associated receptors. Alternatives were not screened at this time. The data needs identified in this work plan must be fulfilled to further refine and proceed with the steps of this process.

5.10.1.1. Remedial Action Objectives

The data identified by this work plan should be sufficient to perform a RA and refinement of ARARs and TBC information. Subsequently, the remedial action objectives can be refined to specify media-specific or operable unit-specific remediation goals for protecting human health and the environment.

5.10.1.2. General Response Actions

The listing of response actions developed in Section 3.4 is considered fairly complete with regard to possible variations. The variations shown also correspond to the assembled list of broadly based alternatives. Little refinement is expected. Any refinement of the alternative list is best performed during the screening of the alternatives step.

5.10.1.3. Volumes or Areas of Media

Volumes or areas of media will be refined once additional information is gained about site conditions and the nature and extent of contamination. The refined remedial action objectives should consider acceptable exposure levels and potential exposure routes.

5.10.1.4. Remedial Technologies and Process Options Identification and Screening

The listing developed under this step of Section 3.4 is considered fairly comprehensive. Therefore, little refinement is expected with the collection of additional data. The most substantial screening step during the development of alternatives will occur with the evaluation of process options.

5.10.1.5. Process Options Evaluation

The evaluation of process options, the last step of developing alternatives, will require substantial refinement. Development of this step was premature for the scope of this work plan. Following additional data collection, this step serves as a substantial screening step of process options. As discussed in Section 3.4, it attempts to select one representative process for each technology type to simplify the subsequent evaluation of alternatives. Without this step, the listing of broad-based alternatives would expand substantially due to variations of process options.

5.10.1.6. Alternatives Selection

Substantial refinement of this step will not be necessary if the evaluation of process options has been performed adequately. Primarily, the detail of specific technologies and process options can be added. The additional data collected should also resolve the confusion and potential variations due to the unknowns concerning waste types.

5.10.1.7. Remedial Action Alternatives Screening

To meet the remedial action objectives, the defined alternatives have been selected primarily based on either media-specific considerations or implementability concerns. This phase of the FS process will screen the alternatives against the short- and long-term aspects of three broad criteria: effectiveness, implementability, and cost. During the screening, remedial action alternatives will be evaluated to ensure protection of human health and environment for each pathway of concern. The purpose of this screening evaluation is to reduce the number of alternatives that will undergo the detailed analysis conducted during the next phase of the FS. A technical memorandum will be issued to the regulators identifying the results of the initial screening of remedial action alternatives.

During alternative screening, the entire alternative is evaluated for its effectiveness, implementability, and cost similar to the evaluation of process options described in Section 3.4. The effectiveness evaluation considers an alternative's ability to reduce contaminant levels, to attain ARARs or other health-based levels, and to protect human health and the environment. Each alternative will be evaluated for its effectiveness in providing protection and reductions in toxicity, mobility, or volume. Reduction of these factors refers to changes in one or more characteristic of a hazardous substance or contaminated media by use of a treatment that decreases the inherent threats or risks of the hazardous material (EPA 1988a).

The implementability evaluation of remedial alternatives will include the technical and administrative feasibility of constructing, operating, and maintaining an alternative. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations until the remedial action is complete. Administrative feasibility refers to the ability to obtain approvals from various agencies, the availability of treatment, storage, and disposal services, and the requirements for and availability of specific equipment and technical specialists (EPA 1988a).

The cost evaluation will focus on the ability to make comparative estimates among alternatives. Both capital and operations and maintenance costs will be considered. The role of cost in the screening of alternatives is twofold. First, an alternative whose cost is grossly excessive in relation to its effectiveness may be eliminated. Second, if two or more alternatives provide similar levels of effectiveness and implementability using a similar method of treatment or engineering control, the more expensive may be eliminated from further consideration (EPA 1988a).

5.10.2. Detailed Analysis of Remedial Action Alternatives

The detailed analysis of remedial action alternatives consists of the analysis and presentation of relevant information to allow decision makers to select remedies for OU5. For the detailed analysis, the remedial action alternatives screened in the previous phase will be assessed against nine evaluation criteria. After making individual criterion assessments, the alternatives are compared to identify their relative advantages and disadvantages. The detailed analysis is designed to provide decision makers with sufficient information to compare the alternatives adequately, select an appropriate remedial action, and demonstrate satisfaction of the CERCLA remedy selection requirements to:

- Protect human health and the environment;
- Attain ARARs (or provide grounds for invoking a waiver);

- Achieve cost-effectiveness;

- Use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and,

- Satisfy the preference for treatment that reduces toxicity, mobility, or volume as a principal element or provide an explanation as to why it does not.

Nine evaluation criteria have been developed to address the CERCLA requirements and other statutory considerations, and to address the additional technical and policy considerations proven important for selecting remedial action alternatives (EPA 1988a). These evaluation criteria serve as the guidance and basis for conducting the detailed analyses during the FS and for subsequently selecting appropriate remedial actions.

The nine evaluation criteria are:

1. Protection of human health and the environment. This evaluation criterion assesses whether an alternative provides adequate protection of human health and the environment.

2. Compliance with ARARs. This evaluation criterion is used to determine whether an alternative complies with federal and state ARARs. It also addresses other information "to be considered."

3. Long-term effectiveness and permanence. This evaluation criterion focuses on the ability of an alternative to maintain protection of human health and the environment after response objectives are met.

4. Reduction of toxicity, mobility, or volume through treatment. This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances as a principal element.

5. Short-term effectiveness. This evaluation criterion addresses the effects of an alternative during the construction and implementation phase until remedial response objectives are met.

6. Implementability. This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative, and the availability of required services and materials during its implementation.

7. Cost. This evaluation criterion estimates the range of capital and O&M costs for each alternative, based on as complete and accurate cost data as possible.

8. State acceptance. This evaluation criterion reflects the statutory requirement to provide for substantial and meaningful State involvement.

9. Community acceptance. This evaluation criterion reflects the community's apparent preferences among or concerns about remedial alternatives under consideration.

The first two criteria must be met by an alternative to be eligible for selection. The assessment of overall protection of human health and the environment is based on the risk-based goals described in CERCLA and the NCP and also draws upon the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. The EPA has maintained protection of human health and the environment as the first criterion of the detailed analysis due to the clear statutory mandate. The compliance with ARARs criterion is used to determine whether each alternative will meet the federal and state ARARs identified in previous stages of the RI/FS process. The detailed analysis will summarize which requirements are applicable or relevant and appropriate to an alternative, and describe how the alternative meets these requirements.

The next five criteria will require the most detailed analysis because evaluation of the advantages and disadvantages of alternatives will focus on one or more of these criteria. Note that the evaluation of alternatives under long-term effectiveness and permanence includes consideration of the degree of threat posed by any hazardous substances remaining at the site and the adequacy and reliability of any controls (engineering or institutional controls) used to manage hazardous substances (EPA 1990d). The short-term effectiveness criterion, however, focuses on the effects on human health and the environment during implementation of the remedial action and how alternatives will protect the community during remedial action.

The detailed analysis evaluates and compares the cost of the remedial alternatives, but will not draw conclusions about their cost effectiveness. In addition, the cost evaluation will include costs of future remedial actions when there is reasonable expectation that a major component of a remedy will require replacement. The cost effectiveness of an alternative is determined in the remedy selection phase.

The state and community acceptance criteria are considered following comment on the RI/FS report and the proposed remedial action plan.

The alternatives defined during the development and screening phase may require better definition. Each alternative will be reviewed to determine if additional information, such as preliminary design calculations, process flow diagrams, preliminary site layout, or limitations, assumptions, and uncertainties, is required to apply the evaluation criteria consistently.

The detailed analysis of the remedial action alternatives will be presented as a narrative discussion accompanied by a summary table. A description of the alternative and a discussion of the individual criteria assessment will be provided. The alternative description will provide data on technology components, quantities of hazardous materials handled, time required for implementation, process sizing, implementation requirements, and assumptions.

The second part of the detailed analysis is the comparative analysis, which will evaluate the relative performance of each remedial action alternative in relation to each specific evaluation criterion. The purpose of the comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another.

5.11. TASK 11: POST RI/FS SUPPORT

This task includes efforts to prepare the responsiveness summary, provide support to the DOE in its preparation of the ROD and associated public participation, conduct any predesign activities, and close out the work assignment. All activities occurring after the release of the FS to the public should be reported under this task. The following are typical activities:

- preparing the proposed remedial design/remedial action plan, including a summary of what will occur during remedial action;
- preparing the predesign report;
- preparing the conceptual design;
- attending public meetings;
- writing and reviewing the responsiveness summary;
- preparing the ROD and briefings;
- reviewing and providing quality control of the work effort; and,
- providing task management and quality control.

It is anticipated that a ROD will be completed for the site as a whole after the completion of all RI/FS activities for each operable unit. An individual ROD will also be completed for OU5 specifically.

5.12. TASK 12: MISCELLANEOUS SUPPORT

This task includes work that is associated with the project but is outside the normal RI/FS scope of work. Activities will vary, but may include the following:

- Meeting the miscellaneous requirements of the FFA between the DOE and the EPA, including the yearly update of schedules, monthly project managers meeting and monthly reports;
- Coordination with other Mound Plant environmental programs;
- Specific support coordination with and review of Agency for Toxic Substances and Disease Registry (ATSDR) activities and reports;
- Support for special federal, state or local projects;
- NEPA coordination, including preparing integrated CERCLA/NEPA documents and coordinating the preparation of a Site Wide Environmental Impact Statement;
- Support for interim remedial actions; and,
- Natural Resource Trustee requirements, including natural resource damage assessments, and fulfillment of the requirements to replace or make restitution for such damage.

5.13. TASK 13: REMEDIAL DESIGN/REMEDIAL ACTION

The FFA requires that the DOE submit to the EPA for approval a work plan for RD/RA. The submittal is required within 60 days of finalization of the ROD for the site as a whole or for any OU. The RD/RA work plan and subsequent tasks are not RI/FS tasks and, therefore, are not addressed in this RI/FS work plan.

6. SCHEDULE

The FFA between the EPA and the DOE provides that "each year DOE shall provide for the EPA approval an overall schedule for all ER Program activities at the Mound Plant." The minimum contents of that schedule include:

- RI/FS studies;
- other studies;
- proposed plan preparation; and,
- ROD preparation.

The schedule submitted to the EPA for approval will include different levels of detail for different years, as prescribed by the FFA, including at least:

- monthly events for the current year;
- quarterly events for the following year, and,
- yearly events for additional years.

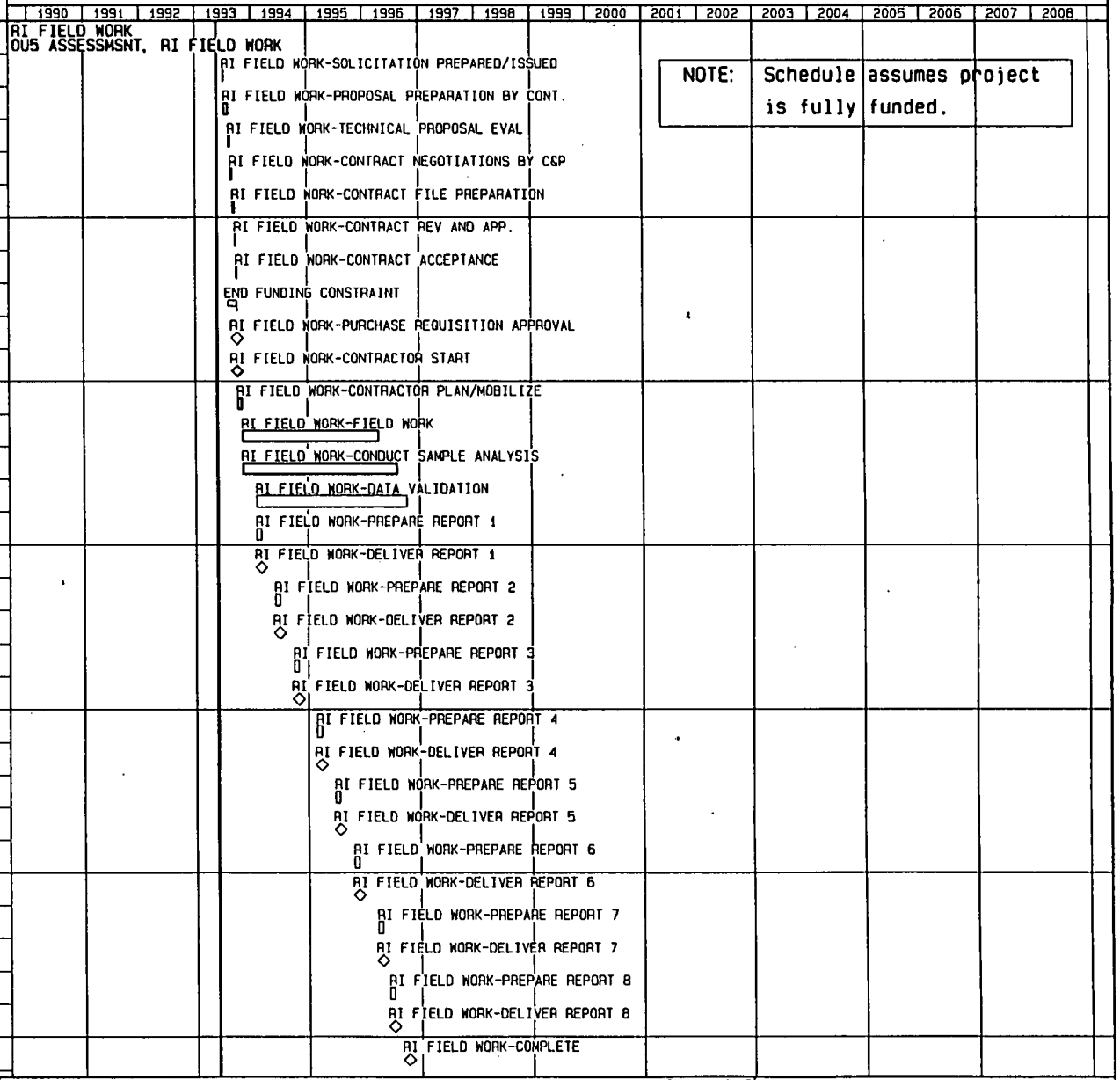
The schedule is updated on a yearly basis. The schedule showing the submitted 1993 updated activity listing is included at the end of this section. The forecast dates contained in the schedule are based on current best estimates of the time required to complete the activities identified. As additional information from field investigations and data analysis becomes available, refinement to these projections will be made in accordance with provisions of the FFA.

In parallel with the schedules for the Mound Plant, the DOE prepares an ER and Waste Management Plan (Five-Year Plan) that identifies, integrates, and prioritizes environmental compliance and clean-up activities at all the DOE nuclear facilities and sites nationwide. The Five-Year Plan is updated annually and incorporates the availability of Congressional funding and application of a national prioritization system to environmental restoration and waste management activities conducted under the Five-Year Plan. It is the intent of the DOE that schedules submitted to the EPA for Mound Plant be consistent with the Five-Year Plan.

The FFA provides that schedules may be amended during the year with the mutual consent of the respective remedial project managers. This would include the modification of schedules for additional work identified during the course of the RI/FS, such as completing an addendum to an approved work plan. Schedules may also be modified consistent with provisions of the FFA that allow the EPA and the DOE to extend their specified period for commenting and responding to comments on documents. Therefore, a detailed OU5 schedule will be issued concurrently, but separately from this Work Plan and the OU5 FSP.

Removal actions are not shown in the current schedule because none are currently identified. As interim remedial actions are identified they will be added to the schedule of activities.

ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR	ACTO
C540W0020	30JUN93	6JUL93	7	140200003
C540W0030	7JUL93	5AUG93	30	140200004
C540W0040	6AUG93	19AUG93	14	140200005
C540W0050	20AUG93	2SEP93	14	140200006
C540W0060	3SEP93	16SEP93	14	140200007
C540W0070	17SEP93	23SEP93	7	140200008
C540W0080	24SEP93	30SEP93	7	140200009
C540FX085	10CT93		0	
C540MX010	10CT93		0	140200002
C540MX084	10CT93		0	
C540W0090	10CT93	31OCT93	31	140210000
C540W0100	1NOV93	12APR96	894	140221000
C540W0120	1NOV93	10AUG96	1014	140222000
C540W0140	30JAN94	9OCT96	984	140223000
C540W0150	31JAN94	1MAR94	30	140224100
C540MX160		1MAR94	0	140224200
C540W0170	1JUN94	30JUN94	30	140224300
C540MX180		30JUN94	0	140224400
C540W0190	30SEP94	29OCT94	30	140224500
C540MX200		29OCT94	0	140224600
C540W0210	28FEB95	29MAR95	30	140224700
C540MX220		29MAR95	0	140224800
C540W0230	29JUN95	28JUL95	30	140224900
C540MX240		28JUL95	0	140224A00
C540W0240	28OCT95	26NOV95	30	
C540MX242		26NOV95	0	
C540W0250	27MAR96	25APR96	30	
C540MX246		25APR96	0	
C540W0260	9JUN96	8JUL96	30	
C540MX248		8JUL96	0	
C540MX250		9OCT96	0	140230000



NOTE: Schedule assumes project is fully funded.

