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Environmental Restoration Program

REMEDIAL INVESTIGATION/FEASIBILITY STUDY OPERABLE UNIT 9, SITE-WIDE WORK PLAN, FIELD SAMPLING PLAN

MOUND PLANT
MIAMISBURG, OHIO

VOLUME I WORK PLAN TEXT (SECTIONS 1 - 15)

May 1992

FINAL

Department of Energy
Albuquerque Field Office

Environmental Restoration Program
Technical Support Office
Los Alamos National Laboratory

ENVIRONMENTAL RESTORATION PROGRAM

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
OPERABLE UNIT 9, SITE-WIDE
WORK PLAN

MOUND PLANT
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DEPARTMENT OF ENERGY
ALBUQUERQUE FIELD OFFICE

ENVIRONMENTAL RESTORATION PROGRAM
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conceptual models, exposure pathways and potential impacts to the public and the environment for all nine operable units. These summaries are included in the work plan, but are not in this Executive Summary. Once the individual operable unit RIs are complete, data from all the investigations will be compiled in order to present a comprehensive conceptual model and report. Second, specific field investigations will be conducted in the Site-Wide, Operable Unit 9 to address potential contamination and contaminant transport both within and outside the Mound Plant boundary. This will include regional studies to ascertain the background setting of the plant. Results of these studies will be reported in a series of interim reports or technical memorandums so that the data will be available during the other operable unit investigations.

The Site-Wide field investigations proposed in this work plan include specific field activities on hydrogeology, residential wells, soils, surface water and sediments, meteorology and air quality, and ecology. Investigations will be phased so that data collected from early phases may assist in determining the number and locations of samples from later phases. Background measurements will include groundwater quality in the bedrock and Buried Valley aquifer, the natural chemical character of the plant soils and the chemical character of surface water and sediments from small watersheds of similar geomorphic setting. Results from the regional soil studies are required before true surface water, sediment, and soil background locations can be determined.

Additional field investigations will be compared to background measurements to establish the current level of contamination in the groundwater, soils, sediments, and surface water that surround the plant. Investigations addressing surface features, geology, and land use will not require field work, but will require the compilation either of information from existing reports or data from the field investigations. A summary of the number and type of samples to be collected is given in Table ES.1. The analytical parameters focus on those chemical and radiological contaminants known to have been used at the plant. The list in Table ES.1 includes generalizations that may not be true for all investigations. Complete lists of actual analytical parameters in each investigation are presented in tables in the following sections of this Work Plan.

A Quality Assurance Project Plan, Health and Safety Plan, and a Field Sampling Plan are provided as companion documents to this work plan.

Geologic Investigations

The Site-Wide geologic investigations will include compilations of stratigraphic and lithologic data across the site. No field work is required, as much of the data exists or will be collected as part of specific field work conducted in the hydrogeology, soils, or sediment investigations. Work that will be completed within the geologic investigations include the following:

- the compilation of stratigraphic and lithologic data across the Site;

Table ES.1. Site-Wide Investigations, Operable Unit 9, Sample Parameters[a]

Investigation	Field Parameters	Sample Type	Number of Samples	Analytical Parameters
Hydrogeology and Groundwater	Organic vapor screening, radionuclide screening	Subsurface soil - geochemical	86 maximum to depend on field screening	Analytical list; USATHAMA explosives in on-plant borings only
		Subsurface soil - geotechnical	28	Geotechnical list
		Subsurface soil - x-ray diffraction	6	Clay mineralogy
	Temperature, pH, specific conductivity, dissolved oxygen, redox potential	Groundwater - New wells - Existing wells	43[a] 56[a]	Analytical list
Residential Wells and Cisterns	Temperature, pH, specific conductivity, dissolved oxygen, redox potential	Groundwater	To be determined	Analytical list except USATHAMA explosives
Cistern Sediment Samples			To be determined	Analytical list except USATHAMA explosives
Soil				
Background soil near Mound Plant		Surface soil	48 (second phase to be determined)	Analytical list, but no VOC analyses
		Subsurface soil	48 (second phase to be determined)	Analytical list, but no VOC analyses
Airborne particulate assessment		Surface soil - Chemical - Radionuclides	32 211 77 262	Analytical list; 20% of samples for USATHAMA explosives Tritium Isotopic thorium, isotopic uranium Isotopic plutonium
		Subsurface soil - Chemical - Radionuclides	32 211 262	Analytical list Tritium Isotopic plutonium

Table ES.1. (page 2 of 3)

Investigation	Field Parameters	Sample Type	Number of Samples	Analytical Parameters
NPDES Outfall 001	Organic vapor screening, radionuclide screening	Subsurface soil	18 to 42	Analytical list; 20% of samples for USATHAMA
		Subsurface soil - geotechnical/ mineralogical	12 to 14	Geotechnical list
Main Hill Seeps	Organic vapor screening, radionuclide screening	Surface soil	24	Analytical list; 20% of samples for USATHAMA
		Subsurface soil	16	Analytical list; 20% of samples for USATHAMA
		Subsurface soil - geotechnical/ mineralogical	8	Geotechnical list
	Temperature, pH, specifc conductivity, dissolved oxygen, redox potential	Groundwater	8	Analytical list, but no USATHAMA explosives
Surface water and sediment				
Background	Organic vapor screening, radionuclide screening	Sediment	24[a]	Analytical list plus molybdenum, lithium, and particle size distribution; no USATHAMA explosives
		Surface water	14 to 23[a]	Analytical list plus molybdenum and lithium, but no USATHAMA explosives
Storm water retention and discharge system	Organic vapor screening, radionuclide screening	Subsurface soil	13 to 25	Analytical list plus molybdenum and lithium
			21	Geotechnical list
		Sediment	36[a]	Analytical list plus molybdenum and lithium
			21	Geotechnical list
	Temperature, pH, specific conductivity, dissolved oxygen, redox potential	Surface water	20 to 23[a]	Analytical list plus molybdenum and lithium
Other drainages (includes Great Miami River, South Pond and other drainages around the plant)	Organic vapor screening, radionuclide screening	Subsurface soil	36[a]	Analytical list
			12 to 18	Geotechnical list
		Sediment	108[a]	Analytical list
			15	Geotechnical list
		Surface water	44 to 50[a]	Analytical list

Table ES.1. (page 3 of 3)

Analytical Parameter List	Additional Analytical List for Water	Geotechnical List
VOCs	Nutrients (TKN, TP)	Particle size distribution
Semivolatile organic compounds	Total dissolved solids	Specific gravity
TAL inorganics	Total suspended solids	Permeability
Bismuth	Alkalinity	Relative density
Fluoride	TAL inorganics (dissolved)	Maximum density
USATHAMA-listed explosives	Ammonia (surface water only)	Moisture content
TCL pesticides/PCBs	Radium-226	Organic content
Isotopic plutonium (238, 239/240)	Americium-241	Cation exchange capacity
Isotopic thorium (228, 230, 232)	Nitrite (groundwater only)	
Isotopic uranium (234/235, 238)		
Strontium-90		
Tritium		
Gamma spectrometry[c]		
Nitrate/nitrite		
Sulfate		
Chloride		
Total organic carbon		