Plot Date 18AUG93
Data Date 24MAY93
Project Start 10CT89
Project Finish 19APR09

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Activity Bar/Early Dates
Critical Activity
Progress Bar
◇/P Milestone/Flag Activity

TWO COUS

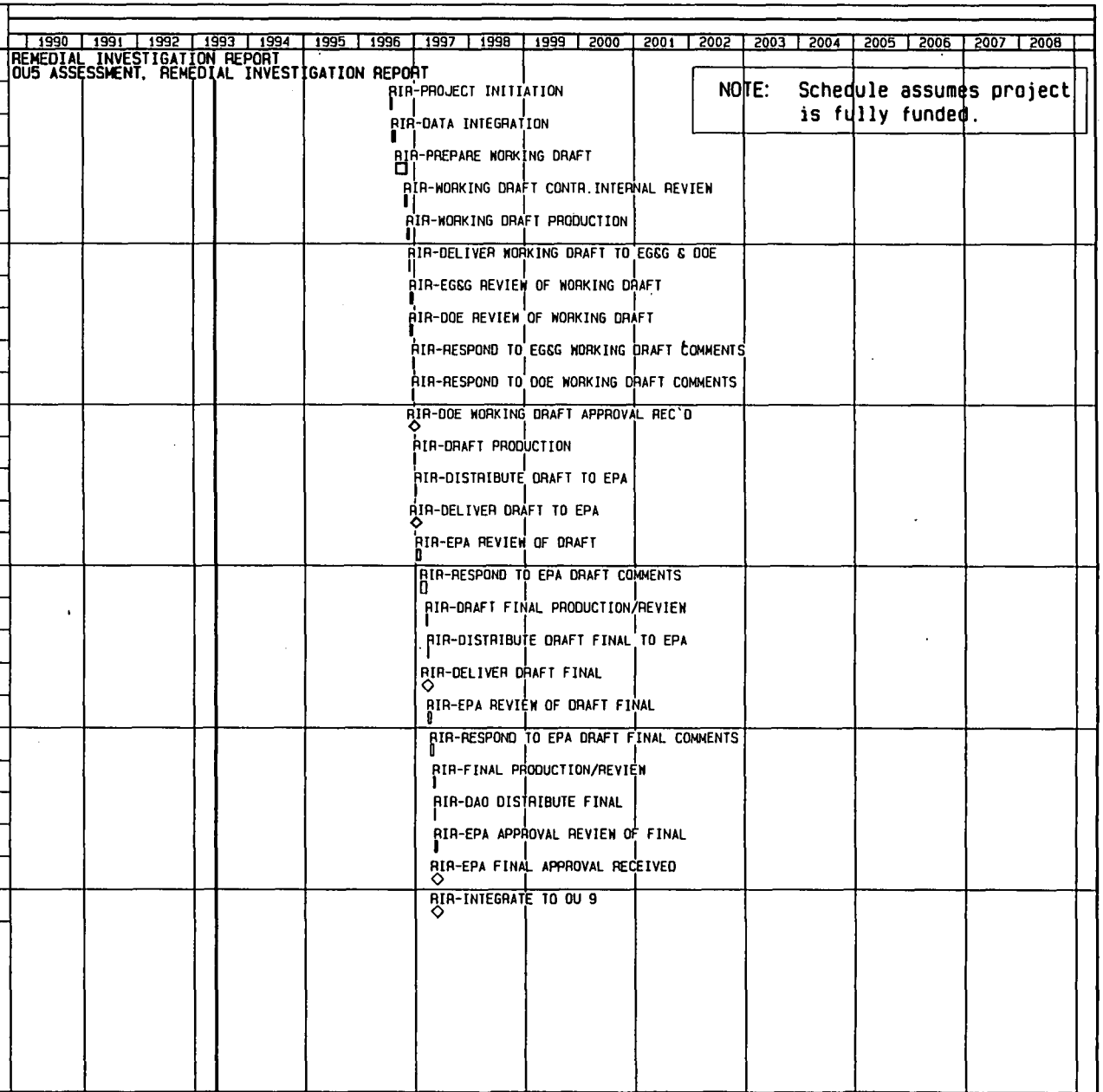
Sheet 1 of 5

OU5 SOUTH PROPERTY
EG&G MOUND ER PROGRAM
OU5 DETAIL SCHEDULE

FOR INCLUSION IN THE WORK PLAN

Date	Revision	Checked	Approved

ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR	ACTO	
					REMEDIAL INVESTIGATION REPORT OU5 ASSESSMENT, REMEDIAL INVESTIGATION REPORT
C544W0010	28JUL96	10AUG96	14	144110000	RIR-PROJECT INITIATION
C544W0020	11AUG96	31AUG96	21	144121100	RIR-DATA INTEGRATION
C544W0030	1SEP96	14NOV96	75	144121200	RIR-PREPARE WORKING DRAFT
C544W0040	1NOV96	14NOV96	14	144121300	RIR-WORKING DRAFT CONTR.INTERNAL REVIEW
C544W0050	15NOV96	28NOV96	14	144123000	RIR-WORKING DRAFT PRODUCTION
C544W0060	29NOV96	1DEC96	3	144123011	RIR-DELIVER WORKING DRAFT TO EG&G & DOE
C544W0070	2DEC96	22DEC96	21	144123021	RIR-EG&G REVIEW OF WORKING DRAFT
C544W0090	2DEC96	22DEC96	21	144123041	RIR-DOE REVIEW OF WORKING DRAFT
C544W0080	23DEC96	29DEC96	7	144123031	RIR-RESPOND TO EG&G WORKING DRAFT COMMENTS
C544W0100	23DEC96	29DEC96	7	144123051	RIR-RESPOND TO DOE WORKING DRAFT COMMENTS
C544WX110		29DEC96	0	144123061	RIR-DOE WORKING DRAFT APPROVAL REC'D
C544W0120	30DEC96	6JAN97	8	144123071	RIR-DRAFT PRODUCTION
C544W0130	7JAN97	9JAN97	3	144123081	RIR-DISTRIBUTE DRAFT TO EPA
C544P3140	10JAN97		0	144123091	RIR-DELIVER DRAFT TO EPA
C544W0150	10JAN97	8FEB97	30	144123101	RIR-EPA REVIEW OF DRAFT
C544W0160	9FEB97	14MAR97	34	144123111	RIR-RESPOND TO EPA DRAFT COMMENTS
C544W0170	15MAR97	22MAR97	8	144123121	RIR-DRAFT FINAL PRODUCTION/REVIEW
C544W0180	23MAR97	25MAR97	3	144123131	RIR-DISTRIBUTE DRAFT FINAL TO EPA
C544WX190	26MAR97		0	144123141	RIR-DELIVER DRAFT FINAL
C544W0200	26MAR97	14APR97	20	144123151	RIR-EPA REVIEW OF DRAFT FINAL
C544W0210	15APR97	3MAY97	19	144123161	RIR-RESPOND TO EPA DRAFT FINAL COMMENTS
C544W0220	4MAY97	11MAY97	8	144123171	RIR-FINAL PRODUCTION/REVIEW
C544W0230	12MAY97	14MAY97	3	144123181	RIR-DAO DISTRIBUTE FINAL
C544W0240	15MAY97	28MAY97	14	144123191	RIR-EPA APPROVAL REVIEW OF FINAL
C544WX250		28MAY97	0	144123201	RIR-EPA FINAL APPROVAL RECEIVED
C544WX260		28MAY97	0	144150000	RIR-INTEGRATE TO OU 9



NOTE: Schedule assumes project is fully funded.

Plot Date 18AUG93
Data Date 24MAY93
Project Start 10CT89
Project Finish 19APR09

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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

TWO COUS

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OU5 SOUTH PROPERTY
EG&G MOUND ER PROGRAM
OU5 DETAIL SCHEDULE

FOR INCLUSION IN THE WORK PLAN

Date	Revision	Checked	Approved

ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR	ACTO	
					FEASIBILITY STUDY/PROPOSED PLAN OU5 ASSESSMENT, FEASIBILITY STUDY/PROPOSED PLAN
C545MX010	17AUG96		0	145100002	FSR/PP-PURCHASE REQUISITION APPROVAL
C545W0020	17AUG96	23AUG96	7	145100003	FSR/PP-SOLICITATION PREPARED/ISSUED
C545W0030	24AUG96	22SEP96	30	145100004	FSR/PP-PROPOSAL PREPARATION BY CONTRACTOR
C545W0040	23SEP96	6OCT96	14	145100005	FSR/PP-TECHNICAL EVAL OF PROPOSAL
C545W0050	7OCT96	20OCT96	14	145100006	FSR/PP-CONTRACT NEGOTIATIONS
C545W0060	21OCT96	3NOV96	14	145100007	FSR/PP-CONTRACT FILE PREPARATION
C545W0070	4NOV96	10NOV96	7	145100008	FSR/PP-REVIEW AND APPROVAL
C545W0080	11NOV96	17NOV96	7	145100009	FSR/PP-CONTRACT ACCEPTANCE
C545W0090	18NOV96	1DEC96	14	145100010	FSR/PP-CONTRACTOR PLAN/MOBILIZE
C545W0110	2DEC96	31DEC96	30	145121100	FSR/PP-ASSEMBLE INIT OBJECTIVE & ALT
C545W0120	1JAN97	30JAN97	30	145121200	FSR/PP-INITIAL SCREEN OF RA ALTS
C545W0160	10JAN97	9MAY97	120	145121500	FSR/PP-DETAILED ANALYSIS OF ALTS
C545W0170	10JAN97	14FEB97	36	145121610	FSR/PP-COMPILE NEPA INFORMATION
C545W0150	31JAN97	1MAR97	30	145121400	FSR/PP-EVAL ALTS & COST EFFECTIVENESS
C545MX130	9FEB97		0	145121310	FSR/PP-SUBMIT RA ALTS/ARARS
C545W0140	9FEB97	10MAR97	30	145121320	FSR/PP-EPA REVIEW ALTS/ARARS
C545W0180	15FEB97	30MAR97	44	145121620	FSR/PP-PREPARE INTEGRATED SECTION
C545W0200	5APR97	9MAY97	35	145121800	FSR/PP-PREP WORK DRFT PROPOSED PLAN
C545W0190	26APR97	9MAY97	14	145121700	FSR/PP-CONTRACTOR INTERNAL REVIEW
C545W0210	10MAY97	23MAY97	14	145123000	FSR/PP-PRODUCE WORKING DRAFT
C545W0220	24MAY97	26MAY97	3	145123011	FSR/PP-DELIVER WORKING DRAFT TO EG&G & DOE
C545W0230	27MAY97	16JUN97	21	145123021	FSR/PP-EG&G REVIEW OF WORKING DRAFT
C545W0250	27MAY97	16JUN97	21	145123041	FSR/PP-DOE REVIEW OF WORKING DRAFT
C545W0240	17JUN97	23JUN97	7	145123031	FSR/PP-RESPOND TO EG&G WORKING DRAFT COMMENTS
C545W0260	17JUN97	23JUN97	7	145123051	FSR/PP-RESPOND TO DOE WORKING DRAFT COMMENTS
C545MX270		23JUN97	0	145123061	FSR/PP-DOE WORKING DRAFT APPROVAL REC'D
C545W0280	24JUN97	1JUL97	8	145123071	FSR/PP-PRODUCE DRAFT
C545W0290	2JUL97	4JUL97	3	145123081	FSR/PP-DISTRIBUTE DRAFT TO EPA
C545P5300	5JUL97		0	145123091	FSR/PP-DELIVER DRAFT TO EPA
C545W0310	5JUL97	3AUG97	30	145123101	FSR/PP-EPA REVIEW OF DRAFT
C545W0320	4AUG97	6SEP97	34	145123111	FSR/PP-RESPOND TO EPA DRAFT COMMENTS

1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008

NOTE: Schedule assumes project is fully funded.

Plot Date 18AUG93
Data Date 24MAY93
Project Start 1OCT89
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Activity Bar/Early Dates
Critical Activity
Progress Bar
◇/P Milestone/Flag Activity

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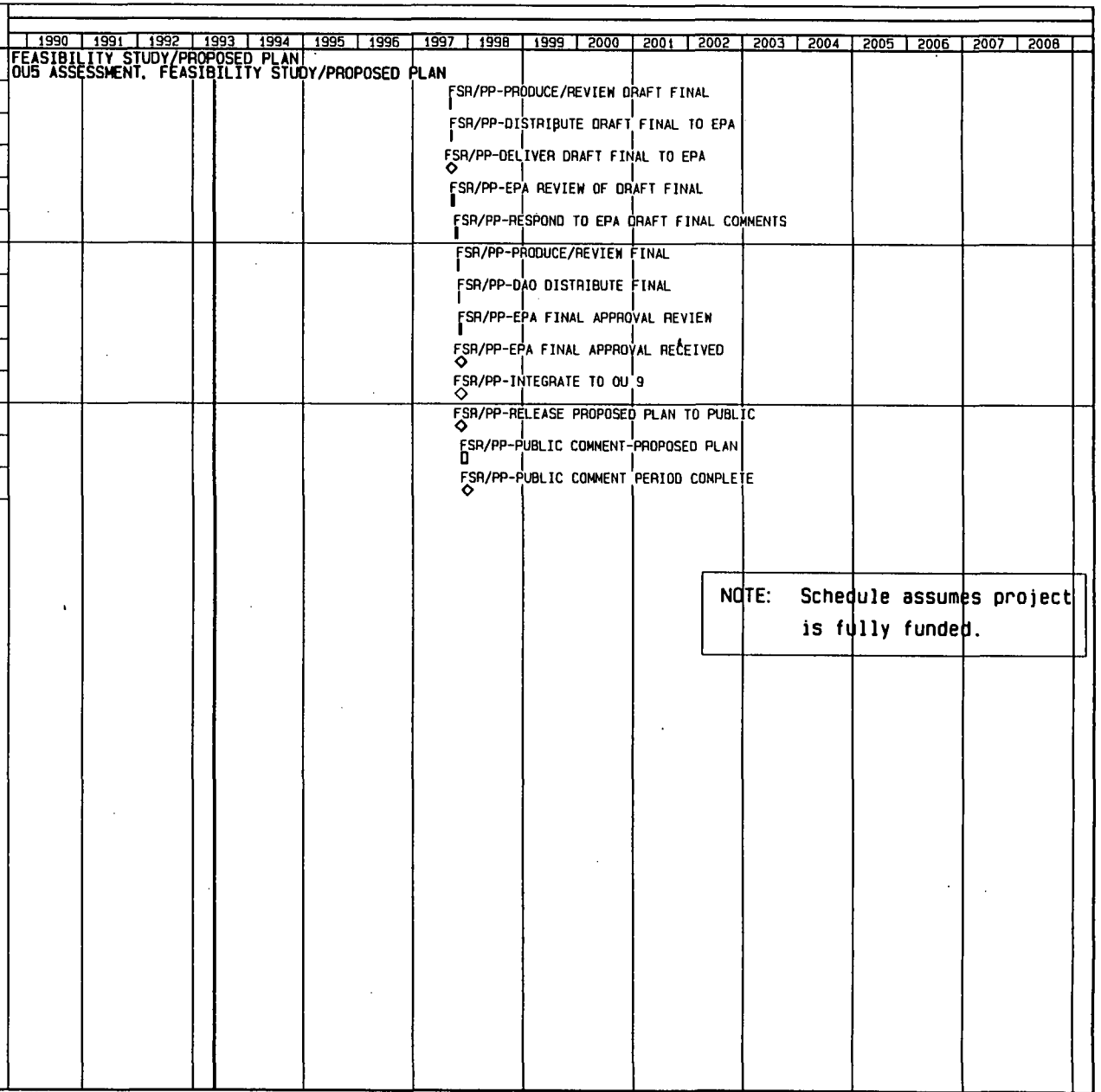
OU5 SOUTH PROPERTY
EG&G MOUND ER PROGRAM
OU5 DETAIL SCHEDULE

FOR INCLUSION IN THE WORK PLAN

Date	Revision	Checked	Approved

ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR	ACTO
C545W0330	7SEP97	14SEP97	8	145123121
C545W0340	15SEP97	17SEP97	3	145123131
C545MX350	18SEP97		0	145123141
C545W0360	18SEP97	7OCT97	20	145123151
C545W0370	8OCT97	26OCT97	19	145123161
C545W0380	27OCT97	3NOV97	8	145123171
C545W0390	4NOV97	6NOV97	3	145123181
C545W0400	7NOV97	20NOV97	14	145123191
C545MX410		20NOV97	0	145123201
C545MX420		20NOV97	0	145150000
C545MX430	21NOV97		0	145160000
C545W0440	21NOV97	3JAN98	44	145170000
C545MX450		3JAN98	0	145180000



NOTE: Schedule assumes project is fully funded.

Plot Date 18AUG93
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Project Start 1OCT89
Project Finish 19APR09

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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

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OU5 SOUTH PROPERTY
EG&G MOUND ER PROGRAM
OU5 DETAIL SCHEDULE

FOR INCLUSION IN THE WORK PLAN

Date	Revision	Checked	Approved

ACTIVITY ID	EARLY START	EARLY FINISH	REM DUR	ACTO	
					ROD/RESPONSIVENESS SUMMARY OU5 ASSESSMENT, ROD/RESPONSIVENESS SUMMARY
C549W0010	11NOV97	24NOV97	14	149111000	ROD/RS-PROJECT INITIATION
C549W0020	25NOV97	15DEC97	21	149112100	ROD/RS-PREPARE WORKING DRAFT
C549W0030	9DEC97	15DEC97	7	149112200	ROD/RS-INTERNAL REVIEW OF WORKING DRAFT
C549W0040	16DEC97	21DEC97	6	149114000	ROD/RS-PRODUCE WORKING DRAFT
C549W0050	22DEC97	24DEC97	3	149114011	ROD/RS-DISTR WORKING DRAFT TO EG&G & DOE
C549W0060	25DEC97	14JAN98	21	149114021	ROD/RS-EG&G REVIEW OF WORKING DRAFT
C549W0080	25DEC97	14JAN98	21	149114041	ROD/RS-DOE REVIEW OF WORKING DRAFT
C549W0070	15JAN98	21JAN98	7	149114031	ROD/RS-RES. TO EG&G WORKING DRAFT COMMENTS
C549W0090	15JAN98	21JAN98	7	149114051	ROD/RS-RESPOND TO DOE WORKING DRAFT COMMENTS
C549WX100		21JAN98	0	149114061	ROD/RS-DOE WORKING DRAFT APPROVAL REC'D
C549W0110	22JAN98	29JAN98	8	149114071	ROD/RS-PRODUCE DRAFT
C549W0120	30JAN98	1FEB98	3	149114081	ROD/RS-DISTRIBUTE DRAFT TO EPA
C549RX130	2FEB98		0	149114091	ROD/RS-DELIVER DRAFT TO EPA
C549W0140	2FEB98	3MAR98	30	149114101	ROD/RS-EPA REVIEW OF DRAFT
C549W0150	4MAR98	22MAR98	19	149114111	ROD/RS-RESPOND TO EPA DRAFT COMMENTS
C549W0160	23MAR98	30MAR98	8	149114121	ROD/RS-PRODUCE/REVIEW DRAFT FINAL
C549W0170	31MAR98	2APR98	3	149114131	ROD/RS-DISTRIBUTE DRAFT FINAL TO EPA
C549WX180	3APR98		0	149114141	ROD/RS-DELIVER DRAFT FINAL
C549W0190	3APR98	16APR98	14	149114151	ROD/RS-EPA REVIEW OF DRAFT FINAL
C549W0200	17APR98	5MAY98	19	149114161	ROD/RS-DOE PREPS/SIGNS FINAL
C549W0210	6MAY98	13MAY98	8	149114171	ROD/RS-PRODUCE FINAL
C549W0220	14MAY98	16MAY98	3	149114181	ROD/RS-DISTRIBUTE FINAL
C549WX240		16MAY98	0	149114201	ROD/RS-ROD RECEIVED/APPROVED BY EPA
C549W0260	17MAY98	31MAY98	15	14912C000	ROD/RS-PUBLIC NOTICE
C549WX270		31MAY98	0	149130000	ROD/RS-COMPLETE

1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008

NOTE: Schedule assumes project is fully funded.