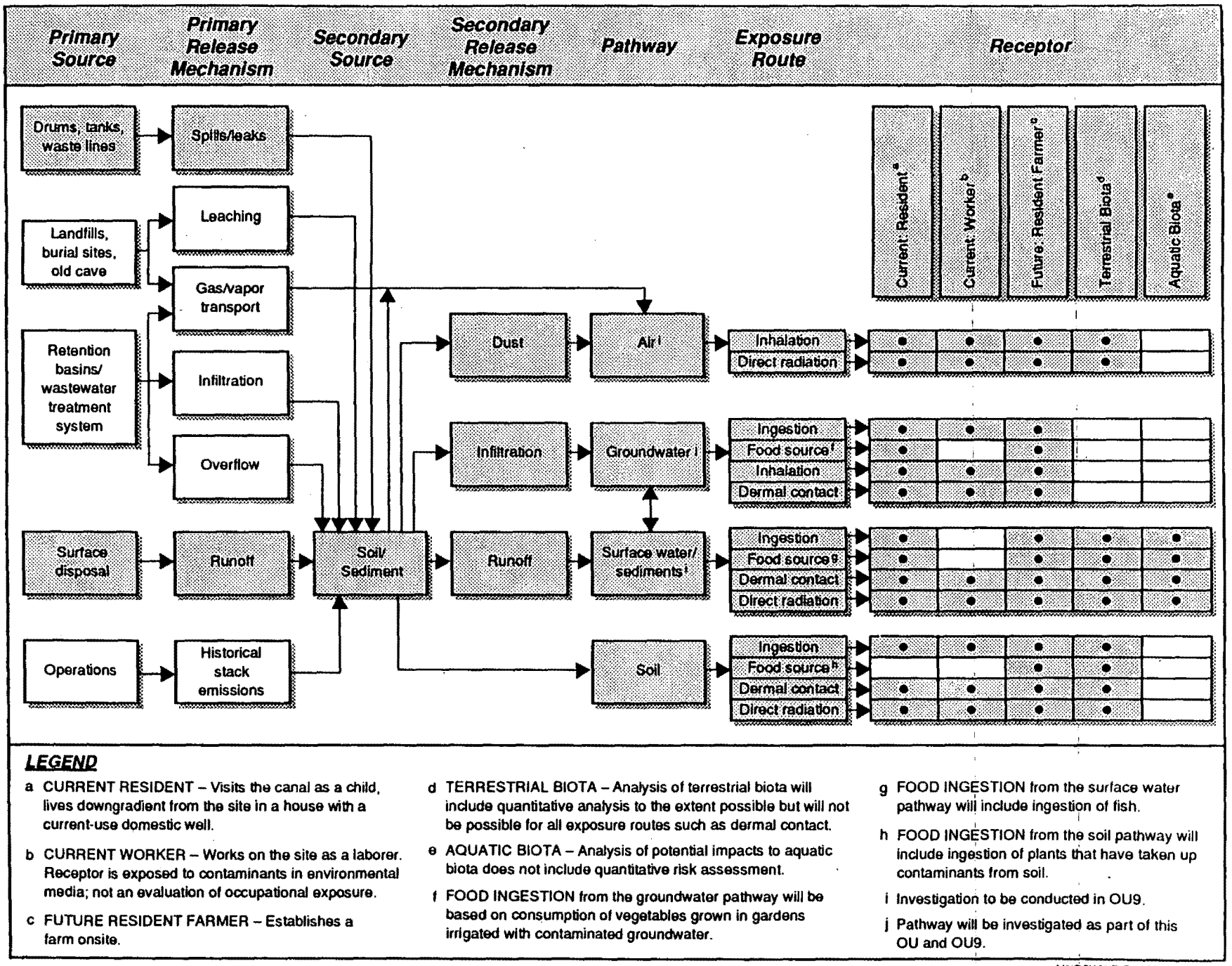
PCB - polychlorinated biphenyl
TAL - Target Analyte List, includes dissolved and total metals and cyanide
TCL - Target Compound List
TKN - total Kjeldahl nitrogen
TP - total phosphorous
VOC - volatile organic compound
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
[a]Most locations to be sampled twice
[b]USATHAMA explosives: HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine), RDX (hexahydro-1,3,5-trinitro-s-triazine), NB (nitrobenzene), 1,3-DNB (1,3-dinitrobenzene), 1,3,5-TNB (1,3,5-trinitrobenzene), 2,4-DNT (2,4-dinitrotoluene), 2,6-DNT (2,6-dinitrotoluene), 2A,4,6-DNT (2-amino-4,6-dinitrotoluene), tetryl (a-methyl-N,2,4,6-tetranitroanaline), 2,4,6-TNT (trinitrotoluene), and PETN (pentaerythrital tetranitrate).
[c]Includes americium-241 and radium-226 (for soils), cobalt-60, cesium-137, potassium-40, bismuth-207, bismuth-210 and polonium-210.

the chemical characteristics of the soil types that occur at the site. Soil sampling below the Main Hill seeps will be done to investigate local accumulation of contamination. Additional specific soil investigations within the plant are scheduled to be performed by operable units responsible for geographic areas of the plant.

Soil sampling to characterize airborne deposits will be conducted along sixteen major compass vectors to compile empirical data of historical contaminant deposition. This sampling is intended to characterize the results of deposition from historic emissions, principally plutonium from the SM/PP stack, tritium from the Main Hill stacks as well as other low altitude sources. Sample density and analytical parameters will decrease with increasing distance from the plant. Three perimeters are considered; the first at 1,000 ft, the second at 10,000 ft (Figure ES.5) and the third at 100,000 ft (Figure ES.6). Chemical analysis will be done on samples collected to the first perimeter only. The analytical parameters at these 32 locations will include the full suite of chemical and radiological parameters listed in Table ES.1. Analyses for tritium will be performed on samples collected out to the second perimeter, and on a limited number of samples to the third perimeter. Samples collected will assess the potential for tritium to accumulate in the moisture rich soil horizon in the regions most likely to have been affected by historic release patterns. Limited sampling for isotopic thorium and uranium will also be conducted out to the second perimeter. Sampling for particulate plutonium will be conducted to the third perimeter. Analysis will be performed for isotopic plutonium to assess the potential for resuspension and vertical migration.

The chemical characterization of soil types for background characterization will be phased. Samples will be collected within the city of Miamisburg that represent the soil series types found at the Site. Samples taken at these locations will be analyzed for the chemical parameters listed in Table ES.1. Results from the soil series sampling will be combined with results of the regional plume study to determine where true background conditions lie. The second phase of sampling will incorporate the State of Ohio guidance on sampling background conditions.

Additional soil samples will be taken in borings along the sanitary sewer pipeline (NPDES Outfall 001) that trends west from the plant near the drainage ditch to the outfall at the Great Miami River (Figure ES.7). This pipeline is part of the original 1947 plant construction and was fitted with a plastic liner in 1981. The potential exists that this pipeline may have contributed to the historic tritium contamination in the Buried Valley aquifer. No sampling for less mobile contaminants has ever been performed. Six boreholes and an optional seventh will be sampled at 5-ft intervals to about 15 ft and a maximum depth of about 25 ft.



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.

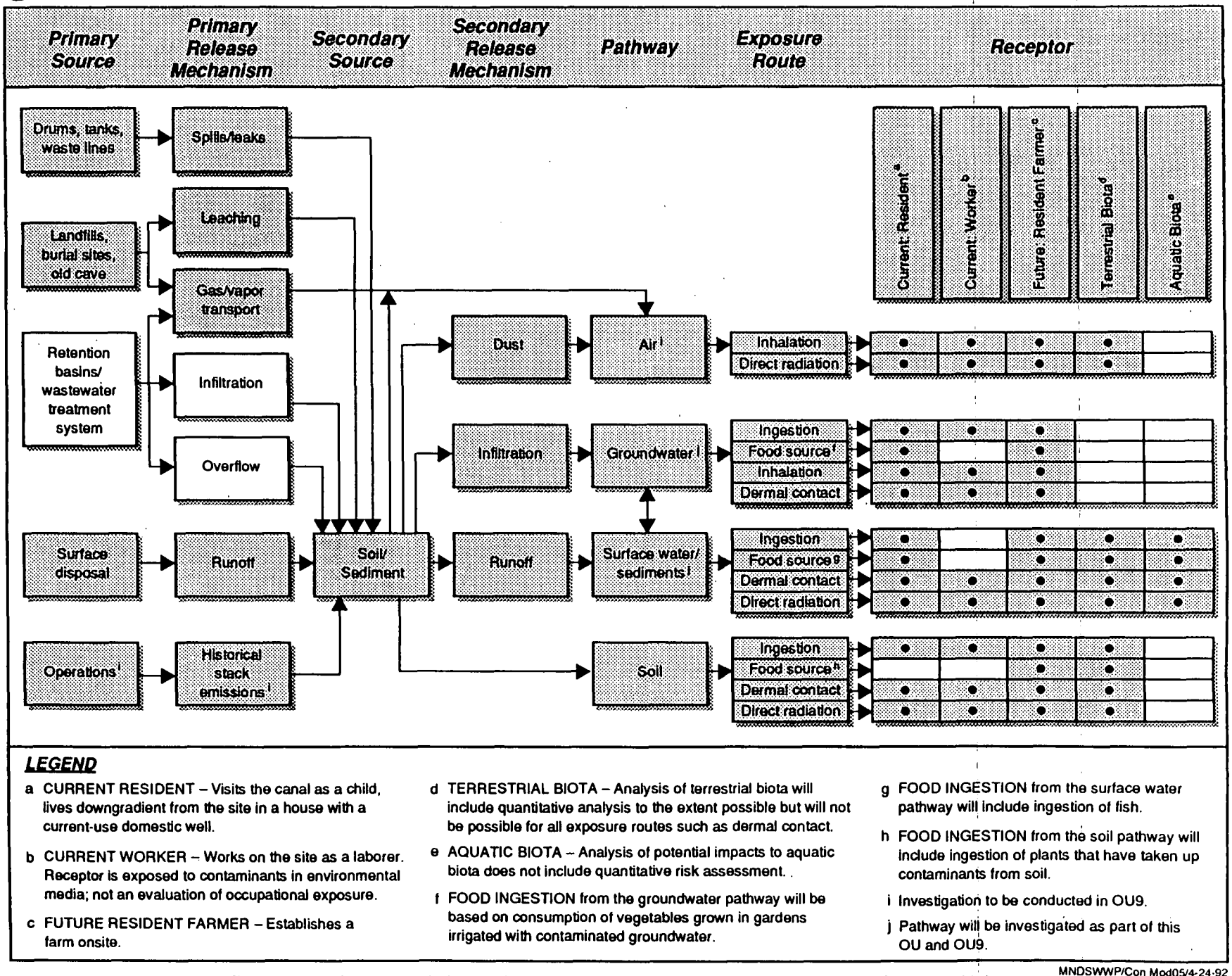
h FOOD INGESTION from the soil pathway will include ingestion of plants that have taken up contaminants from soil.

i Investigation to be conducted in OU9.

j Pathway will be investigated as part of this OU and OU9.

MNDSWWP/Con Mod03/3-25-92

Figure 3.6. Conceptual site model for the Miscellaneous Sites, Operable Unit 3.



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.

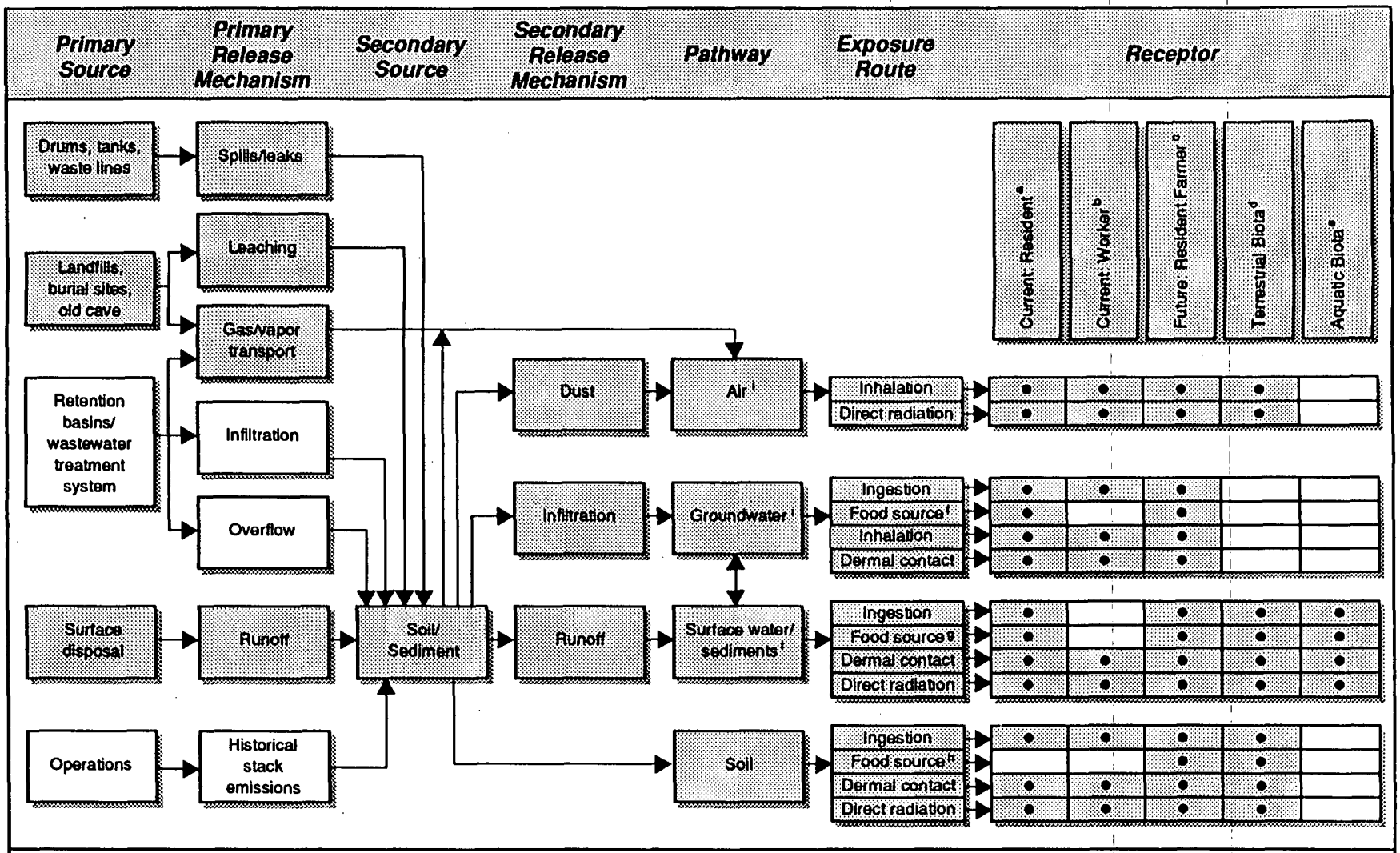
h FOOD INGESTION from the soil pathway will include ingestion of plants that have taken up contaminants from soil.

i Investigation to be conducted in OU9.

j Pathway will be investigated as part of this OU and OU9.