Plot Date 18AUG93
Data Date 24MAY93
Project Start 1OCT89
Project Finish 19APR09

Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

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OU5 SOUTH PROPERTY
EG&G MOUND ER PROGRAM
OU5 DETAIL SCHEDULE

FOR INCLUSION IN THE WORK PLAN

Date	Revision	Checked	Approved

7. ER PROGRAM: PROJECT MANAGEMENT AT MOUND PLANT

7.1. INTRODUCTION

The ER Program is an effort to provide for a consistent, organized approach to remediating historical environmental issues at DOE installations. The program provides for a phased, multi-year effort designed to evaluate problems and fund remedial activities on a priority basis. Project management is based on guidance developed for the ER Program on a national basis, adjusted for the specific requirements of the DOE Albuquerque Operations Office (DOE AL), and further adjusted to fulfill the specific requirements of RI/FS and RD/RA at Mound Plant. Detailed discussion of the DOE nationwide management of environmental restoration, including specific budgets and schedules for Mound Plant, are included in a Five-Year issued annually.

7.1.1. Work Breakdown Structure

In order to monitor the schedule and budget across the DOE, the ER Program has established a work breakdown structure (WBS). The WBS sequentially lists codes for the following attributes of each potential release site:

- DOE Operations Office;
- DOE Area Office/Facility;
- Operable unit number; and,
- Release site designator.

The DOE Operations Office and Area Office/Facility designators for the DOE AL, Dayton Area Office, Mound Plant are AL-MD. The WBS code for the South Property, Operable Unit 5, is AL-MD-5. For Mound Plant, the WBS code extends to the operable unit level where it is broken down to the RI/FS subtask level.

7.1.2. Technical Approach

7.1.2.1. Policy

The policy of the DOE relative to CERCLA is clearly stated in DOE Order 5400.4, and three key elements of that policy are integral to the technical approach of the RI/FS at Mound Plant. First it is the policy of the DOE to investigate potential environmental contamination in accordance with CERCLA. In accordance with that policy, the DOE AL, ER Program Group, has and will utilize applicable EPA CERCLA guidance documents. It is also the policy of the DOE to ensure that corrective actions carried out under other authority such as RCRA or Ohio state law are integrated with CERCLA implementation.

At Mound Plant, it is the goal of the ER Program to integrate CERCLA and RCRA compliance. Finally, pursuant to DOE policy, the DOE has entered into a Mound Plant FFA with U.S. EPA and is actively pursuing an agreement with Ohio EPA to assist in regulatory compliance.

7.1.2.2. Division of RI/FS Into Operable Units (OUs)

Because of its complexity, the RI/FS at Mound Plant has been divided into OUs to facilitate management. This approach encompasses the preparation of separate RI/FS documents (work plans, reports, etc.) for each OU. However, the Site-Wide, OU9 will culminate in a comprehensive RI/FS for the Site as a whole, integrating the results of each OU specific RI/FS.

The technical approach of the RI/FS has been planned to include appropriate technologies for Site characterization, protection of health and safety, feasibility engineering, and remediation. Each of these elements has specific requirements which indicate the need for a Site division into operable units. Different potential contaminants will be addressed by different technologies for characterization and remediation. The different technologies extend to the selection of appropriate measures for the protection of the health and safety of both workers and the public.

The proposed OUs have the potential to affect distinct and discrete physical systems. The characterization of distinct physical systems indicates the need for a conceptual model of contaminant sources and migration in each system. This characterization can be completed most effectively and efficiently with OUs divided accordingly.

Since the public will probably have varying degrees of concern about various areas of the site, it is appropriate to prioritize the cleanup of these areas in order to be responsive to public concerns. The area of greatest public concern, the Miami-Erie Canal, has been identified through community participation. Further prioritization has not been completed by the community. However, as areas are prioritized, the present OU division should provide the flexibility to respond quickly to address the public concerns regarding the cleanup at the Mound Plant.

DOE's primary goal is to complete all necessary remediation in the shortest time possible, consistent with available funding. This goal can best be met by optimizing available funding, i.e., by ensuring cost-effective implementation of the RI/FS consistent with the NCP direction on OUs. Remediation can be

prioritized to expedite the reduction of risk. The achievement of this objective can best be addressed by using the OU approach throughout the RI/FS, and for any subsequent remedial actions.

The DOE is committed to conducting an RI/FS and implementing an RD/RA at each of its facilities across the country. The fulfillment of that commitment is limited by the funding available in any year; therefore, DOE has prioritized its sites on a nationwide basis. Mound Plant will have a finite funding resource in any given year and cannot implement actions above the level permitted by that resource, as stated by law (the Anti-Deficiency Act). The available funding for Mound Plant has been, and should be, distributed to the areas of greatest concern, i.e., to the prioritized OUs, based upon risk.

7.2. COORDINATION

7.2.1. Organizational Coordination

Several entities have an involvement in the RI/FS at Mound Plant, including DOE HQ, the DOE AL, the DOE Dayton Area Office (DOE DAO), and EG&G Mound Applied Technologies (the operating contractor at the Mound Plant). Some of the functions of the DOE and its contractors are important for an understanding of the DOE implementation of the RI/FS, and are described below.

7.2.1.1 DOE

The Mound Plant is one of seven facilities managed by the DOE AL. The Manager of DOE AL is the DOE signatory to the FFA between the DOE and EPA. The FFA between the DOE and the EPA provides for a DOE Remedial Project Manager (RPM) who is the DOE organizational focus for the RI/FS and RD/RA. That responsibility has been delegated to an individual in the DOE DAO. One of the missions of DAO is to operate in an environmentally sound manner, which includes compliance with applicable environmental laws and regulations (DOE Order 5400.4).

The DOE ER Program is organized into divisions which have tiered elements at DOE HQ, DOE AL, and DOE DAO. DOE AL has an ER Program Group, which is responsible for ER Program implementation, including program management and oversight, at all seven installations within DOE AL. There are corresponding entities with ER Program responsibilities at DOE HQ and DOE DAO. Each of these entities is responsible for determining programmatic direction and giving guidance and oversight to DOE DAO and the RPM.

7.2.1.2. EG&G Mound Applied Technologies

The seven installations overseen by DOE AL are operated by different operating contractors. At Mound Plant that contractor is EG&G Mound Applied Technologies, which has an ER Program structure paralleling that of the DOE. EG&G Mound has a manager responsible for the ER Program who reports directly to the DOE manager responsible for environment, safety, and health. Each of the EG&G environmental functional groups provides necessary support to the RPM.

7.2.1.3. Technical Subcontractors

The management staff for the Mound Plant RI/FS includes a DOE RPM and management support from EG&G Mound Applied Technologies. This management team directs multiple technical subcontractors that assist in conducting the RI/FS.

7.2.1.4. Quality Assurance

Quality assurance is an implicit function throughout the hierarchy of RI/FS execution at Mound Plant. The DOE AL and DOE DAO have directed the contractors, including EG&G Mound Applied Technologies, to implement the RI/FS at Mound Plant while retaining responsibility for quality assurance. These same contractors are responsible both for quality control and for coordinating quality assurance for the DOE. The Quality Assurance Program Plan (currently the OU9 Site-Wide QAPjP is fulfilling this role) is the controlling document for RI/FS quality assurance. In addition, OU specific QAPjPs provide more detailed guidance.

7.2.1.5. National Environmental Policy Act (NEPA)

The DOE intends to achieve compliance with the NEPA during execution of RI/FS at the Mound Plant. Responsibility for preparing NEPA documents resides in the DOE line organizations, as stated in a Secretary of Energy Notice (SEN-15-90). Briefly stated, the Mound Plant strategy is that each RI/FS report will be an integrated NEPA/CERCLA document, meeting the requirements for an Environmental Assessment (EA). In addition, a FEIS will be prepared for the Mound Plant and will address cumulative impacts from the ER Program remedial actions, ongoing Mound Plant operations, and the proposed D&D Program clean up of radioactively contaminated structures and soil. In order to keep the FEIS from being a predecisional document, it will address alternatives for a broad class of actions, while the integrated RI/FS/EA will address more specific alternatives.

Because the Mound Plant RI/FS reports will be integrated NEPA/CERCLA documents, there will be some specific modifications and additions to the documents beyond CERCLA requirements, as follows:

- The title of the RI/FS Report will indicate that it is also an Environmental Assessment or FEIS, as appropriate;

- The FS development and screening of alternatives and detailed analysis of alternatives will include a no-action alternative required by NEPA (also as required by CERCLA);

- The FS alternatives analysis will include probable environmental impacts, both direct and indirect, and will include risk of accidents;

- The RI/FS report will include a listing of agencies and persons consulted; and,

- The RI/FS report will include a description, unique to NEPA, of the relationship of proposed actions to land use plans and policies.

If the RI/FS report is also an FEIS, it will address additional requirements beyond those for EA-level documentation. It will include:

- a description of the objectives of the study as well as the purpose and need for the proposed action;

- the alternatives analysis and comparison among alternatives, including environmental consequences;

- a list of preparers;

- a list of agencies, organizations, and persons to whom copies of the FEIS are sent; and,

- an index.

7.2.2. Project File Requirements

Project file requirements are derived from two primary sources; the EPA-DOE and Ohio EPA-DOE regulatory agreements, and the EPA guidance on administrative records.

7.2.3. Progress Reporting Requirements

The ER DOE-DAO Office develops monthly progress reports which include the following for OU5:

- Activities in the preceding month, including:

  - status of documents (including plans or reports delivered);
  - ongoing field activities;
  - laboratory work in progress;

- laboratory reports delivered; and,
- ongoing studies (feasibility studies or RAs).

- Activities due in the forthcoming month, including:

  - status of documents, including plans or reports to be delivered;
  - due dates for regulatory review comments;
  - ongoing field activities or planned start-up;
  - laboratory work in progress;
  - laboratory reports to be delivered; and,
  - ongoing studies or planned start-up (feasibility studies or RAs).

- Problem areas.

In addition to the record of OU status, the ER DOE DAO office maintains a monthly compendium of significant contacts and events during the preceding month, including:

- records of telephone conversations;
- summaries of public meetings;
- quality assurance audit reports and responses; and,
- notification logs for deviations for remedial investigation plans.

8. REFERENCES

Bailey, R. G. 1978. "Description of Ecoregions of the United States." United States Department of Agriculture Forest Service. May 1978.

Bradley, J. E. 1953. "Health Physics Monthly Information report." Monsanto Chemical Company Report No. 809, Mound Laboratory, Miamisburg, Ohio. January 1-31, 1953.

Dames and Moore. 1976a. "Potable Water Standards Project Mounds Laboratory." Report prepared for Monsanto Research Corporation. Cincinnati, Ohio. August 1976.

Dames and Moore. 1976b. "Evaluation of the Buried Valley Aquifer Adjacent to Mound Laboratory." Report prepared for Monsanto Research Corporation. Cincinnati, Ohio. December 1976.

DOE. 1979. "Final Environmental Impact Statement, Mound Facility, Miamisburg, Ohio." U.S. Department of Energy report DOE-E1S-0014. June 1979.

DOE. 1986. "Phase I: Installation Assessment Mound [DRAFT]." Comprehensive Environmental Assessment and Response Program. U.S. Department of Energy, Albuquerque, New Mexico, April 1986.

DOE. 1990. "Preliminary Results of Reconnaissance Magnetic Survey of Mound Plant Areas 2,6,7, and C." Letter report prepared for U.S. Department of Energy, Albuquerque Operations Office, by Roy F. Weston, Inc., Albuquerque, New Mexico. November 1990.

DOE. 1991a. Preinvestigation Evaluation of Remedial Action Technologies (PERAT), Operable Unit 5, Technical Memorandum #1, U.S. Department of Energy, Albuquerque Operations Office, May 1991.

DOE. 1991b. "Area B, Operable Unit 1, History of Area B [DRAFT]." U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1991.

DOE. 1992a. RI/FS, Operable Unit 9, Site-Wide Work Plan [FINAL, Revision 4], U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1992.

DOE. 1992b. ERP, Operable Unit 3, Limited Field Investigation Report [DRAFT, Revision 1], U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. December 1992.

DOE. 1992c. Operable Unit 9, Site Scoping Report: Volume 2: Geologic Log and Well Information Report [DRAFT FINAL], U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. April 1993.

DOE. 1992d. Operable Unit 9, Site Scoping Report: Volume 6, Photo History Report [FINAL], U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1992.

DOE. 1992e. Operable Unit 9, Site Scoping Report: Volume 4, Engineering Map Series [FINAL], U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February, 1992.

DOE. 1992f. Reconnaissance Sampling Report, Soil Gas Survey and Geophysical Investigation, Mound Plant, Main Hill and SM/PP Hill. U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1993.

DOE. 1993a. Operable Unit 9, Site Scoping Report: Volume 3, Radiological Site Survey [DRAFT FINAL], U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. March 1993.

DOE. 1993b. Remedial Investigation/Feasibility Study, Operable Unit 9 Hydrogeologic Investigation Well Information Report, U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico, June 1993.

DOE. 1993c. Operable Unit 9, Site Scoping Report: Volume 7, Waste Management [FINAL, REVISION 0]. U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. February 1993.

DOE. 1993d. RI/FS, Operable Unit 9, Site-Wide Quality Assurance Project Plan. [DRAFT FINAL]. U.S. Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico. March 1993.

Draper, D. G. 1985. "Final Disposition, Thorium Dirt, SMP Area." Internal Mound Plant memorandum to W. P. Davis. April 22, 1985.

EG&G. 1992. "Environmental Monitoring at Mound: 1990 Report." B. M. Farmer, D. G. Carfagno, W. D. Gloehler, J. F. Griffin, and C. Kinard, EG&G Mound Applied Technologies, June 1991.

EPA. 1987. Data Quality Objectives for Remedial Response Activities. U.S. Environmental Protection Agency. Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, Report No. EPA 540\G-87\003. Washington, D.C. March 1987.

EPA. 1988a. "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA [INTERIM FINAL]." Document No. EPA/540/G-89/004, OSWER Directive 9355.3-01. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C. October 1988.

EPA. 1988b. Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA\540\G-88\006. Washington, D.C. August 1988.

EPA. 1988c. "Technology Screening Guide for Treatment of CERCLA Soils and Sludges." Document No. EPA/540/2-88/004, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response & Office of Emergency and Remedial Response, Washington, D.C. September 1988.

EPA. 1989. "Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part A. Interim Final." U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. Washington, D.C. OSWER Directive 9285.701A.

EPA. 1990a. "Federal Facility Agreement, Statement of Work." Administrative Docket Number: VW-'90-C-075. U.S. Environmental Protection Agency.

EPA. 1990b. "Fact Sheet -- Drinking Water Regulations Under the Safe Drinking Water Act." U.S. Environmental Protection Agency, Criteria and Standards Division, Office of Drinking Water. December 1990.

EPA. 1990c. "EPA Health Effects Assessments Summary Tables." Fourth Quarter, FY-1990, OERR #9200 6-303 (90-4). September 1990.

EPA. 1990d. "40 CFR Part 300, National Oil and Hazardous Substance Pollution Contingency Plan; Final Rule, Part II." Federal Register, Vol. 55, No. 46, Rules and Regulations. U.S. Environmental Protection Agency, Washington, D.C. March 8, 1990.

FEMA. 1993. Letter regarding Map Panel. May 17, 1993.

Freeze, R. A. and Cherry, J. A. 1979. Groundwater. Published by Prentice-Hall, New Jersey.

Garner, J. N. 1991. Personal communication from J. N. Garner, EG&G Mound Applied Technologies, Mound Plant, Miamisburg, Ohio, to C. W. Criswell, Roy F. Weston, Inc., Albuquerque, New Mexico, July 1991.

Goldthwait, R. P., White, G. W., and Forsyth, J. L. 1979. "Glacial Map of Ohio." USGS Miscellaneous Investigations Series Map 1-316.

Halbach, F. L. 1950. "Report No. 3 of Steering Committee for Disposal of Units III and IV (Completion Report for Disposal of Unit IV. Runnymeade Road and Dixon Avenue, Dayton, Ohio)." Monsanto Chemical Company report No. MLM-461, Mound Laboratory, Miamisburg, Ohio. April 17, 1950.

Kearney, A. T. 1988. "Preliminary Review/Visual Site Inspection, U.S. DOE Mound, Miamisburg, Ohio." Prepared for U.S. Environmental Protection Agency, Region V, Chicago, Illinois. July 1988.

Meyer, H. E. 1955a. "Quarterly Health Physics Report Through March 31, 1955." Monsanto Chemical Company report No. MLM-1044, Mound Laboratory, Miamisburg, Ohio. April 12, 1955.