MNDSWWP/Con Mod05/4-24-92

Figure 3.11. Conceptual site model for the Radioactively Contaminated Soils, Operable Unit 5.



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.

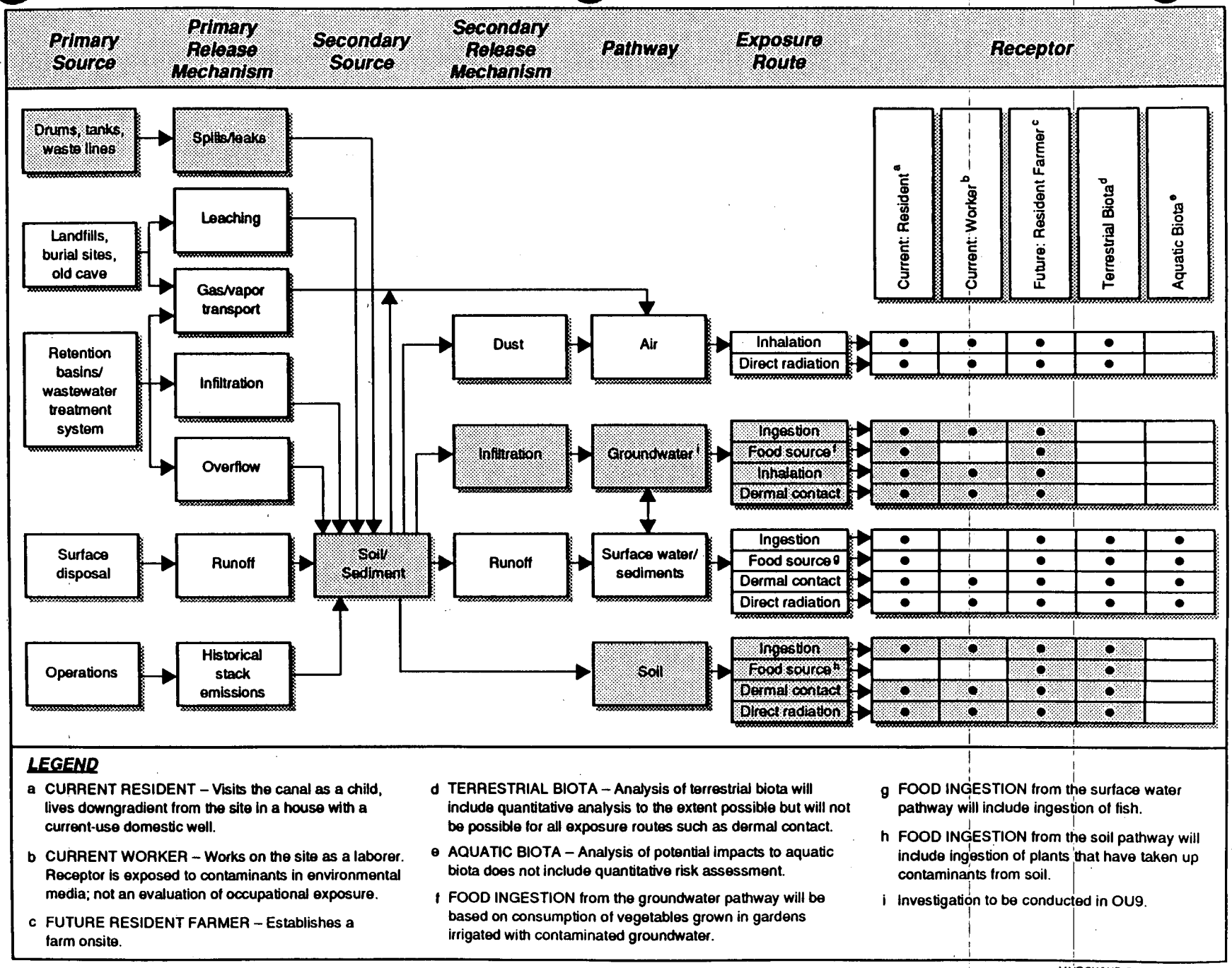
g FOOD INGESTION from the surface water pathway will include ingestion of fish.

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

i Investigation to be conducted in OU9.

MNDSWWP/Con Mod06/4-24-92

Figure 3.14. Conceptual site model for the D&D Program Areas, Operable Unit 6.



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.

i Investigation to be conducted in OU9.

MNDSWWP/Con Mod08/4-27-92

Figure 3.17. Conceptual site model for the Inactive Underground Storage Tanks, Operable Unit 8.

Figure 3.19 shows the conceptual site model for Operable Unit 9. The conceptual site model for Operable Unit 9 is designed to identify the potential migration pathways for contaminants off the Mound Plant property. The identified exposure pathways are air, surface water, sediments, groundwater, and biota. Air acts as a migration pathway for controlled stack emissions and for uncontrolled emissions from land and water surfaces. Surface water and sediments act as migration pathways for contaminated soil that has resulted from past leaks and spills. There are no primary source terms defined in Operable Unit 9. The Site-wide investigation will not characterize source terms on-plant, but will transfer these investigations to other Operable Unit-specific investigations. For instance, these sediments in the asphalt-lined pond will be sampled as part of the Operable Unit 9 investigations, but the pond itself, if deemed a source term, will be investigated by either Operable Unit 2 or Operable Unit 5.

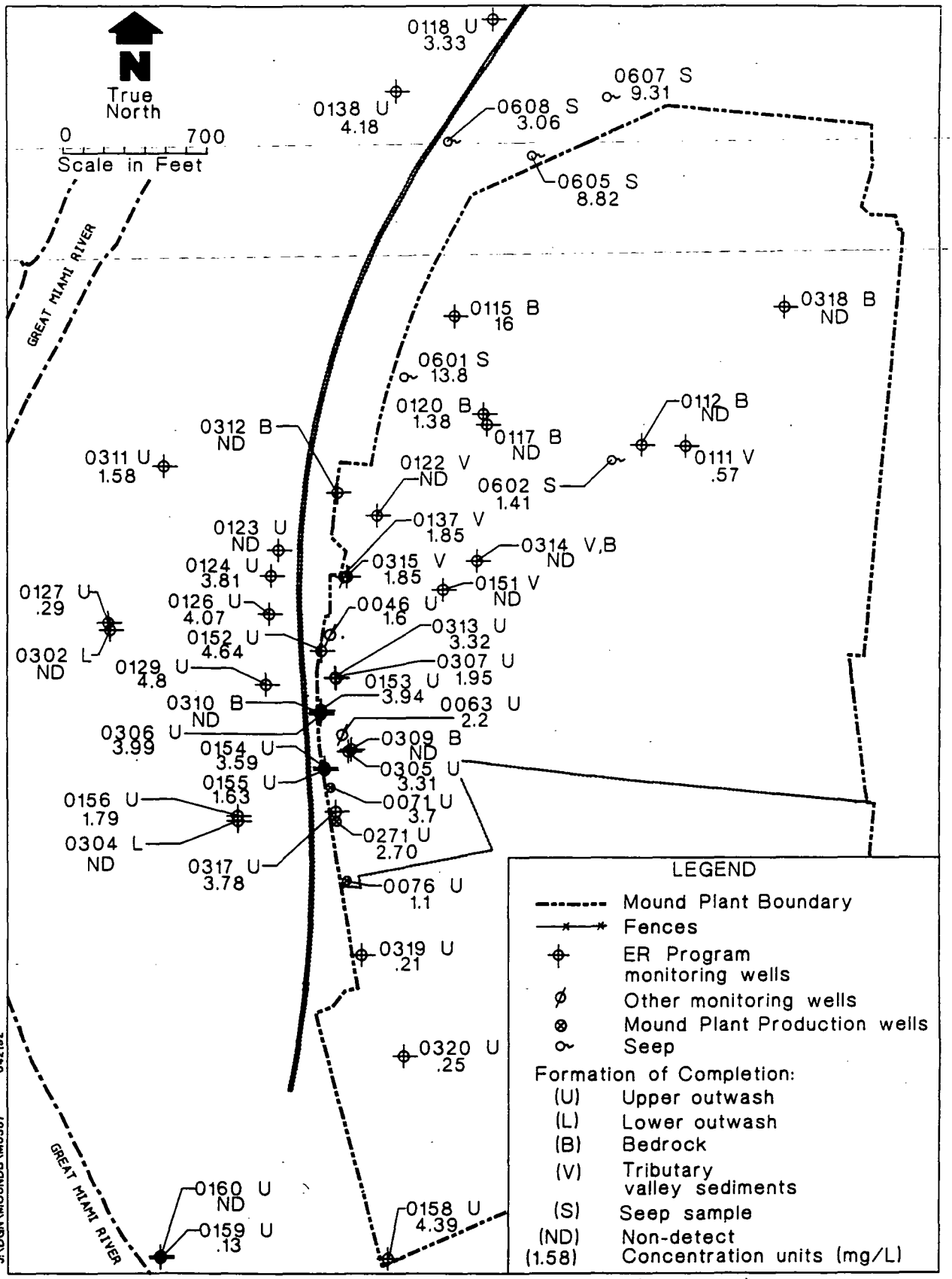


Figure 6.22a. Nitrate-nitrite concentrations (May 1991.)

Table VI.12. Analytical Levels for Hydrogeological Investigations

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of the site natural hydrogeologic system	Understand the hydrology in order to define potential transport pathways and to provide sufficient engineering data for development and screening of remedial action alternatives and the baseline risk assessment.	Subsurface soils and bedrock	- Lithologic logs - New well completion data		I II
				- VOCs - Semivolatile organic compounds - TAL inorganics - TCL pesticides/PCBs - Bismuth - Fluoride - USATHAMA explosives - Nitrate/nitrite - Chloride - Sulfate - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Strontium-90 - Gamma spectrometry - Tritium - Total organic carbon	IV IV IV IV IV IV V IV IV IV V V V V V V III
				- pH - Particle size distribution - Clay mineralogy - Cation exchange capacity - Permeability test - Relative density - Maximum density - Moisture content - Organic content - Specific gravity	III III III III III III III III III III
		Groundwater	- Temperature - pH - Specific conductivity - Dissolved oxygen - Redox potential - Water level		II II II II II I

Table VI.12. (page 2 of 2)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of on-plant and off-plant contamination including background wells.	Determine the nature and extent of contamination and the concentration of potential contaminants.	Groundwater	- Aquifer tests		I
			- Pumping data		I
			- Precipitation data		I
				- VOCs	IV
				- Semivolatile organic compounds	IV
				- TCL pesticides/PCBs	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- USATHAMA explosives	V
				- Nitrate/nitrite	IV
				- Nitrite	III
				- Chloride	IV
				- Sulfate	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Radium-226	V
				- Strontium-90	V
				- Americium-241	V
				- Gamma spectrometry	V
				- Tritium	V
				- Total suspended solids	III
				- Total dissolved solids	III
				- Total organic carbon	III
				- Nutrients (TKN,TP)	III
				- Alkalinity	III

Notes:
[a]As defined in "Data Quality Objectives for Remedial Response Activities," EPA-540/G-87/003, discussed in Section 15.
- Explosives includes the 11 USATHAMA explosives: HMX; RDX; 1,3,5-TNB; 1,3-DNB; NB; Tetryl; 2A,4,6-DNT; 2,4,6-TNT; 2,6-DNT; 2,4-DNT; and PETN.
- Onsite screening for plutonium-238 and thorium-232 is performed using a FIDLER detection system calibrated to detect these isotopes.
FIDLER - field instrument for the detecton of low-energy radiation
PCB - polychlorinated biphenyl
SOP - standard operating procedure
TAL - Target Analyte List, includes dissolved and/or total metals
TCL - Target Compound List
TKN - total Kjeldahl nitrogen
TP - total phosphorous
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
VOC - volatile organic compound