Meyer, H. E. 1955b. "Quarterly Health Physics Report Through June 30, 1955." Monsanto Chemical Company, Mound Laboratory, Miamisburg, Ohio. July 10, 1955.

Meyer, H. E. 1955c. "Final Disposal of Unit IV Materials." Handwritten memorandum to file. Monsanto Chemical Company, Mound Laboratory, Miamisburg, Ohio. 1955.

Meyer, H. E. 1955d. "Unit III and IV Scrap Burial." Letter from H. E. Meyer, Monsanto Chemical Company, Mound Laboratory, Miamisburg, Ohio, to B. J. Hosfeld. August 18, 1955.

Meyer, H. E. 1956. "History of Health Physics for 1955." Monsanto Chemical Company, Mound Laboratory, Miamisburg, Ohio. February 13, 1956.

Meyer, H. E. 1979. "Thorium-232 Program, Mound Facility." Monsanto Research Corporation, Mound Plant, Miamisburg, Ohio. October 3, 1979.

Meyer, H. E. 1991. Personal communication from H. E. Meyer, EG&G Mound Applied Technologies, Mound Plant, Miamisburg, Ohio, to L. Vanselow, Roy F. Weston, Inc., Seattle, Washington. June 1991.

MCC. 1951-1956. Excerpts from the Record Logbook T Building, Unusual Occurrences. February 23, 1951 through May 2, 1961.

MCC. 1953-1957. Excerpts from the Record Logbook R Building. July 24, 1953 through January 3, 1957.

MRC. 1961-1968. Excerpts from *Week-at-a-Glance* calendar log of E. Alfrey, Monsanto Research Corporation, Mound Laboratory, Miamisburg, Ohio. 1961-1968.

MRC. 1973. "Options for Disposal of Thorium Ore Residues Stored at Monsanto Research Corporation, Mound Laboratory, Miamisburg, Ohio." Report prepared by Monsanto Research Corporation, Mound Laboratory, Miamisburg, Ohio. April 9, 1973.

MRC. 1985. "Mound Site Development Plan, 1985 Report." Monsanto Research Corporation, Mound Plant, Miamisburg, Ohio. April 1985.

OEPA. 1990. "State of Ohio Water Quality Standards, Chapter 3745-1 of the Administrative Code." State of Ohio, Ohio Environmental Protection Agency, Division of Water Quality Monitoring and Assessment, Columbus, Ohio. Effective May 1, 1990.

Rader, P.L. 1988. Orphan soil removal job scope and guidelines. Monsanto Research Corporation, Mound Laboratory, Miamisburg, Ohio. Effective May 1, 1990.

RFA. 1988. Preliminary Review/Visual Site Inspection for RCRA Facility Assessment of Mound Plant conducted by A. T. Kearney, May, 1988, U.S. Environmental Protection Agency, Region V, EPA Contract Number 68-01-7374, Chicago, Illinois.

Rogers, D. R. 1975. "Mound Laboratory Environmental Plutonium Study, 1974." Monsanto Research Corporation report for the U.S. Department of Energy, Miamisburg, Ohio. September 1975.

Schauer, P. J. 1953. "Preliminary Investigation of the Disposal of Ra-226, Ac-227, and Th-228." Interoffice memorandum to R. A. Staniforth, Monsanto Chemical Company, Mound Laboratory, Miamisburg, Ohio. July 1, 1953.

SCS. 1976. "Soil Survey of Montgomery County." U.S. Department of Agriculture Soil Conservation Service. June 1976.

Spieker, A. M. 1968. Groundwater in the Lower Great Miami River Valley, Ohio. USGS Professional paper 605-A, p. 37.

Stought, R. L., D. A. Edling, and D. G. Draper. 1988. "The Mound Site Survey Project for the Characterization of Radioactive Materials in Site Soils." Monsanto Research Corporation for the U.S. Department of Energy, Miamisburg, Ohio. May 1988.

Struble, R. A. 1987. "Sand and Gravel Resources of Montgomery County, Ohio." Report of Investigation No. 135. Ohio Department of Natural Resources, Division of Geological Survey, Columbus, Ohio.

Terran. 1987. "Groundwater Occurrence and Movement in the Consolidated Bedrock at the DOE Mound Laboratory Miamisburg, Ohio." Letter report by Terran Corporation, Hydrogeologic Consultants, Fairborn, Ohio, prepared for Monsanto Research Corporation, Miamisburg, Ohio. March 19, 1987.

APPENDIX A

MOUND PLANT CHEMICAL SOIL DATA

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ACRONYMS

CEARP Comprehensive Environmental Assessment and Response Program
PAH polynuclear aromatic hydrocarbon
PCB polychlorinated biphenyl
SM Special Metallurgical (Building)
WD Waste Disposal (Building)
TAL target analyte list
PETN pentaerythritol tetranitrate (explosive)
RDX hexahydro-1,3,5-trinitro-s-triazine cyclo-tetramethylene tetranitramine
HMX octahydro-1,3,5,7-tetranitro-1,3,5,6-tetrazocine cyclo-tetramethylenetetranitramine

A.1. MOUND PLANT CHEMICAL SOIL DATA

This appendix summarizes all available chemical-in-soil data collected at Mound Plant. The chemical analysis data were generated during the following sampling events:

1. Reconnaissance Sampling Investigation, 1989
2. Operable Unit 3, Miscellaneous Sites, 1991
3. Verification Sampling of Portions of Area 14 and Area 17, 1991
4. Comprehensive Environmental Assessment and Response Program (CEARP) Phase 2, Stage 1, 1987

The following list presents a general description of each area sampled and the associated sample collection dates.

Area	Description	Sampling Dates
1	Bulk transfer of thorium drums	7/21 through 8/16/89
4/4a	Waste Disposal (WD) Building influent tank/overflow and sewage sludge drying pits	8/16 through 8/17/89
11	Contamination from Special Metallurgical (SM) Building operations	7/24 through 8/8/89
14	Radioactive waste line break	7/23/89 and 8/27 through 8/28/91
16	Sanitary sewage septic tank and leach basin for SM Building	7/21 through 8/8/89
17	Area under SM Building	7/26 through 8/6/89 and 9/3 through 9/4/91
19	Underground waste transfer lines	8/1 through 8/17/89
D	Acid leach field for Building 38	7/19 through 8/3/89
C	Historical Lithium Burn Area	3/10/87
I	East Lagoon	3/10/87
I	West Lagoon	3/10/87
MND01	Hydrogeochemical	5/10/87 and 8/2/90
OU 3	Building 27, powerhouse, solvent storage; Building 42 sewer lines	6/26 through 7/9/91

The analytical data resulting from sample analyses are discussed in the following subsections by area. A brief outline of the number of samples collected, the sample depth ranges, and the analyses performed on the samples for that area is presented. Also, a brief description of analytes found above the laboratory reporting quantitation limit is given. A table for each area is provided that lists analytes above the quantitation limits as well as any estimated values below the quantitation limits for analytes that may be of concern. Organic compound concentrations were compared to background levels, where possible (Dragun 1988). Discussions of the laboratory data and data validation for these areas may be found in the following references:

1. Operable Unit 3 - Limited Field Investigation Report (DOE in progress).
2. Operable Unit 6 - Reconnaissance Sampling Report, Decontamination and Decommissioning Areas (DOE 1992a).
3. Operable Unit 6 - Decontamination and Decommissioning, Area 17, Special Metallurgical (SM) Building Annex Verification Report (DOE 1992c).
4. Operable Unit 6 - Decontamination and Decommissioning Proposed Area 14 Fuel Oil Storage System Verification Report (DOE 1992b).

A comprehensive evaluation of all laboratory data is beyond the scope of this preliminary report.

Detections of common laboratory chemicals are not discussed unless the detected values are well above that associated with a blank value. Common laboratory chemicals include dichloromethane, toluene, acetone, 2-butanone, and phthalates. All inorganic analyte concentrations were compared to published background levels (Dragun 1988; Kabata-Pendias 1992; ASTDR 1990; Michigan 1988). Only those metals above the background levels are mentioned in the area summary.

A.1.1. OPERABLE UNIT 3, MISCELLANEOUS SITES - BUILDING 27

Ten samples were collected from four locations between June 27, 1991, and July 2, 1991 (Figure A.1). Sample depths ranged to a maximum of 12 ft. All samples were analyzed for volatiles, semivolatiles, pesticides/polychlorinated biphenyls (PCBs), explosives, and metals. The results discussed in this section were derived from the data validation reports.

The only organic compounds detected above the quantitation limit were tetrachloroethene and acetone. Polynuclear aromatic hydrocarbons (PAHs) and PCBs were detected in one sample at location 15; all results were below the quantitation limits. Metal concentrations were compared to background levels (main text, Table III.1). Antimony, cadmium, and silver were detected above background in every sample. The maximum concentration for antimony was 25.5 milligrams/kilogram (mg/kg), the

maximum concentration for cadmium was 4.3 mg/kg, and the maximum concentration for silver was 15.7 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0006	06/27/91	0-2	2-Butanone	J2	12
			Acetone	J27	12
			Tetrachloroethene	12	6
		2-6	2-Butanone	J5	12
			Acetone	J56	6
		8-12	Bis(2-ethylhexyl)phthalate	J220	790
			Tetrachloroethene	J4	6
0015	07/02/91	0-3.5	PAH compounds[b]	J580 greatest	770
			Aroclor 1254	J66.4	93.7
		8-12	4-Methyl-2-pentanone	J3	12

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
PAH - polynuclear aromatic hydrocarbon

A.1.2. OPERABLE UNIT 3, MISCELLANEOUS SITES - POWERHOUSE

Six samples were collected from four locations on June 26, 1991, and July 9, 1991 (Figure A.1). Sample depths ranged to a maximum of 5 ft. All samples were analyzed for volatiles, semivolatiles, pesticides/PCBs, and metals. The following discussion is based on the data validation reports.

No organic compounds were detected above the reporting quantitation limits. Metal concentrations were compared to background levels (main text, Table III.1). Antimony, cadmium, and silver were detected above background in every sample. The maximum concentration for antimony was 33.4 mg/kg, the maximum concentration for cadmium was 6.3 mg/kg, and the maximum concentration for silver was 17.1 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0001	06/26/91	0-0.5	Chlorobenzene	J5	6
		0-0.5	Ethylbenzene	IJ	6
		0-0.5	Isophorone	J780	3,700
		0-0.5	Isophorone	J510	3,700
		0-0.5	N-nitroso-Di-n-propylamine	J740	3,700
			N-nitroso-Di-n-propylamine	J440	3,700
0002	06/26/91	0-0.5	Ethylbenzene	J2	6
		0-0.5	Toluene	J4	6
		0-0.5	Total xylenes	J3	6
		0-0.5	Isophorone	J410	3,900
		0-0.5	PAH compounds[b]	J700	3,900
0002	07/9/91	4.5-5.5	Dichloromethane	J24	5
		4.5-5.5	Total xylenes	J3	5
		2.5-3.5	Pyrene	J820	7,800

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
PAH - polynuclear aromatic hydrocarbon

A.1.3. OPERABLE UNIT 3, MISCELLANEOUS SITES - SOLVENT STORAGE

Ten samples were collected from three locations between June 29, 1991, and July 1, 1991 (Figure A.1). Sample depths ranged to a maximum of 20.5 ft. All samples were analyzed for volatiles, semivolatiles, pesticides/PCBs, explosives, and metals, with the following exceptions: MND33-0010-0002 was not analyzed for metals, and MND33-0010-0004 was analyzed only for volatiles. The following discussion is based on the data validation reports.

PAHs and PCBs were detected in three samples. Other detected organics are detailed below. All results were below the quantitation limits. Metal concentrations were compared to background levels (main text, Table III.1). Antimony, cadmium, and silver were detected above background in every sample. The maximum concentration for antimony was 53.3 mg/kg, the maximum concentration for cadmium was 12.7 mg/kg, and the maximum concentration for silver was 18.3 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0010	6/29/91	0.5-1.5	1,1-Trichloroethane	J5	6
		0.5-1.5	2-Butanone	J5	12
		1.5-2.5	2-Butanone	J3	10
		2.5-6.5	2-Butanone	J7	12
		8.5-12.5	2-Butanone	J4	12
		14.5-18.5	2-Butanone	J63	12
		0.5-1.5	4-methyl-2-pentanone	J8	12
		0.5-1.5	Benzene	J5	6
		0.5-1.5	Carbon disulfide	J9	6
		2.5-6.5	Carbon disulfide	J3	6
		14.5-18.5	Carbon disulfide	J6	6
		1.5-2.5	Di-n-octyl-phalate	J77	710
		0.5-1.5	Styrene	J2	6
		8.5-17.5	Tetrachloroethene	J3	6
		0.5-1.5	Total xylenes	J2	6
		18.5-20.5	Total xylenes	J2	6
		8.5-12.5	Trichloroethene	J2	6
0011	6/30/91	0-1.5	Aroclor-1248	J147	168
		1.5-3.0	Aroclor-1248	J36.8	86
		0-1.5	Carbon disulfide	J1	5
		0-1.5	PAH compounds[b]	J160	690
		1.5-3.0	Trichloroethene	2J	5
0014	06/30/91	0-2.0	Aroclor 1254	J42.4	178.4
		1.5-3.0	Aroclor 1254	J42.4	175.2
		0-2.0	Aroclor-1260	J44.6	178.4
		1.5-3.0	Aroclor-1260	J25.4	175.2
		0-2.0	Bis(2-ethylhexyl)phthalate	J130	720
		0-2.0	Carbon disulfide	J2	5
		0-2.0	Di-n-octyl-phthalate	J180	720
		0-2.0	Dichloromethane	13	5
		0-2.0	PAH compounds[b]	J390	720

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
PAH - polynuclear aromatic hydrocarbon

A.1.4. OPERABLE UNIT 3, MISCELLANEOUS SITES - BUILDING 42, SEWER LINES

One sample was collected on July 1, 1991 (Figure A.1). The sample was composited from the 9 to 15 ft depth interval. The sample was analyzed for volatiles, semivolatiles, pesticides/PCBs, explosives, and metals.

No organic compounds were detected. Metal concentrations were compared to background levels (main text, Table III.1). Antimony, cadmium, and silver were detected above background. The maximum concentration for antimony was 11.9 mg/kg, the maximum concentration for cadmium was 2.0 mg/kg, and the maximum concentration for silver was 11.2 mg/kg.

A.1.5. MOUND 15 - AREA D

Thirty samples were collected from five locations between July 19, 1989 and August 3, 1989 (Figure A.1). Sample depths ranged from the surface to a maximum depth of 14.5 ft. Twenty-nine of thirty samples were analyzed for pesticides/PCBs. Twenty-three of thirty samples were analyzed for target analyte list (TAL) metals. Laboratory data are discusssed in the references listed in subsection A.1.

Only two organic compounds were detected. These compounds are detailed below. Metal concentrations were compared to background levels (main text, Table III.1). Antimony, cadmium, silver, and zinc were detected above background in sample location 0105. The maximum concentration for antimony was 6.8 mg/kg, the maximum concentration for cadmium was 5.5 mg/kg, the maximum concentration for silver was 15.7 mg/kg, and the maximum concentration for zinc was 342 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result (µg/kg)	Quantitation Limit (µg/kg)
0103	8/02/89	13-14.5	Beta-BHC	12	10
0104	8/02/89	3-5	Endrin ketone[a]	20	18

[a]Endrin ketone is a common breakdown product of endrin.

A.1.6. MOUND 14 - AREA 19

Nine samples were collected from nine locations between August 1, 1989, and August 17, 1989 (Figure A.1). Sample depths ranged to a maximum of 8 ft. A summary of requested analyses is as follows:

- volatiles analyzed in 3 of 9 samples,
- semivolatiles analyzed in 7 of 9 samples,
- pesticides/PCBs analyzed in 3 of 9 samples,
- TAL metals analyzed in 3 of 9 samples, and
- arsenic and lead analyzed in 2 of 9 samples.

Laboratory data are summarized in the references in subsection A.1.

PAHs were detected at location 2200, 3800, and 5200. Pyrene and fluoranthene were found at levels above quantitation limits. Other PAHs were detected below the quantitation limits. Organic compounds detected are detailed below. N-nitroso-diphenylamine was detected in both blanks and samples. Metal concentrations were compared to background levels (main text, Table III.1). Cadmium, silver, and zinc were detected above background in several samples. The maximum concentration for cadmium was 4.3 mg/kg, the maximum concentration for silver was 4.2 mg/kg, and the maximum concentration for zinc was 349 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
2200	8/01/89	3-4	1,1,1-Trichloroethane	J2	7
			Fluoranthene	J51	460
			Pyrene	J61	460
2300	8/01/89	3-6	1,1,1-Trichloroethane	J1	5
3800	8/04/89	2-5	Fluoranthene	1,000	810
			Pyrene	890	810
			PAH compounds[b]	Below quantitation limits	
5200	8/04/89	0-3	Fluoranthene	790	750
			Pyrene	900	750
			PAH compounds[b]	Below quantitation limits	

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
PAH - polynuclear aromatic hydrocarbon

A.1.7. MOUND 13 - AREA 17

Seventeen samples were collected from nine locations between July 26, 1989, and August 6, 1989 (Figure A.1). Sample depths ranged to a maximum of 15 ft. A summary of analyses performed is as follows:

- volatiles analyzed in 16 of 17 samples,
- semivolatiles analyzed in 17 of 17 samples,
- pesticides/PCBs analyzed in 17 of 17 samples, and
- TAL metals analyzed in 11 of 17 samples.

Laboratory data are discussed in the references listed in subsection A.1.

Very few organic analytes were found above the quantitation limits. PAHs were detected at locations 0095 through 0098. All detected organic compounds are detailed below. Several chlorinated compounds were found above the quantitation limits. Metal concentrations were compared to background levels (main text, Table III.1). Cadmium, silver, and zinc were detected above background in several samples. The maximum concentration for cadmium was 9.6 mg/kg, the maximum concentration for silver was 3.2 mg/kg, and the maximum concentration for zinc was 352 mg/kg.