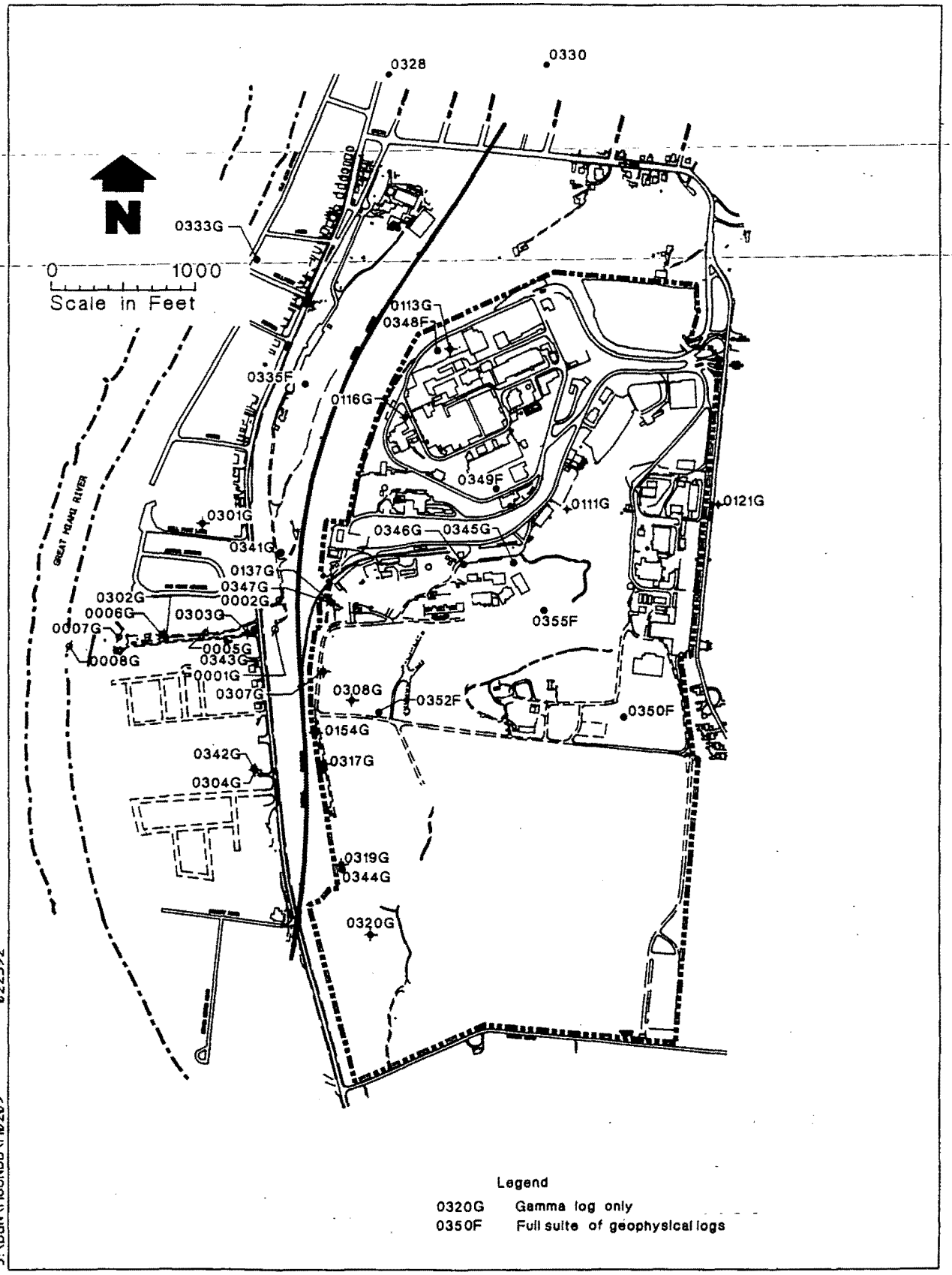


Figure 6.27. Location of new monitoring wells where geophysical logs will be produced.

Table VI.15 lists the proposed wells, their purposes, and their depths. The second part of the table lists optional wells that will be installed if more data gaps are identified. Table VI.16 lists the proposed piezometers. Figures 6.29 and 6.30 show the locations of wells and piezometers, respectively.

Well Installation North and West of Plant

Wells proposed as part of this Work Plan for the area west of the Mound Plant are listed in Table VI.15. These will provide information on gradients in the Buried Valley aquifer. Well 0342 will be installed adjacent to 0156, 0157, and 0304, located west of U.S. Route 25. It will be screened in the lower outwash. Well 0343, also in the lower outwash, and 0383, in the upper outwash, will be installed adjacent to 0303. These new wells will complete well clusters at two locations that are needed to determine if a vertical gradient exists between the upper and lower outwash. Wells 0343 and 0383 are two of the wells proposed for instrumentation to monitor continuous water levels.

Four well pairs are proposed north and northwest of the Main Hill. Two of these pairs will be located in Miamisburg and may be used to establish the background water quality (wells 0327, 0328, 0329, and 0330). The third pair will be located on the northwest slope of the Main Hill and will be used to monitor the groundwater quality north of the Main Hill seeps. If the first hole at this location, 0336, is drilled to bedrock and intersects both an upper and a lower outwash unit or a single thick saturated outwash (≈50 ft), 0337 will be installed. The purpose of these wells is to monitor the direction of flow in both outwash units. The fourth well pair (0333 and 0334) will be located northwest of the Main Hill within 200 ft of the Great Miami River. Well 0333 will be installed just above bedrock, and well 0334 will be installed at the water table. The purposes of these two wells are to determine groundwater gradients and to define stratigraphy in this area.

Well Installation in the Buried Valley Aquifer Tributary Valley

Three wells are proposed to be installed in the unconsolidated deposits of the Buried Valley aquifer tributary valley. These wells will provide information on stratigraphy, vertical and lateral groundwater flow directions, and groundwater quality.

Well 0345, proposed north of Building 49, will provide water level and stratigraphic information. In addition, this well will be located at the confluence of the main valley with a small channel on the SM/PP Hill, in an area where plutonium concentrations in the soil have historically been high. This well will be screened in the upper outwash just above bedrock if sufficient saturated thickness exists; if not, it will be screened in the top of the bedrock. It will be sampled for possible sources of contamination.

Well 0347 will be nested with 0137 and 0315 in order to monitor groundwater quality at the mouth of the tributary valley. It will be completed at the base of the outwash. With the shallower well, 0315 and 0347 will provide vertical gradient information at the edge of the transition zone between the main Buried Valley aquifer and the tributary valley.

The final well in the tributary valley area will be 0384. This well will be located in the parking lot south of Building 98, which has been documented through historic photos as a disposal area. This well will be used to core the stratigraphy and will be completed in the water-bearing zone to identify any outwash deposits.

Well Installation in the Transition Zone

From 7 to 11 wells, depending on the stratigraphy and thickness of water saturation, have been proposed for the transition zone. The stratigraphy in this area is complex. The tributary valley empties into the area, and the bedrock contact drops sharply to the west. The thickness of both outwash and till zones also increases south of the landfill as the bedrock again drops steeply.

Well 0340 will be located west of well 0312. Well 0340 will be completed in the lower outwash and will be clustered with bedrock well 0341 in order to determine the vertical gradients on the southwest slope of the Main Hill. Well 0340 will also be used to monitor groundwater quality.

Wells 0385, 0386, and 0387 will be located at the mouth of the tributary valley. The thicknesses of the stratigraphic units increase rapidly in this area resulting in a complex flow regime. These wells will help define the stratigraphy and the vertical and horizontal flow paths. There is a possibility of three additional wells (0389, 0390, and 0391) in a nest with 0386. If both the upper and lower outwash units are present, then one well will be finished in each. Again, if either the upper or lower outwash are thick enough to measure vertical gradients, approximately 50 ft, then two wells will be finished in that unit. An additional well (0392) will also be clustered with well 0387 if both an upper and lower outwash are present or if only a single unit is present but has a saturated thickness greater than 50 ft. These proposed wells are important in that they monitor groundwater flowing from the tributary valley to the main portion of the Buried Valley aquifer.

Well 0388 will also be used to monitor groundwater quality and provide information on the groundwater flow in the area. This well will be located west of the Overflow Pond, at the southern edge of the tributary valley.

Two wells south of the transition zone, 0344 and 0356, will both be completed in the lower outwash and used to monitor groundwater quality off the SM\PP Hill. Well 0344 will be clustered with 0319, and well 0356 will be clustered with 0320.

Piezometer Installation West of Plant

Thirteen piezometers will be installed in the area west of the Mound Plant (Figure 6.30). Piezometers P016 through P020 and P035 through P042 will provide information on the regional gradient in the upper

outwash, and on vertical gradients at intervals from the water table to the top of bedrock. The piezometers located adjacent to the river will also provide information on the correlation of groundwater levels with the river stage, the effects of any groundwater mounding caused by the river, and the potential for groundwater to flow under the river. Piezometers P016 through P020 will be screened in the upper outwash. Piezometers P035 through P038 and P039 through P042 are two piezometer clusters. All will be completed in outwash units. In each nest, the four zones of completion will be at the base of the lower outwash, top of the lower outwash, base of the upper outwash, and at the water table in the upper outwash.

Piezometer Installation in the Buried Valley Aquifer Tributary Valley

There are four piezometers proposed for the tributary valley (Figure 6.30). Piezometer P021 will be used to monitor groundwater levels on the edge of the tributary valley, on the slope of the Main Hill. This piezometer will replace water level measurements from wells 0035, 0042, and 0242, which are either dry or were not cased according to ER or EPA TEGD procedures. Piezometer P021 will be screened in the first saturated zone in the bedrock.