Twenty-three locations were sampled on September 3 and September 4, 1991. The sample depth range for all samples was 1.5 to 2 ft. All samples were analyzed for semivolatiles, pesticides/PCBs, TAL metals, and cyanide. Additionally, 4 locations were analyzed for volatiles, and 15 locations were analyzed for anions (nitrate/nitrite, sulfate, chloride). Mapping coordinates are not available at this time.

PAHs were detected in locations 0107, 0110, 0113, and 0114; all values were below the quantitation limits. Other organic compounds were detected as, as detailed below. Tetrachloroethene was noted in several blanks. The maximum nitrate level was 72.5 mg/kg. No metals were detected above background levels (main text, Table III.1).

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0091	7/26/89	0-0.5	1,1,1-Trichloroethane	J3	5
0092	7/26/89	0-0.5	1,1,1-Trichloroethane	19	6
			Trichloroethene	J2	6
0093	7/26/89	0-0.5	1,1,1-Trichloroethane	J2	5
0094	7/26/89	0-0.5	1,1,1-Trichloroethane	J1	5
0095	8/05/89	8-10	Pyrene	J120	1,100
			Fluoranthene	J130 µg/kg	1,100
		13-15	Aroclor 1260	J79	170
			Carbon disulfide	J3	5
			Trichloroethene	21	5
			Fluoranthene	J140	1,400

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0096	8/05/89	8-10	Pyrene	J440	2,600
			Fluoranthene	J690	2,600
0097	8/05/89	0-0.5	Benzo(b)Fluoranthene	J160	1,100
			Fluoranthene	J140	1,100
		3-5	Trichloromethane	10	6
			Bromodichloromethane	J1	6
			PAH compounds[b]	Below quantitation limits	
	8/06/89	8-10	Pyrene	J380	330
			Fluoranthene	J400	330
			PAH compounds[b]	Below quantitation limits	
0098	8/06/89	0-0.5	PAH compounds[b]	Below quantitation limits	
		3-5	Fluoranthene	J160	990
			Pyrene	J130	990
			Trichloroethene	J1	6
0107	9/04/91	1.5-2	Pyrene	J33	310
0110	9/04/91	1.5-2	Pyrene	J93	390
			Fluoranthene	J110	390
			Phenanthrene	J49	390
0113	9/03/91	1.5-2	Pyrene	J69	360
			Fluoranthene	J49	360
0114	9/03/91	1.5-2	PAH compounds[b]	Below quantitation limits	
0117	9/03/91	1.5-2	Tetrachloroethene	J5	6
0120	9/03/91	1.5-2	Tetrachloroethene	6	6

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
PAH - polynuclear aromatic hydrocarbon

A.1.8. MOUND 12 - AREA 16

Seventeen samples were collected from seven locations between July 21, 1989, and August 8, 1989 (Figure A.1). Sample depths ranged to a maximum of 14.5 ft. A summary of requested analyses is as follows:

- volatiles analyzed in 13 of 17 samples,
- semivolatiles analyzed in 13 of 17 samples,
- pesticides/PCBs analyzed in 14 of 17 samples,
- TAL metals analyzed in 3 of 17 samples, and
- arsenic and lead analyzed in 3 of 17 samples.

Laboratory data are discussed in the references listed in subsection A.1.

Organic compounds were detected at locations 0080, 0082, and 0083; results are detailed below. Tetrachloroethene was noted in both blanks and samples. Metal concentrations were compared to background levels (main text, Table III.1). Cadmium, silver, and zinc were detected above background in location 0080. The maximum concentration for cadmium was 5.0 mg/kg, the maximum concentration for silver was 2.8 mg/kg, and the maximum concentration for zinc was 327 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0080	8/08/89	3-6	Trichloromethane	11	6
			Bromodichloromethane	J3	6
		5-6.5	Phenol	J61	390
			Benzo(b)fluoranthene	J45	390
0082	7/25/89	0-0.5	1,1,1-Trichloroethane	J6	6
			Pyrene	J89	860
0083	7/25/89	3-4.5	1,1,1-Trichloroethane	J3	6
		8-9.5	1,1,1-Trichloroethane	J5	6
		13-14.5	1,1,1-Trichloroethane	6	6

[a]'J' qualifier is used to denote an estimated value.

A.1.9. MOUND 11 - AREA 14

Fifteen samples were collected from 15 locations on July 23, 1989 (Figure A.1). The sample depth range for all samples was 0 to 0.5 ft. All samples were analyzed for volatiles, semivolatiles, pesticides/PCBs, and TAL metals.

Laboratory data are discussed the references in subsection A.1.

PAHs were detected at locations 0066, 0072 through 0074, and 0076, although only pyrene, detected at location 0073, was above the quantitation limits. Additional detected organic compounds, including

three pesticides, are detailed below. All were below the quantitation limits. Metal concentrations were compared to background levels (main text, Table III.1). Cadmium, silver, and zinc were detected above background in several samples. The maximum concentration of cadmium was 7.2 mg/kg, the maximum concentration for silver was 4.0 mg/kg, and the maximum concentration for zinc was 331 mg/kg.

Twenty-four samples were collected from 24 locations on August 27 and August 28, 1991. The sample depth range for all samples was 1.5 to 2 ft. All samples were analyzed for volatiles, semivolatiles, pesticide/PCBs, TAL metals, anions, and cyanide. Mapping coordinates are not available at this time.

PAHs were detected in locations 0083, 0087, 0088, 0091, and 0093. All detections were below the quantitation limits. Other organic compounds included carbon disulfide and dieldrin, as detailed below. Location 0102 also has an associated field duplicate. While no compounds were noted in the sample, the field duplicate contained PAHs and dieldrin, all below quantitation limits. Metal concentrations were compared to background levels (main text, Table III.1). Antimony, cadmium, and silver results were all non-detect; however, the detection limits were above background concentration limits. Zinc was detected above background in one sample. The maximum concentration for zinc was 1,180 mg/kg; all other results for zinc were well below 100 mg/kg. Cyanide was detected in several samples at a maximum concentration of 2.4 mg/kg. The majority of cyanide results were non-detect; however, the detection limits were above background limits.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0063	7/23/89	0-0.5	1,1,1-Trichloroethane	J11	5
			Trichloroethene	J2	5
0064	7/23/89	0-0.5	1,1,1-Trichloroethane	J3	6
			Trichloromethane	J1	6
0065	7/23/89	0-0.5	2-Hexanone	J3	11
0066	7/23/89	0-0.5	Benzo(b)fluoranthene	J98	760
			Fluoranthene	J150	760
			Phenanthrene	J93	760
			Trichloroethene	J3	6
0069	7/23/89	0-0.5	Carbon disulfide	J3	6
0071	7/23/89	0-0.5	Trichloroethene	J3	6
			1,1,1-Trichloroethane	J4	6
0072	7/23/89	0-0.5	1,1,1-Trichloroethane	J5	6
			Trichloroethene	J3	6
			PAH compounds[b]	Below quantitation limits	

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0073	7/23/89	0-0.5	Carbon disulfide	J2	6
			Pyrene	J2,800	2,200
0074	7/23/89	0-0.5	PAH compounds[b]	Below quantitation limits	
			1,1,1-Trichloroethane	J6	8
			Trichloroethene	J2	8
			Phenanthrene	J170	1,000
			Trichloromethane	J2	8
			4,4'-DDT	J27	25
0075	7/23/89	0-0.5	Beta-BHC	13	10
0076	7/23/89	0-0.5	Benzo(k)fluoranthene	J92	800
			Pyrene	J190	800
			Fluoranthene	J250	800
			Pentachlorophenol	J190	3,900
0077	7/23/89	0-0.5	4,4'-DDE	J54	41
0080	8/27/91	1.5-2	Carbon disulfide	9	6
			Dieldrin	J9.8	20
0083	8/27/91	1.5-2	PAH compounds[b]	Below quantitation limits	
0087	8/27/91	1.5-2	Fluoranthene	J53	360
0088	8/27/91	1.5-2	Fluoranthene	J110	350
			Pyrene	J81	350
			Phenanthrene	J80	350
0091	8/27/91	1.5-2	Fluoranthene	J56	360
0093	8/27/91	1.5-2	PAH compounds[b]	Below quantitation limits	

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
PAH - polynuclear aromatic hydrocarbon

A.1.10. MOUND 10 - AREA 11

Twenty-seven samples were collected from nine locations between July 24, 1989, and August 8, 1989 (Figure A.1). Sample depths ranged to a maximum of 8.2 ft. A summary of analyses performed is as follows:

- volatiles analyzed in 19 of 27 samples,
- semivolatiles analyzed in 18 of 27 samples,

- pesticides/PCBs analyzed in 19 of 27 samples, and
- TAL metals analyzed in 14 of 27 samples.

Laboratory data are discussed in the references listed in subsection A.1.

PAHs were detected at locations 0049 through 0052, 0054, and 0057. Detection limits were not given for analysis at location 0049. All other PAH detections were below quantitation limits, except pyrene at location 0050. Other organic compounds of interest include pesticides/PCBs and chlorinated compounds, as detailed below. Tetrachloroethene and N-nitroso-diphenylamine were noted in both blanks and samples. Metal concentrations were compared to background levels (main text, Table III.1). Cadmium, silver, and zinc were detected above background in several samples. The maximum concentration for cadmium was 8.0 mg/kg, the maximum concentration for silver was 2.9 mg/kg, and the maximum concentration for zinc was 302 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0049	7/24/89	0-0.5	Benzo(a)anthracene	J640	NA
			Benzo(b)fluoranthene	J1,500	NA
			Benzo(k)fluoranthene	J1,600	NA
			Fluoranthene	J950	NA
			Pyrene	J2,700	NA
			Phenanthrene	J330	NA
		3-6	PAH compounds[b]	Below quantitation limits	360
0050	7/25/89	0-0.5	Pyrene	J5,000	3,000
			Beta-BHC	J99	93
			1,1,1-Trichloroethane	41	6
			PAH compounds[b]	Below quantitation limits	3,000
	7/24/89	4.5-6	1,1,1-Trichloroethane	J7	5
0051	7/25/89	0-0.5	Endrin ketone	J39	35
			PAH compounds[b]	Below quantitation limits	1,800
		6-6.5	1,1,1-Trichloroethane	J1	6
0052	7/25/89	0-0.5	1,1,1-Trichloroethane	J3	6
			Aroclor 1254	J56	170
			Aroclor 1260	J21	170
			PAH compounds[b]	Below quantitation limits	1,800
0053	7/24/89	0-0.5	Pyrene	J89	710
			Fluoranthene	J120	710
		3-7.5	Pyrene	J110	790
			Fluoranthene	J140	790
			Phenanthrene	J87	790
		7-7.5	1,1,1-Trichloroethane	J2	5

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0054	7/24/89	0-0.5	PAH compounds[b]	Below quantitation limits	1,800
		6-6.5	1,1,1-Trichloroethane	8	5
0055	7/24/89	0-0.5	1,1,1-Trichloroethane	33	5
		6.7-7	1,1,1-Trichloroethane	J2	5
0056	8/06/89	0.5-1	1,1,1-Trichloroethane	J2	5
			Fluoranthene	J21,000	77,000
			Trichloroethene	J2	5
0057	8/06/89	0.5-1	PAH compounds[b]	Below quantitation limits	3,100
		3-5	Beta-BHC	J24	27
			PAH compounds[b]	Below quantitation limits	2,200

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
NA - not available.
PAH - polynuclear aromatic hydrocarbon

A.1.11. MOUND 9 - AREA 4/4A

Twenty-six samples were collected from eight locations on August 16 and August 17, 1989 (Figure A.1). Sample depths ranged to a maximum of 8 ft. A summary of requested analyses is as follows:

- volatiles analyzed in 0 of 26 samples,
- semivolatiles analyzed in 7 of 26 samples,
- pesticides/PCBs analyzed in 0 of 26 samples,
- TAL metals analyzed in 15 of 26 samples, and
- arsenic and lead analyzed in 11 of 26 samples.

Laboratory data are reviewed in the references listed in subsection A.1.

Only two organic compounds of interest were detected, both below the quantitation limits. At location 0038, 2-methylnaphthalene was detected at 0 to 0.5 ft, with a concentration of J760 µg/kg, and phenanthrene was detected at J780 µg/kg. The quantitation limit for both compounds was 2,800 µg/kg. N-nitroso-diphenylamine was detected below quantitation limits in both blanks and samples. Metal concentrations were compared to background levels (main text, Table III.1). Cadmium, silver, lead, and zinc were detected above background in several samples. The maximum concentrations for cadmium, silver, lead, and zinc were 8.3 mg/kg, 3.9 mg/kg, 105 mg/kg, and 303 mg/kg, respectively.

A.1.12. MOUND 08 - AREA 1

Thirty samples were collected from 19 locations between July 21, 1989, and August 16, 1989 (Figure A.1). Sample depths ranged to a maximum of 4 ft. A summary of requested analyses is as follows:

- volatiles analyzed in 15 of 30 samples,
- semivolatiles analyzed in 12 of 30 samples,
- pesticides/PCBs analyzed in 4 of 30 samples, and
- TAL metals analyzed in 19 of 30 samples.

Laboratory data are summarized in the references listed in subsection A.1.

Organic compounds detected above the quantitation limits or of note include acetone, 4-methylphenol, phenol, trichloromethane, bromodichloromethane, and dibromochloromethane. Acetone was found above usual blank concentrations at three locations. N-nitroso-diphenylamine was noted in both blanks and samples.

Metal concentrations were compared to background levels (main text, Table III.1). Cadmium, silver, and zinc were detected above background in several samples. Nickel was detected above background in one sample. The maximum concentration for cadmium was 8.1 mg/kg, the maximum concentration for silver was 4.4 mg/kg, and the maximum concentration for zinc was 825 mg/kg. The single high nickel concentration was 247 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0005	8/03/89	0.5-2	Acetone	96	12
0007	8/03/89	2-2.5	Acetone	75	11
0008	8/03/89	0.5-2	Acetone	31	12
		2-3	Acetone	27	12
0012	8/03/89	0.5-1	Phenol	J320	390
			4-Methylphenol	410	390
0014	8/03/89	0.5-3	Trichloromethane	24	6
			Phenol	J85	390
			Bromodichloromethane	J5	6
			Dibromochloromethane	J1	6

[a]'J' qualifier is used to denote an estimated value.

A.1.13. MOUND 06 - AREA C, HISTORICAL LITHIUM BURN AREA

Two samples were collected from two locations on March 10, 1987 (Figure A.1). The sample depth range was 0 to 0.5 ft. Each sample was analyzed for semivolatiles and TAL metals.

PAHs were found in both samples, well below quantitation limits. These compounds are detailed below. Metal concentrations were compared to background levels (main text, Table III.1). Only cadmium was detected above background; the maximum concentration was 8.7 mg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0001	3/10/87	0-0.5	Fluoranthene	J57	500
			Pyrene	J45	500
0002	3/10/87	0-0.5	Fluoranthene	J170	500
			Pyrene	J92	500
			Phenanthrene	J110	500

[a]'J' qualifier is used to denote an estimated value.

A.1.14. MOUND 05 - AREA I - EAST LAGOON

Four samples were collected from four locations on March 10, 1987 (Figure A.1). The sample depth range was 0 to 0.5 ft. Each sample was analyzed for semivolatiles and explosives.

PAHs were detected in all samples below the quantitation limits. The detection limits at location 0004 were very high.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0001	3/10/87	0-0.5	Fluoranthene	J150	500
			Phenanthrene	J160	500
			Benzo(a)anthracene	J86	500
0002	3/10/87	0-0.5	Fluoranthene	J160	500
			Pyrene	J180	500
			Phenanthrene	J150	500
0003	3/10/87	0-0.5	Phenanthrene	J350	400
			Pyrene	J380	400

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0004	3/10/87	0-0.5	PAH compounds[b]	Below quantitation limits[c]	

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
[c]Quantitation limit for PAH compounds at location 0004 was 400,000 µg/kg. The highest estimated value for a PAH compound was J83,000 µg/kg for fluoranthene.
PAH - polynuclear aromatic hydrocarbon

A.1.15. MOUND 04 - AREA I - WEST LAGOON

Five samples were collected from five locations on March 10, 1987 (Figure A.1). Sample depth ranges were 0 to 0.5 ft. Each sample was analyzed for semivolatiles and explosives. In addition, location 0001 was also analyzed for volatiles, but none were detected.

PAHs were detected in all samples except location 0005. All results were below the quantitation limits, except fluoranthene at location 0001, as detailed below. The explosive RDX was detected at location 0002 at 6.85 µg/kg.

Location	Date	Depth (ft)	Organics	Analysis Result[a] (µg/kg)	Quantitation Limit (µg/kg)
0001	3/10/87	0-0.5	Fluoranthene PAH compounds[b]	1,000 Below quantitation limits	500
0002	3/10/87	0-0.5	Pyrene RDX	J220 6.85	800
0003	3/10/87	0-0.5	Benzo(a)anthracene	J860	1,000
0004	3/10/87	0-0.5	PAH compounds[b]	Below quantitation limits	

[a]'J' qualifier is used to denote an estimated value.
[b]PAH compounds may include acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, benzo(g,h,i)perylene, fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, pyrene, or phenanthrene.
PAH - polynuclear aromatic hydrocarbon
RDX - hexahydro-1,3,5-trinitro-s-triazine cyclotetratmethylene-tetranitramine

A.1.16. MOUND 01 - HYDROGEOCHEMICAL

Six samples were collected from six locations (Figure A.1). Location 0001 was sampled on May 10, 1987; all others were sampled on August 2, 1990. Sample depth ranges were 0 to 1 ft. Each sample was analyzed for volatiles, and location 0001 was also analyzed for the explosives HMX and RDX.

Low amounts of tetrachloroethene and trichloroethene were found in two samples. No explosives were detected.

Location	Date	Depth (ft)	Organics	Analysis Result (µg/kg)	Quantitation Limit (µg/kg)
0017	8/02/90	0-0.7	Tetrachloroethene	30	20
			Trichloroethene	20	20
0019	8/02/90	0-0.4	Trichloroethene	20	20

A.2. REFERENCES

ATSDR. 1990. "Toxicological Profile for Aluminum and Compounds [DRAFT]." Prepared by Clement Associates, Inc. October 1990.

DOE. In progress. "Operable Unit 3, Limited Field Investigation Report." Environmental Restoration Program, U.S. Department of Energy, Albuquerque Field Office, Albuquerque, New Mexico.

DOE. 1992a. "Reconnaissance Sampling Report, Decontamination and Decommissioning Areas, Operable Unit 6, Mound Plant, Miamisburg, Ohio [FINAL]." Environmental Restoration Program, U.S. Department of Energy, Albuquerque Field Office, Albuquerque, New Mexico. May 1992.

DOE. 1992b. "Operable Unit 6, Decontamination and Decommissioning, Proposed Area 14 Fuel Oil Storage System Verification Report, Mound Plant, Miamisburg, Ohio [DRAFT FINAL]." Environmental Restoration Program, U.S. Department of Energy, Albuquerque Field Office, Albuquerque, New Mexico. August 1992.

DOE 1992c. "Operable Unit 6, Decontamination and Decommissioning, Area 17, Special Metallurgical (SM) Building Annex Verification Report, Mound Plant, Miamisburg, Ohio [DRAFT FINAL]." Environmental Restoration Program, U.S. Department of Energy, Albuquerque Field Office, Albuquerque, New Mexico. August 1992.

Dragun, James. 1988. "The Soil Chemistry of Hazardous Materials." Hazardous Materials Control Research Institute. Silver Spring, Maryland.

Kabata-Pendias, A., and H. Pendias. 1992. *Trace Elements in Soils and Plants.* 2d Ed. CRC Press. Boca Raton, Florida.

Michigan. 1988. "How Clean is Clean?" Draft Guidance, Michigan Department of Natural Resources, Waste Management Division. May 1988.

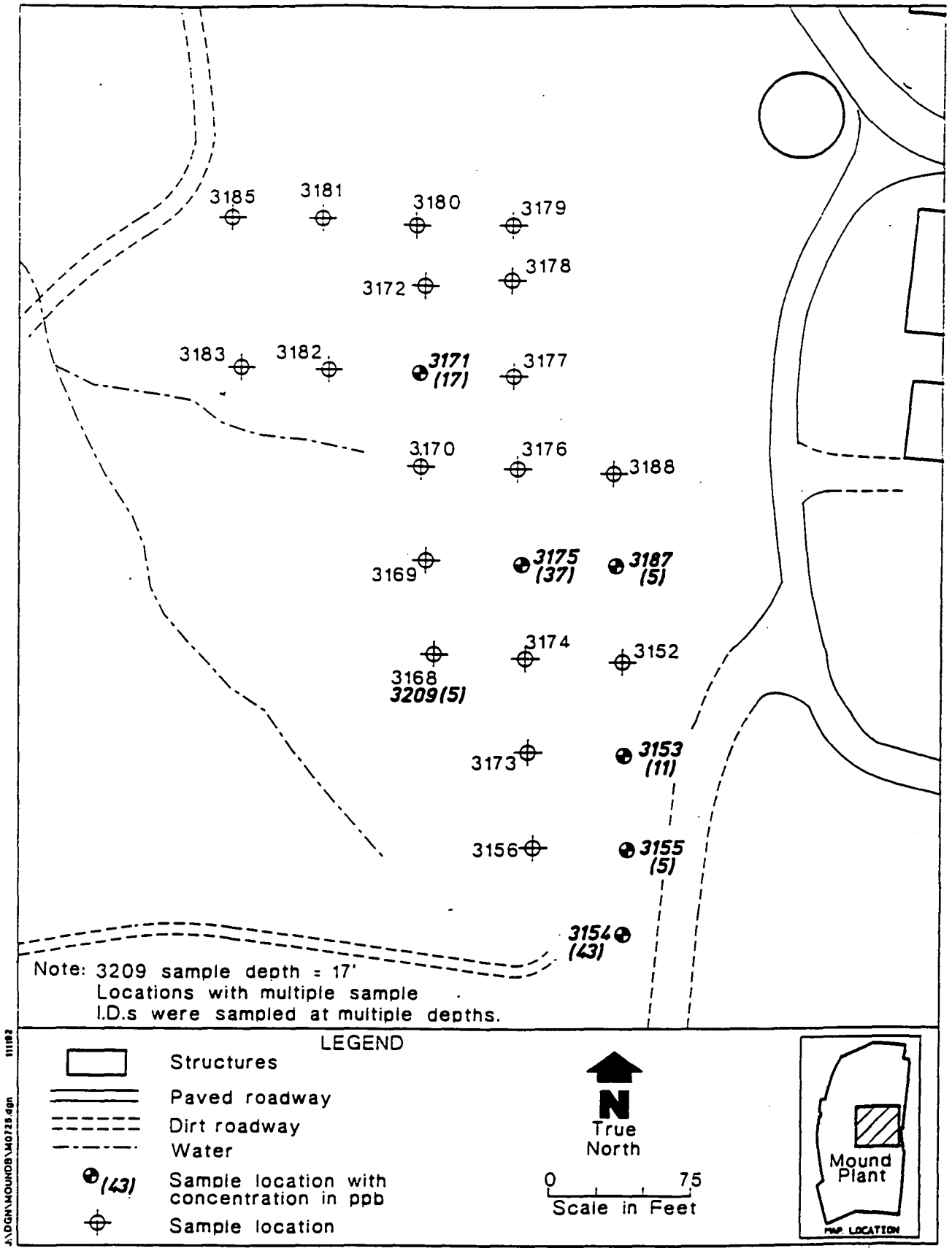


Figure A.1. Total VOCs detection map for Area J.

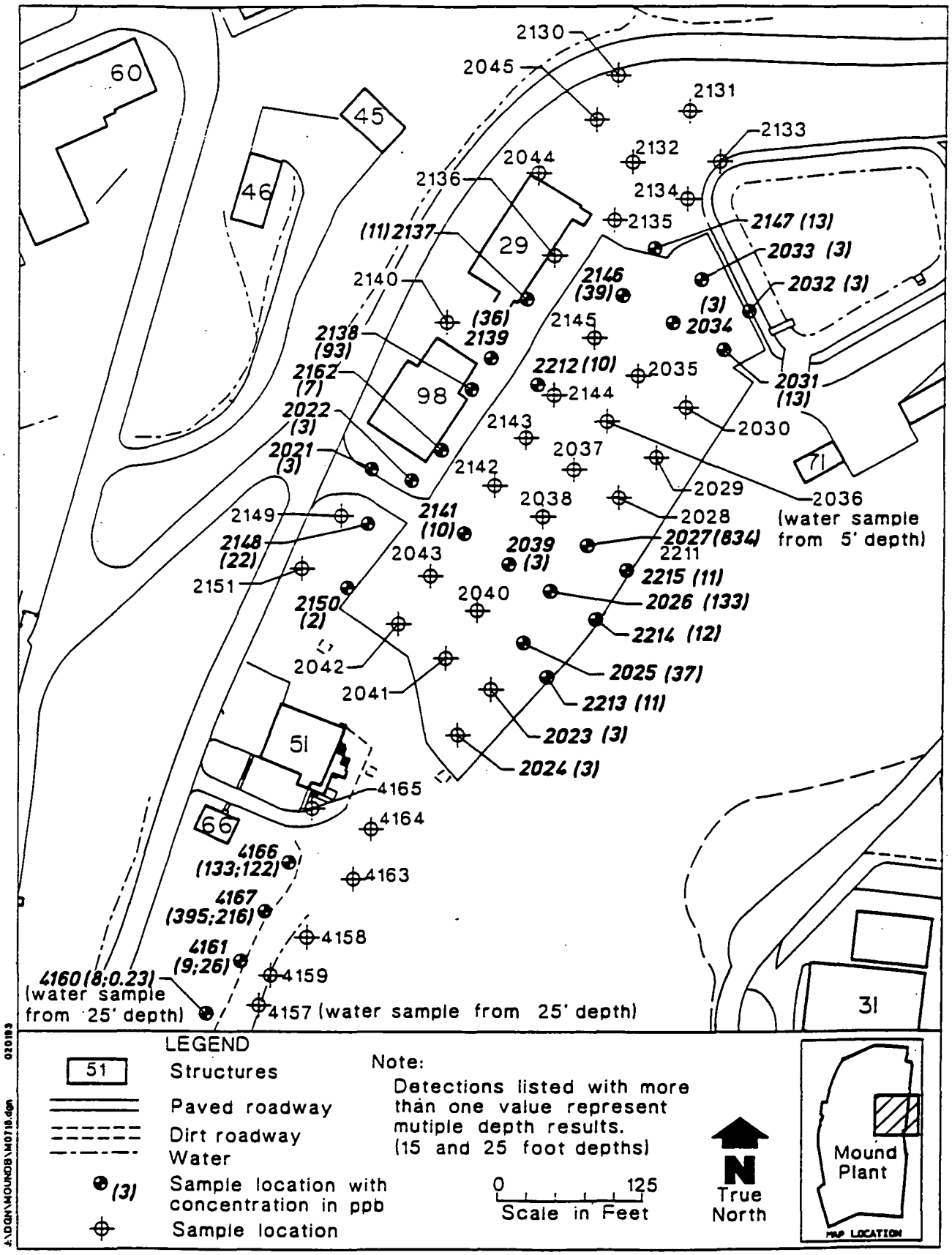


Figure A.2. Total VOCs detection map for Area 7 and Building 51.

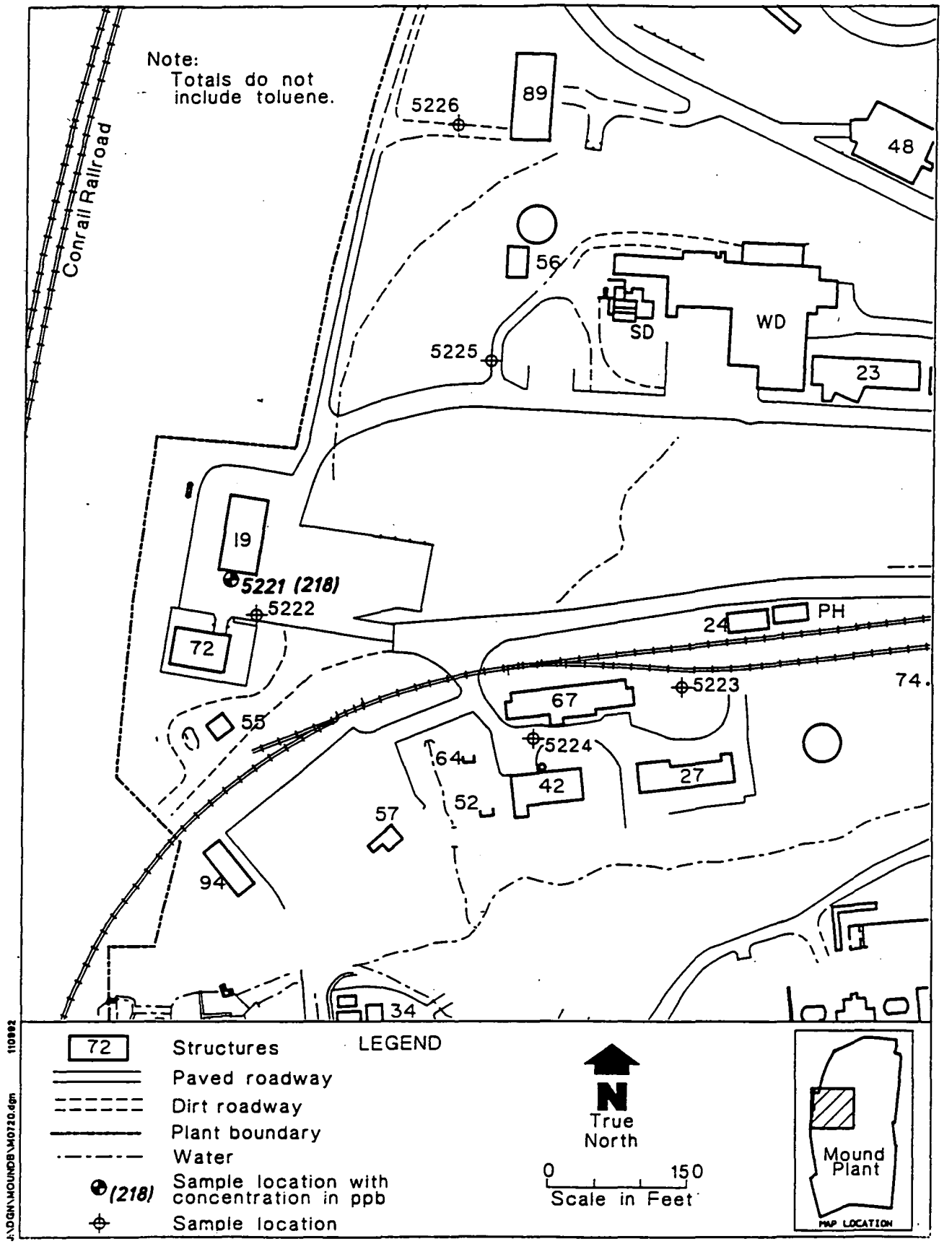


Figure A.3. Total VOCs Detection Map for Southwest of Main Hill.

PHASE 1: SITE RECONNAISSANCE INVESTIGATION

Screening techniques are part of the initial phase of the exploratory study. The data obtained from field-screening techniques are a qualitative screen that can be used to determine a strategy for directing investigations in areas of probable contamination and aquire data needed to prepare refined DQOs for additional investigations in subsequent phases.

PHASE 2: INITIAL RI SAMPLING

Phase 2 provides detailed data of sufficient and consistent quality to define areas of contamination and contaminant pathways and migration. Samples for the various media (soils, sediments, surface water, and groundwater) will be obtained and analyzed for all contaminants of concern.

PHASE 3: DATA GAP (NATURE & EXTENT) INVESTIGATIONS

Phase 3 (and subsequent phases) will be performed to fill data gaps found as a result of previous phase activities and to provide detailed investigations into hydrogeologic characterizations as it relates to contaminant pathway and remedial design.

STEP 1: RECONNAISSANCE DATA COLLECTION

RI TASK 1: SOIL GAS / GAMMA SURVEYS	RI TASK 2: GEOPHYSICAL SURVEYS	RI TASK 3: SEEPS SURVEY	RI TASK 4: SUBSURFACE UTILITY EVALUATION	RI TASK 5: PRELIMINARY HYDROGEOLOGIC INVESTIGATION
• Determine AOC Locations within the OU5 boundaries by conducting directed surveys. • Identify selected and total VOCs and Radionuclides (coordinate with duplicate screening by Soils Screening facility). • Identify which potential sources have released contaminants to soil. • Define the extent of contamination (Horizontal). • Produce isoconcentration maps of identified contamination.	• Determine near-surface and subsurface objects in select AOCs. • Identify objects which could impact subsequent intrusive investigation. • Produce map of identified objects.	• Locate potential seeps during wet and dry seasons. • Coordinate Aerial Photographic survey information. • Interview Plant personnel for knowledge of potential seeps/sources. • Review available building plans for potential contaminant seep sources - such as foundation drains, process lines, sewer lines, and others. (Refine lithologic database, based on the review of building plans and available soil borings) • Produce map of identified potential contaminant source of release areas.	• Review available utility plans for potential AOC sources - such as foundation drains, process lines, sewer lines, and others. • Produce map of potential utility source pathways to AOCs (coordinate this map with RI TASK 3).	• Obtain quarterly groundwater level data of selected existing monitoring wells. • Obtain groundwater sampling data from prior OU-9 investigations.

STEP 2: PREPARATION FOR PHASE 2

RI TASK 6: DATA COMPILATION AND ANALYSIS	RI TASK 7: REVIEW AND APPROVAL
• Review and evaluate all data obtained from Step 1 and determine strategy for Phase 2. • Locate and map AOCs. Modify WP, FSP, QAPjp, and HSP.	• Submit modified WP, FSP, QAPjp, and HSP to USEPA and OEPA for review, comment and approval. • Resolve comments and finalize documents.

STEP 1: NATURE AND EXTENT DATA COLLECTION

RI TASK 8: SURFACE & SUBSURFACE SOIL/SEDIMENT SAMPLING	RI TASK 9: PRELIMINARY HYDROGEOLOGIC INVESTIGATIONS	RI TASK 10: SURFACE WATER/SEEP SAMPLING	RI TASK 11: BEDROCK TOPOGRAPHIC MAPPING
• Perform random and directed sampling schemes in AOCs and Non-AOCs. • Borings into bedrock for a select quantity. • Sediments sampled from all areas of deposition by surface water. • Refine the lithologic database, based on soil borings. • Define horizontal and vertical extent of AOCs.	• Perform slug tests on selected existing monitoring wells. • Obtain groundwater sampling data from recent OU-9 surveys. • Sample groundwater when encountered during RI TASK 8 soil borings. • Identify perched and bedrock water tables encountered as a result of RI TASK 8 soil borings.	• Sample surface water seeps and characterize. • Sample plant drainage ditch and ephemeral stream channels.	• Review building plans and lithologic database and refine bedrock topographical database. • Provide a refined map indicating depth to bedrock, configuration of bedrock, thickness of unconsolidated deposits and weathered bedrock zones, fractured bedrock zone, presence of saturated layers and lithologic data.

STEP 2: PREPARATION FOR PHASE 3

RI TASK 12: DATA COMPILATION AND ANALYSIS	RI TASK 13: REVIEW AND APPROVAL
• Review and evaluate all data obtained from Step 1 and determine strategy for Phase 3. • Refine the horizontal and vertical extent of contamination. • Modify WP, FSP, QAPjp, and HSP.	• Submit modified WP, FSP, QAPjp, and HSP to USEPA and OEPA for review, comment, and approval. • Resolve comments and finalize documents.