Piezometers P022 and P023 will be located in the center of the valley, just west of Building 42. These piezometers are multipurpose. Piezometer P022 will be screened at the water table and P023 will be screened at the bottom of the outwash or possibly at the upper bedrock contact if the outwash is very thin. The purpose of the two intervals is to determine if there is a vertical gradient either into or out of the bedrock in the tributary valley. This information will indicate if the bedrock recharges the unconsolidated sediments in the valley. These two piezometers will also be used to define the extent of the outwash. Current cross sections indicate that the outwash occurs as lenses in the tributary valley. These piezometers will help establish whether or not the outwash is continuous.

The last piezometer proposed for the tributary valley, P024, will be located just north of Building 87. This piezometer will be used for groundwater level information on the southern edge of the tributary valley. Piezometer P024 will be screened in the first saturated interval.

Piezometer Installation in the Transition Zone

Ten piezometers are proposed for the transition zone, seven of which (P025, P026, P028, P029, P030, P032, and P034) will be located west of the Mound Plant production wells. The purpose of these piezometers is to form a clearer picture of the groundwater flow, the lithology, and the possible contaminant transport pathways in the area. All of the piezometers except P030 will be screened at the water table. The piezometers will also be used to determine the influence of the production wells on the groundwater flow system.

Well 0353 will be installed east of the spoils area and will investigate shallow bedrock groundwater quality as it approaches the production wells.

Well 0354 will be located south of the SM/PP Hill, near seep 0609, to determine groundwater quality and bedrock stratigraphy.

Continuous water level monitoring will also be implemented on two bedrock wells. Proposed well 0335 will be monitored continuously to determine the delay time in reaction of deep bedrock groundwater to changes in river stage. This will provide information on the interconnection of the river with the bedrock groundwater flow system. Existing well 0120, completed in shallow bedrock on the Main Hill, will be monitored continuously to determine water level responses to precipitation. Well 0120 should not be affected by river stage, only by man-made discharges and precipitation. Comparison of water levels in well 0120 with precipitation data will provide information on the delay time of recharge events with water level changes.

Investigations of the bedrock flow system may include a second phase of wells. Once the existence and nature of a regional pressure surface are established, additional wells may be warranted. If the gradient and flow directions are incomplete, wells 0366, 0367, 0368, and 0369 may be considered to provide information about the bedrock stratigraphy and the complex flow system through the bedrock.

6.5.2.5. Modeling of Groundwater Flow and Contaminant Transport

Due to the abundance and variety of potential source terms of groundwater contamination, the complexity of the hydrogeologic system, and the high value of the potentially affected groundwater resource (the sole source Buried Valley aquifer), there is an anticipated need for numerical modeling to support risk assessment and feasibility studies. These numerical simulations may include hydrodynamic, contaminant transport, and geochemical components, as appropriate. The parameters and conditions required as input to these models include aquifer hydraulic properties, aquifer hydraulic conditions, contaminant transport terms, groundwater quality, contaminant chemistry and aquifer matrix information.

The hydrodynamic component (i.e., groundwater) flow requires information about the aquifer properties and aquifer conditions, the former including the spatial distribution of hydraulic conductivity, transmissivity, and storativity, and the latter including spatial and temporal distribution of hydraulic head. The data required to calculate these parameters will be collected from the geotechnical information and water level measurements. Aquifer conditions will be determined by hydraulic measurements in different hydrostratigraphic units at the same locations (nested wells), and by pumping well discharge histories. Measurements of the Great Miami River stage in relation to nearby groundwater levels in the new

Table VI.17. Specifications for Hydrogeology and Groundwater Investigation Sampling

Drilling Program

Number of Boreholes: 43 (includes 6 deep bedrock wells and 5 optional wells that depend on local geologic conditions))
Drilling Technique: Cable-tool, hollow stem auger, and air-rotary rigs
Drilling Locations and Depths: See Table VI.15
Total Footage: Approximately 4,000 ft

Environmental Samples

Subsurface soil samples--Geochemical

Number:	Minimum two per well or well pair; maximum to depend on field screening and proximity to source areas
Analytical Parameters:	Analytical parameter list, but only 20% of samples for VOCs, semivolatile organic compounds, bismuth, fluoride, USATHAMA explosives, and TCL pesticides/PCBs

Groundwater samples
(New Wells)

Number:	86 (43 locations sampled 2 times)
Analytical Parameters:	Analytical parameter list; analytical list for water; and field parameter list

Groundwater samples
(Existing Wells)

Number:	Approximately 112 (56 locations currently sampled quarterly or semiannually to be sampled 2 times)
Analytical Parameters:	Analytical parameter list; analytical list for water; and field parameter list

Geotechnical

Subsurface soil samples

Number:	Approximately 28 (6 locations; 2 samples from each stratigraphic unit at each location; 1 to 3 stratigraphic units anticipated)
Parameters:	Particle size distribution, pH, relative density, maximum density, specific gravity, permeability, organic content, moisture content, and cation exchange capacity

Subsurface soil samples--X-ray diffraction

Number:	6 (2 in aquitard, 2 in upper water bearing zone, 2 in lower water bearing zone)
Analytical Parameters:	Clay mineralogy by X-ray diffraction

Quality Control Samples

Trip Blanks

Number:	1 per cooler containing VOC samples
Analytical Parameters:	VOCs

Equipment Rinsate Blanks

Number:	1 per 10 geochemical samples
Analytical Parameters:	Analytical parameter list

Field Ambient Blanks

Number:	1 per 20 geochemical samples
Analytical Parameters:	VOCs

Field Duplicates

Number:	1 per 10 geochemical samples
Analytical Parameters:	Analytical parameter list

Matrix Spike/Matrix Spike Duplicates

Number:	1 per 20 geochemical samples
Analytical Parameters:	Analytical parameter list

ANALYTICAL PARAMETER LIST
VOCs
Semivolatile organic compounds
TAL inorganics
Bismuth
Fluoride
USATHAMA-listed explosives (on plant locations only)
TCL pesticides/PCBs
Isotopic plutonium (238, 239/240)
Isotopic thorium (228, 230, 232)
Isotopic uranium (234/235, 238)
Strontium-90
Tritium
Gamma spectrometry
Nitrate/nitrite
Sulfate
Chloride
Total organic carbon

FIELD PARAMETER LIST (WATER)
Temperature
pH
Specific conductivity
Dissolved oxygen
Redox potential
Water level

ANALYTICAL LIST FOR WATER
Nitrite
Nutrients (TKN, TP)
Total dissolved solids
Total suspended solids
Alkalinity
TAL inorganics (dissolved)
Radium-226
Americium-241

CLP - Contract Laboratory Program
PCB - polychlorinated biphenyl
SOW - statement of work
TAL - target analyte list
TKN - total Kjeldahl nitrogen
TCL - target compound list
TP - total phosphorus
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
VOC - volatile organic compound

analyzed for the parameters listed in Table VI.17. In suspected source areas, core samples will be collected at no less than 5-ft intervals. If the field screening indicates elevated contaminant concentrations, samples will be collected at locations of highest readings and at subsequent 5-ft intervals.

Water quality samples will be collected at all monitoring well locations after the new monitoring wells are installed. At least two rounds of water sampling will be performed on a Site-wide basis. The Site-wide sampling will be initiated within four to six months after the installation of all new wells and will be performed at least twice. Sampling and analysis will be performed for all parameters listed in Table VI.17. This Site-wide sampling effort has two major objectives: 1) to obtain a current inventory of all groundwater contaminants across the Site; and 2) to prepare for the evaluation of the need for long-term sampling at the Site. The locations of existing monitoring wells that are candidates for the Site-wide sampling efforts are shown in Figure 6.31.