STEP 1: FURTHER DEFINED NATURE AND EXTENT DATA COLLECTION

RI TASK 14: HYDROGEOLOGIC INVESTIGATIONS	RI TASK 15: ADDITIONAL MEDIA INVESTIGATIONS
• Locate, install and sample monitoring wells to identify contamination and verify lack of contamination. Wells will be located upgradient and downgradient of AOCs and OU-5 area (a select quantity of wells will be installed into bedrock). • Identify free product encountered. Sample select subsurface utility trenches in AOCs to determine potential contaminant migration. • Data from existing or new wells will be used to determine background groundwater levels. • Incorporate new monitoring wells into quarterly groundwater level monitoring program.	• Perform additional sampling of surface and subsurface soil and sediment, seeps, and surface water as data needs are determined.

STEP 2: PREPARATION FOR SUBSEQUENT PHASES

RI TASK 16: DATA COMPILATION AND ANALYSIS	RI TASK 17: REVIEW AND APPROVAL
• Review and evaluate all data obtained from Step 1 and determine strategy for subsequent phase. • Refine the horizontal and vertical extent of contamination. Modify WP, FSP, QAPjp, and HSP.	• Submit modified WP, FSP, QAPjp, and HSP to USEPA and OEPA for review, comment and approval. • Resolve comments and finalize documents.

FINAL PHASE: PREPARE RI/FS REPORT

OPERABLE UNIT 5 RI/FS OBJECTIVES

- To define the nature and extent of contamination (location, extent, and source) in the soil and water in OU5.
- To characterize the risks to human health and the environment.
- To evaluate potential remedies.

Figure ADD.1. Listing of Tasks To Be Completed Under Project Phase

Table I.2. Potential Radioactive Contaminants at Mound Plant

Radioactive Contaminant	Half-Life	Radioactivity Emitted	Decay Products	Health Standards in µCi/ml				Possible Source	Data
				DOE 5480 Worker	10CFR20				
					EPA Worker	Worker	Public		
Actinium-227	21.6 y	Alpha,Beta,Gamma(Th L X-ray)	Fr-223,Th-227,Ra-223,Rn-219...Tl-207	7.0E-13 W	7.0E-13 W	2.0E-12 S	8.0E-14 S	"Old Cave" SW Bldg (irradiation of Ra-226) 1955	D&D SW Bldg late 1950s (SSP)
Americium-241	458 y	Alpha,Gamma(Np L X-ray)	Np-237,Pa-233,U-233,Th-229...Bi-209	2.0E-12 W	3.0E-12	6.0E-12 S	2.0E-13 S	Waste from Pu-238 processing 60s and 70s	Alpha Wastewater Treatment System
Bismuth-207	38 y	Gamma(Pb X-ray)	Pb-207(stable)	2.0E-07 W	1.0E-07 W	2.0E-07 S	6.0E-09 S	Wasteline break near HH bldg	OU-9 Site Scoping Report Vol. III
Bismuth-210	5.0 d	Alpha,Beta,Gamma(Po X-ray)	Po-210,Pb-206(stable)	1.0E-08 W	1.0E-08 W	6.0E-09 S	2.0E-10 S	Wasteline break near HH bldg	DOE Site Survey Project (SSP)
Bismuth-210m	2.6E+06 y	Alpha,Gamma	Tl-206,Pb-206(stable)	3.0E-10 W	3.0E-10 W	6.0E-13 *	2.0E-14*	Wasteline break near HH bldg	DOE Site Survey Project (SSP)
Cadmium-113	1.3E+15 y	Beta	In-113(stable)	3.0E-09 W	3.0E-09 W	3.0E-09*	1.0E-10*	Impurity from irradiation of Bi slug	Polonium from irradiated Bismith (Gnagey)
Cessium-137	30 y	Beta,Gamma(Ba X-ray)	Ba-137m,Ba137(stable)	7.0E-08 D	6.0E-08 D	6.0E-08 S	2.0E-09 S	Reactor fuel reprocessing pilot plant	Doe Site Survey Project (SSP)
Cobalt-60	5.3 y	Beta,Gamma	Ni-60(stable)	7.0E-08 W	7.0E-08 W	3.0E-07 S	1.0E-08 S	Impurity from irradition of Bi slug aluminum can	Bldg 48, Dec 1970 (SSP)
Neptunium-237	2.1E+06 y	Alpha,Gamma(Pa L X-ray)	Pa-233,U-233,Th-229,Ra-225...Bi-209	2.0E-12 W	2.0E-12	4.0E-12 S	1.0E-13 S	Waste from Pu-238 processing 60s and 70s (impurity)	Alpha Wastewater Treatment System
Neptunium-239	2.4 d	Beta,Gamma(Pu X-ray)	Pu-239,U-235,Th-231...Tl-207	1.0E-06 W	9.0E-07	8.0E-07 S	3.0E-08 S	Waste from Pu-238 processing 60s and 70s (impurity)	Alpha Wastewater Treatment System (?)
Nickel-59	1.0E+05 y	Gamma(Co X-ray)	Co-59(stable)	3.0E-06 W	3.0E-06 W	5.0E-07 S	2.0E-08 S	Impurity from irradiation of Bi slug aluminum can	Polonium from irradiated Bismuth (Gnagey)
Nickel-63	92 y	Beta	Cu-63(stable)	1.0E-06 W	1.0E-06 W	6.0E-08 S	2-0E-09 S	Impurity from irradiation of Bi slug aluminum can	Polonium from irradiated Bismuth (Gnagey)
Plutonium-236	2.9 y	Alpha,Gamma(U L X-ray)	U-232,Th-228,Ra-224,Rn-220...Po-212	7.0E-12 W	8.0E-12 W	6.0E-13 *	2.0E-14 *	Pu-238 impurity (?)	OU-9 Site Scoping Report Vol. III
Plutonium-238	36 y	Alpha,Gamma(U L X-ray)	U-234,Th-230,Ra-226,Rn-222...Po-210	7.0E-12 W	3.0E-12 W	2.0E-12 S	7.0E-14 S	Pu R&D started in 1949 (Alpha section SW/R complex)	Alpha Wastewater Treatment System (SSP)
Plutonium-239	2.4c+04 y	Alpha,Gamma(U X-ray)	U-235,Th-231,Pa-231,Ac-227...Tl-207	6.0E-12 W	3.0E-12 W	2.0E-12 S	6.0E-14 S	Impurities in PPO process 60s-70s (SW/R Complex)	Alpha Wastewater Treatment System
Plutonium-240	6580 y	Alpha,Gamma(U L X-ray)	U-236,Th-232,Ra-228,Ac-228...Po-212	2.0E-12 W	3.0E-12 W	2.0E-12 S	6.0E-14 S	Impurities in PPO process 60s-late 70s	Alpha Wastewater Treatment System (SSP)
Plutonium-241	13.2 y	Alpha,Beta,Gamma(U X-ray)	Am-241,Np-237,Pa-233,U-233...Bi-209	1.0E-12 W	1.0E-10 W	9.0E-11 S	3.0E-12 s	Impurities in PPO process 60s-late 70s	Alpha Wastewater Treatment System (SSP)
Plutonium-242	3.8E+05 y	Alpha,Gamma(U L X-ray)	U-238,Th-234,Pa-234m,Pa-234...Po-210	2.0E-12 W	3.0E-12 W	2.0E-12 S	6.0E-14 S	Impurities in PPO process 60s-late 70s	Alpha Wastewater Treatment System (SSP)
Polonium-209	103 y	Alpha,Gamma(Bi X-ray)	Pb-205,Tl-205(stable)	1.0E-01 W	1.0E-01 W	6.0E-13 *	2.0E-14 *	Rare isotope separation, SW & R Bldg (1950-85)	SD Plant Sludge

Table I.2. Potential Radioactive Contaminants at Mound Plant

Radioactive Contaminant	Half-Life	Radioactivity Emitted	Decay Products	Health Standards in µCi/ml				Possible Source	Data
				DOE 5480 Worker	10CFR20				
					EPA Worker	Worker	Public		
Polonium-210	138.4 d	Alpha,Gamma	Pb-206(stable)	3.0E-10 W	3.0E-10 W	5.0E-10 S	2.0E-11 S	Po-210 R&D started 1943, ended 1971	Bldg 48, Dec 1970
Protactinium-231	3.3E+04 y	Alpha,Gamma(Ac X-ray)	Ac-227,Fr-223,Th-227,Ra-223...Tl-207	7.0E-13 W	6.0E-13 W	1.0E-12 S	4.0E-14 S	Th Project 1975 (Cotter Conc. & St. Louis Airpt Cake)	OU-9 Site Scoping Report Vol. III
Radium-226	1602 y	Alpha,Gamma(Rn X-ray)	Ra-222,Po-213,Pb-214,Bi-214...Po-210	3.0E-08 D	3.0E-10 W	3.0E-11 S	3.0E-12 S	"Old Cave" SW Bldg (rare isotope process) 1955	D&D SW Bldg late 1950s (SSP)
Radon-222	3.8 d	Alpha,Gamma	Po-218,Pb-214,Bi-214...Po-210	3.0E-10 W	4 WLM	3.0E-08	3.0E-09	"Old Cave" SW Bldg (rare isotope process) 1955	Stack monitor on Cave Stack
Silver-108	2.4 m	Beta,Gamma(Pd X-ray)	Pd-108 and Cd-108(stable)	5.0E-02 W	5.0E-02 W	1.0E-06 *	3.0E-08 *	Impurity from irradiation of Bi slug aluminum can	Polonium from irradiated Bismuth (Gnagey)
Strontium-90	28.4 y	Beta	Y-90,Z-90(stable)	8.0E-09 D	8.0E-09 D	1.0E-09 S	3.0E-11 S	Reactor fuel reprocessing pilot plant	(?)
Thorium-228	1.9 y	Alpha,Gamma(Ra L X-ray)	Ra-224,Rn-220,Po-216,Pb-212...Po-212	4.0E-12 W	4.0E-12 W	9.0E-12 S	3.0E-13 S	Rare isotope separation, SW & R Bldg (1950-85)	SD Plant Sludge (SSP)
Thorium-229	7340 y	Alpha,Gamma(Ra X-ray)	Ra-225,Ac-225,Fr-221,At-217...Pb-209	4.0E-13 W	4.0E-13 W	6.0E-13 *	2.0E-14 *	Rare Isotope separation, SW & R Bldg (1950-85)	SD Plant Sludge
Thorium-230	8.0E+04 y	Alpha,Gamma(Ra L X-ray)	Ra-226,Ra-222,Po-218,Pb-214...Po-210	3.0E-12 W	3.0E-12 W	2.0E-12 S	8.0E-14 S	Brazilian and Belgian Congo Th-Project (1954-55,75)	SD Plant Sludge
Thorium-232	1.4E+10 y	Alpha,Gamma(Ra L X-ray)	Ra-228,Ac-228,Th-228,Ra-224...Po-212	5.0E-13 W	5.0E-13 W	3.0E-11 S	1.0E-12 S	Pu-238 impurity and Thorium Projects (1953-1975)	Repackaging Project (SSP)
Tin-121	27 h	Beta	Sb-121(stable)	5.0E-06 W	5.0E-06 W	3.0E-09 *	1.0E-10 *	Impurity from irradiation of Bi Slug aluminum can	Polonium from irradiated Bismuth (Gnagey)
Tritium	12.3 y	Beta	He-3(stable)	2.0E-05 W	2.0E-05 W	5.0E-06 S	2.0E-07 S	SW/R Complex, T & HH Bldgs (mid 50s-present)	OU-9 Site Scoping Report Vol. III (SSP)
Uranium-232	72 y	Alpha,Gamma(Th L X-ray)	Th-228,Ra-224,Rn-220,Po-216...Po-212	2.0E-10 W	2.0E-10 W	1.0E-10 S	3.0E-12 S	Pu-238 impurity	OU-9 Site Scoping Report Vol. III (SSP)
Uranium-233	1.6E+05 y	Alpha,Gamma(Th X-ray)	Th-229,Ra-225,Ac-225,Fr-221...Bi-209	3.0E-10 W	3.0E-10 W	5.0E-10 S	2.0E-11 S	Rare isotope separation, SW & R Bldg (1950-85)	Alpha Wastewater Treatment System
Uranium-234	2.5E+05 y	Alpha,Gammaa(Th L X-ray)	Th-230,Ra-226,Rn-222,Po-213...Po-210	3.0E-10 W	3.0E-10 W	6.0E-10 S	2.0E-11 S	Rare isotope separation, SW & R Bldg (1950-85)	OU-9 Site Scoping Report Vol. III (SSP)
Uranium-235	7.1E+06 y	Alpha,Gamma(Th X-ray)	Th-231,Pa-231,Ac-227,Fr-223...Tl-207	3.0E-10 W	3.0E-10 W	5.0E-10 S	2.0E-11 S	Rare isotope separation, SW & R Bldg (1950-85)	Alpha Wastewater Treatment System
Uranium-236	2.4E+07 y	Alpha,Gamma(Th L X-ray)	Th-232,Ra-228,Ac-228,Th-228...Pb-208	3.0E-10 W	3.0E-10 W	6.0E-10 S	2.0E-11 S	Pu-238 impurity	OU-9 Site Scoping Report Vol. III (SSP)
Uranium-238	4.5E+09 y	Alpha,Gamma(Th L X-ray)	Th-234,Pa-234m,Pa-234...Po-210	3.0E-10 W	3.0E-10 W	7.0E-11 S	3.0E-12 S	Waste from Pu-238 processing 60s and 70s	Alpha Wastewater Treatment System

m = minute, h = hour, d = day, y = year, D - Day, W = Week, S = Soluble, * = submersion in a cloud of airborne material, WLM = Working Level Month

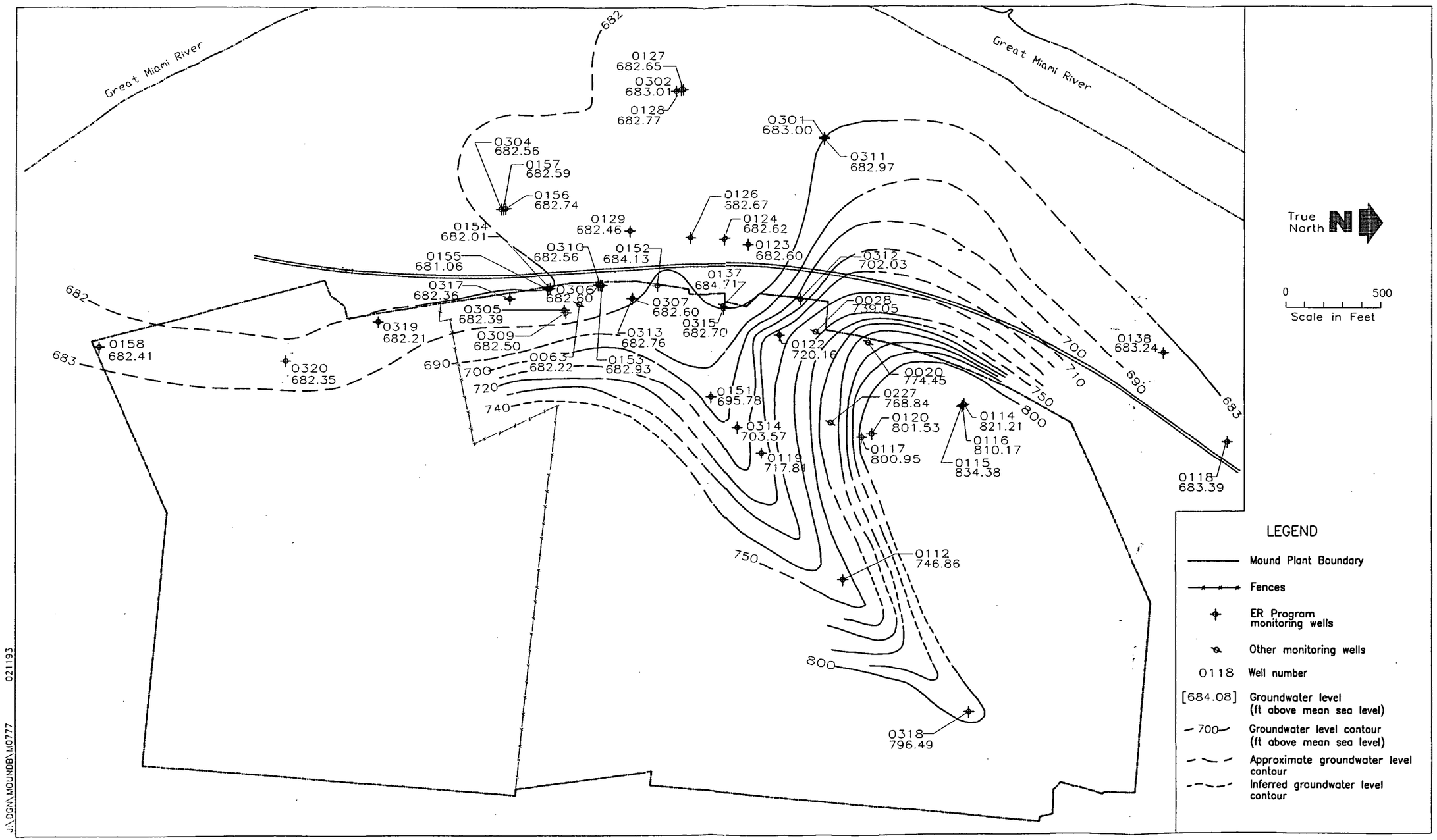


Figure 2.2. Localized Groundwater Level Contour Map for September 1992

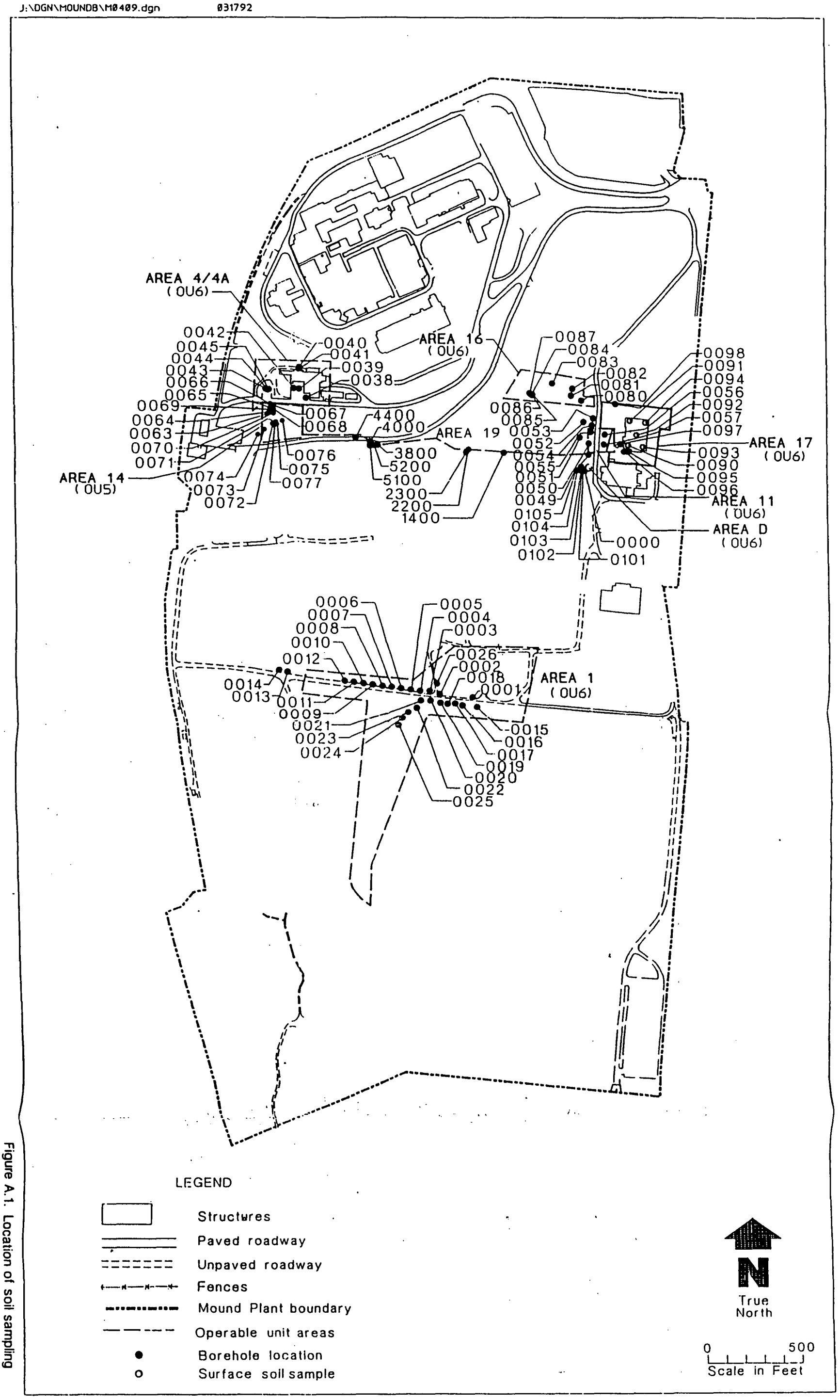
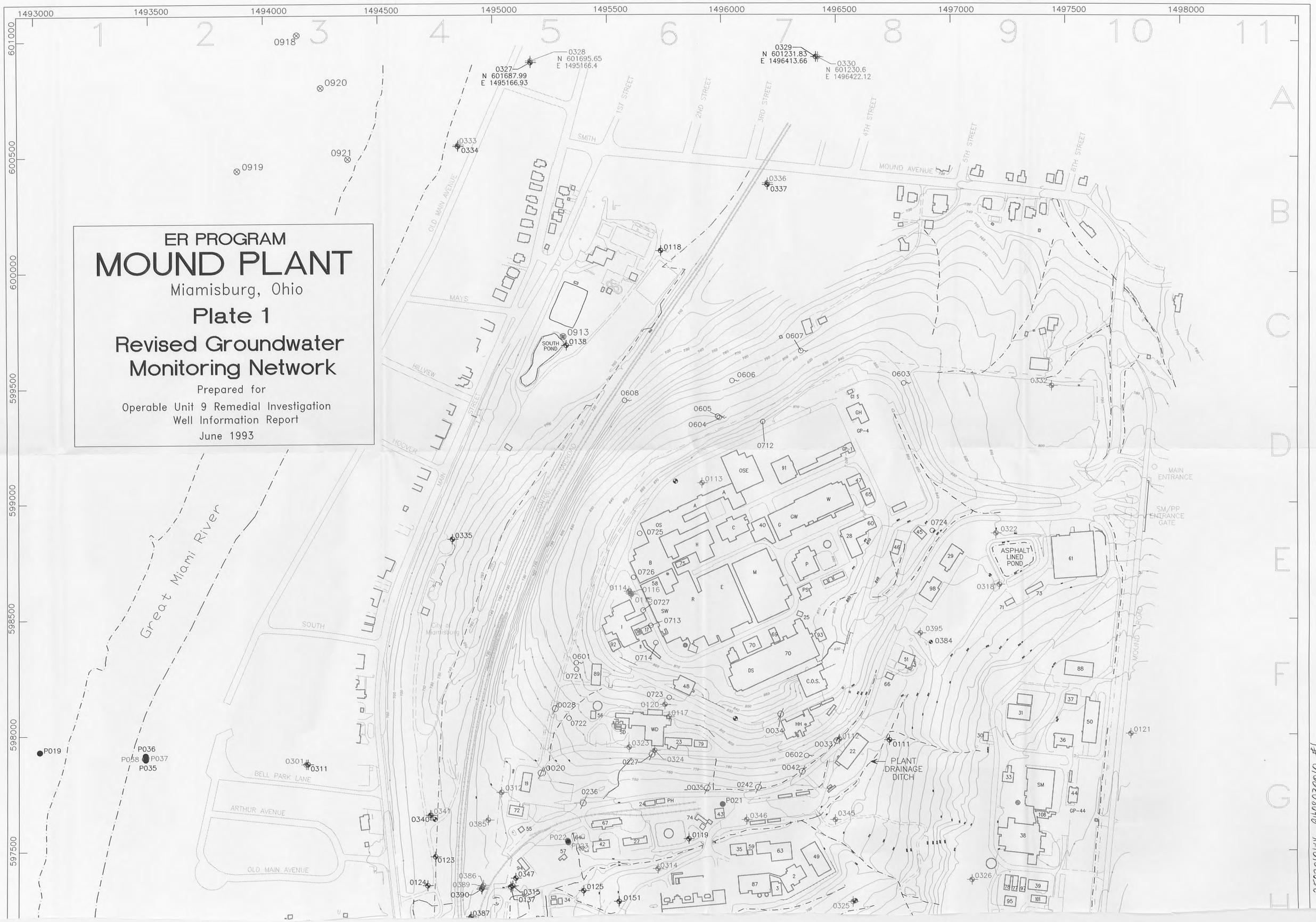


Figure A.1. Location of soil sampling areas for chemicals.



25DR0101XX-940830010 #1
Rev 10/97

53 Structures
Paved roadway
Unpaved roadway
Railroad
Water course
Fence
Retaining wall
Mound Plant boundary
Property boundary
Contour line

Other monitoring wells and piezometers
Municipal and Plant production wells
Domestic and other supply wells

Groundwater seep
Tritium groundwater assessment monitoring station
Piezometers
Borehole

Existing well completed in Upper Buried Valley aquifer
Existing well completed in Lower Buried Valley aquifer
Existing well completed in Bedrock

Piezometer completed in Upper Buried Valley aquifer
Piezometer completed in Lower Buried Valley aquifer
Piezometer completed in Bedrock
Estimated well location

NOTES:

1. The electronic base map data file was obtained by WESTON from Woolpert Consultants, Inc., Dayton, Ohio. The data were photogrammetrically complied from aerial photography dated 12/08/85.

2. WESTON converted MOUND plant coordinates to Ohio State Plane Coordinates using an algorithm provided by Oak Ridge National Laboratory, Grand Junction Project Office.

3. Area west of Dayton–Cincinnati Pike was digitized from a hand drafted map, dated 3/12/86 from Monsanto Research Corp.

4. New monitoring wells and piezometers and the older existing ER Program monitoring wells were resurveyed in reference to control monuments established by the National Geodetic Survey. Horizontal coordinates were established in the North American Datum of 1983 (NAD 83) and transformed into NAD 27 using a program called NADCON. Because discrepancies were noted between the reported and measured Mound Plant monuments, a second transformation of the data to conform to the plant coordinates was necessary.

5. Older unused monitoring wells and piezometers, domestic wells, municipal and plant production wells were not resurveyed. The location coordinates of these wells and piezometers remain unchanged from previously published ER Program maps.

NOTE: MAP PROVIDED BY ROY F. WESTON INC. IN INTERGRAPH MICROSTATION FORMAT AND CONVERTED TO AUTOCAD REL. 12 BY SCIENCE APPLICATIONS INTERNATIONAL CORPORATION 8/19/93, WITH THE EXCEPTION OF THIS NOTE, ALL MAP DATA EDITORIAL CONTROL, AND REVISION HISTORY IS BY ROY F. WESTON INC.

Contour interval 10 ft.

0 100 200 400 600 800 1000
Scale in Feet

BOX 28137
25020101XX-9408030010 #2

J:\DGN\MOUNDB\M0825.dgn 062893

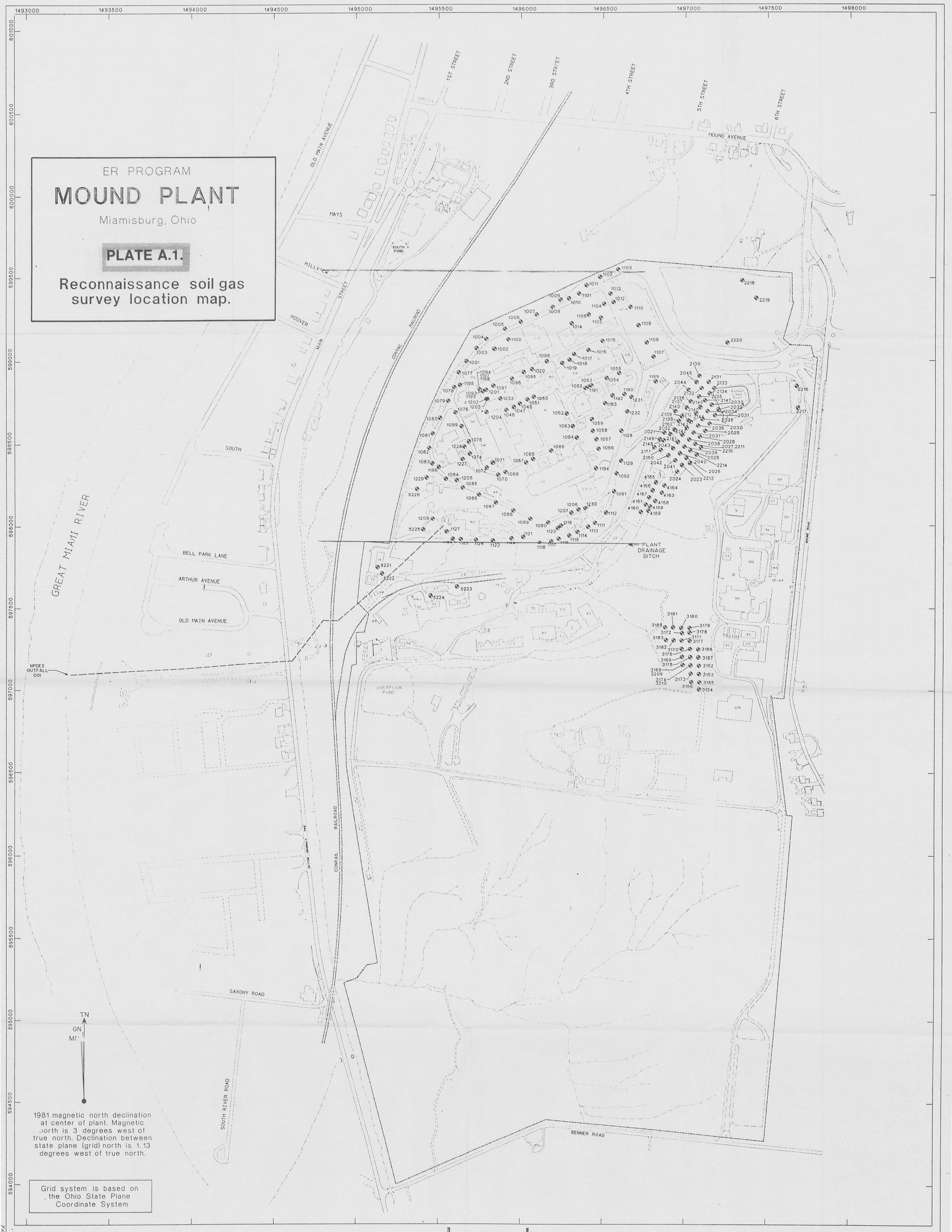
ER PROGRAM

MOUND PLANT

Miamisburg, Ohio

PLATE A.1.

Reconnaissance soil gas survey location map.



1981 magnetic north declination at center of plant. Magnetic north is 3 degrees west of true north. Declination between state plane (grid) north is 1.13 degrees west of true north.

Grid system is based on the Ohio State Plane Coordinate System

Legend

- Structure
- Paved Roadway
- Unpaved Roadway
- Railroad
- Water
- Mound Plant Boundary
- 1100 Sample location

NOTES:

1. The electronic base map data file was obtained by WESTON from Woolpert Consultants, Inc., Dayton, Ohio. The data were photogrammetrically compiled from aerial photography dated 12/08/85.

2. WESTON converted MOUND plant coordinates to Ohio State Plane Coordinates using an algorithm provided by Oak Ridge National Laboratory, Grand Junction Project Office.

3. Area west of Dayton-Cincinnati Pike was digitized from a hand drafted map, dated 3/12/86 from Monstanto Research Corp.

0 100 200 400 600 800 1000
Scale in Feet

SAIC Science Applications International Corporation

SOURCE: ROY F. WESTON, INC.

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SAIC
Science Applications International Corporation

SOURCE: ROY F. WESTON, INC.

ER PROGRAM

MOUND PLANT

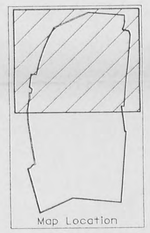
Miamisburg, Ohio

PLATE A.2.
(1 OF 2)

Site Survey Project
Site Survey Project Sampling Locations

Prepared for

Site Scoping Report: Volume 3,
Radiological Site Survey



Surface Location
Core Location
Potential Release Site
Elevated Activity
Sampling Location for Verification Survey of Former WTS Pipeline

0 50 100 150 200
Scale in Feet
1 Inch = 100 feet

Grid system is based on the Ohio State Plane Coordinate System

NOTE: Accuracy of surface locations is +/- 25 feet.

TN
GN
MN

1981 magnetic north declination at center of plant. Magnetic north is 3 degrees west of true north. Declination between state plane (grid) north is 1.13 degrees west of true north.

1494500 1495000 1495500 1496000 1496500 1497000 1497500

599500 599000 598500 598000 597500 597000

CONRAIL RAILROAD

MOUND ROAD

AREA 3
AREA 4/4a
AREA 5
AREA 6
AREA 7
AREA 8
AREA 9
AREA 10
AREA 11
AREA 12
AREA 13
AREA 14
AREA 15
AREA 16
AREA 17
AREA 19
AREA 20
AREA 21
AREA D
AREA J

POSSIBLE ELEVATED THORIUM

PARKING LOT

Asphalt Lined Pond

Retention Basins

Overflow Pond

OUTFALL 002

MATCH LINE

MATCH LINE

BOX 23137 25020101XX-94080260010 #

ER PROGRAM

MOUND PLANT

Miamisburg, Ohio

PLATE A.2.

(2 OF 2)

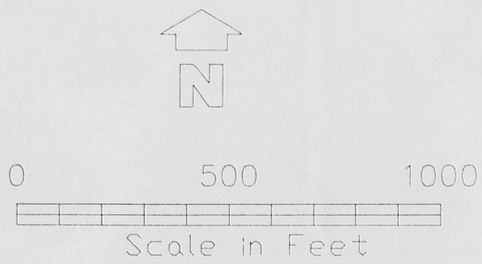
Site Survey Project

Site Survey Project Sampling Locations

Prepared for

Site Scoping Report: Volume 3, Radiological Site Survey

2502010/XX-9408030010 #5
Reg. 28137



SAIC
Science Applications International Corporation

SOURCE: ROY F. WESTON, INC.

NOTE: CONTOURS WERE CREATED WITH CPS/PC (REGISTERED TRADEMARK) USING SURVEYED SAMPLE LOCATIONS. THE BUILDINGS AND D & D SITES WERE HAND-DIGITIZED FROM EXISTING DRAWINGS.

MOUND, 89, 80 COMBINED Pu CONC. IN SURFACE SAMPLES (pCi/g)-34000 [SPUCOMB.CMD]

Box 28137 25020101XX-9408030010

#6

PLATE A.3. Contours of Combined Reconnaissance Investigation and Site Survey Surface Soil Concentrations for Plutonium

0 500 1000

Scale in Feet

NOTE: CONTOURS WERE CREATED WITH CPS/PC (REGISTERED TRADEMARK) USING SURVEYED SAMPLE LOCATIONS. THE BUILDINGS AND D & D SITES WERE HAND-DIGITIZED FROM EXISTING DRAWINGS.

SAIC
Science Applications International Corporation

SOURCE: ROY F. WESTON, INC.

MOUND, 89, 80 COMBINED Th CONC. IN SURFACE SAMPLES (pCi/g) [STHCOMB.CMD]

25020101XX-9408030010 #1
Box 28137

PLATE A.4. Contours of Combined Reconnaissance Investigation and Site Survey Surface Soil Concentrations for Thorium