At the completion of this work, a Site-wide monitoring plan will be submitted to the regulatory agencies for approval. The plan will propose monitoring those wells showing contamination or that are within the projected pathway of contaminant movements.

6.5.2.10. Survey of New and Existing Wells

All existing wells will be resurveyed at the same time as the new wells are surveyed in order to correct for the known data errors. Checks on known data points should also be referenced at each station. Horizontal control will be surveyed to within ±0.5 ft. Vertical control will be surveyed to 0.1 ft.

6.5.2.11. Well Abandonment

A plan will be developed to evaluate all older wells and develop a procedure for the abandonment of those wells that are inappropriate for use in this program. Construction considerations for wells used in the program include the casing material, the length of the screen, the number of stratigraphic intervals screened, and whether or not the well is screened below the water table. Abandonment procedures will include drilling out the well and removal of the gravel pack to ensure no cross contamination is possible between stratigraphic intervals. Correlation between well abandonment schedules and the Site-wide sampling effort under CERCLA and other operational programs at Mound Plant is essential. A tentative list of wells that require abandonment will be compiled before the CERCLA Site-wide geochemical sampling efforts proceed. At least one well, 0055, is currently scheduled to be abandoned in 1992 (Table VI.5). A Site-wide well abandonment plan is currently in preparation and will requrie coordination with other Mound Plant programs.

Table VII.5. Residential Well Data Quality Objectives

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of residential wells	Identify potential for contamination of groundwater in public sector for risk assessment.	Subsurface soils and bedrock	- Lithologic logs (if available)		I
			- Stratigraphy data (if available)		I
			- Well completion data (if available)		I
		Groundwater	- Temperature		II
			- pH		II
			- Specific conductivity		II
			- Dissolved oxygen		II
			- Redox potential		II
			- Water level		I
			- Aquifer tests (if available)		I
			- Pumping data (if available)		I
			- Precipitation data (if available)		I
				- VOCs	V
				- Semivolatile organic compounds	V
				- TCL pesticides/PCBs	V
				- TAL inorganics	V
				- Bismuth	IV
				- Fluoride	V
				- Nitrate/nitrite	V
				- Nitrite	V
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Radium-226	V
				- Americium-241	V
				- Gamma spectrometry	V
				- Tritium	V
				- Strontium-90	V
				- Total suspended solids	III
				- Total dissolved solids	III
				- Alkalinity	III

Table VII.5. (page 2 of 2)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of residential wells	Identify potential for contamination of groundwater in public sector for risk assessment.	Sediments (cistern)		- VOCs	IV
				- Semivolatile organic compounds	IV
				- TCL pesticides/PCBs	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Nitrate/nitrite	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Tritium	V
				- Gamma spectrometry	V
				- Strontium-90	V

[a]As defined in "Data Quality Objectives for Remedial Response Activities," EPA-540/G-87/003, discussed in Section 15.
DQO - Data Quality Objective
PCB - polychlorinated biphenyl
TAL - Target Analyte List, includes dissolved and/or total metals and cyanide
TCL - Target Compound List
VOC - volatile organic compound

Table VII.7. Specifications for the Residential Well Investigation Groundwater Sampling

Environmental Samples

Groundwater Samples

Number:	To be determined by criteria selection
Analytical Parameters:	Water analytical parameter list; field parameter list

Cistern Water Samples

Number:	To be determined by criteria selection
Analytical Parameters:	Water analytical parameter list; field parameter list

Cistern Sediment Samples

Number:	To be determined by criteria selection
Analytical Parameters:	Sediment analytical parameter list

Quality Control Samples

Trip Blanks

Number:	1 per cooler containing VOC samples
Analytical Parameters:	VOCs

Equipment Rinsate Blanks

Number:	1 for every 10 or fewer samples collected
Analytical Parameters:	Water analytical parameter list

Field Ambient Blanks

Number:	1 for every 10 samples collected
Analytical Parameters:	VOCs

Field Duplicates

Number:	1 for every 10 samples collected
Analytical Parameters:	Sediment or water analytical parameter list, as appropriate; field parameter list

Matrix Spike/Matrix Spike Duplicates

Number:	1 for every 10 samples collected

WATER ANALYTICAL PARAMETER LIST

VOCs
Semivolatile organic compounds
TAL inorganics
Fluoride
Bismuth
TCL pesticides/PCBs
Isotopic plutonium (238, 239/240)
Isotopic thorium (228, 230, 232)
Isotopic uranium (234/235, 238)
Radium-226
Americium-241
Strontium-90
Tritium
Gamma spectrometry
Nitrate/nitrite
Nitrite
Total suspeneded solids
Total dissolved solids
Alkalinity

FIELD PARAMETER LIST

pH
Temperature
Redox potential
Dissolved oxygen
Specific conductivity
Water level

SEDIMENT ANALYTICAL PARAMETER LIST

VOCs
Semivolatile organic compounds
TCL pesticides/PCBs
TAL inorganics
Bismuth
Fluoride
Nitrate/nitrite
Isotopic plutonium (238, 239/240)
Isotopic thorium (228, 230, 232)
Isotopic uranium (234/235, 238)
Strontium-90
Tritium
Gamma spectrometry

Beyond the Mound Plant boundaries, environmental studies have been conducted to monitor radionuclides in the regional surface waters and ponds as reported in the Annual Environmental Monitoring reports (EG&G 1989a). Data from the environmental monitoring program for the years 1975 to 1989 were reported in the Site Scoping Report: Volume 8 (DOE 1991e). Limited additional specific studies were performed by Mound Plant in the mid-1970s on soil contamination. These studies were focused on off-plant plutonium contamination in the Miami-Erie Canal (Rogers 1975) due to surface water runoff, and the amount and distribution of plutonium-238 deposited in regional soils from Mound Plant stack emissions (MRC 1977). The Buried Valley Aquifer Evaluation Project (Dames and Moore 1976b) established contamination levels of tritium in soils along the Miami-Erie Canal and westward toward the Great Miami River along the trace of the Mound Plant sanitary sewer pipeline. No recent data exist beyond these older investigations.

No studies are known to exist that evaluate hazardous chemical constituents, metals or other radionuclides in off-plant soils. The potential for off-plant chemical contamination appears greatest along the plant sanitary sewer line, as historical waste management practices could not preclude the possibility that this pipeline did not carry hazardous wastes or did not leak. The presence of surficial tritium contamination near the pipeline suggests that it did indeed leak, but this could also be attributed to airborne deposition. Other than the Miami-Erie Canal, which receives surface water effluent, other areas adjacent to the plant appear to have a low probability of having received hazardous wastes from spills or runoff. The slopes of the Main Hill are known to be affected by small groundwater seeps that are contaminated with tritium, uranium-233, VOCs, nitrate, sulfate, and chloride. Ponding of water along the base of the hill may have affected the local soils.

8.3. WORK PLAN RATIONALE

DOE has agreed to conduct an investigation of the soils on the Site. The Site-wide soils investigation will address the basic characterization of static soil matrix parameters of soil types that occur on the Site and the nature and extent of contamination of soils outside the Mound Plant boundary due to local contaminant transport or regionally by airborne processes. The work required to fulfill the objectives includes the physical and chemical characterization of soil types as well as sample analysis for regional and local contamination. The analytical levels for the soil investigations are given in Table VIII.9. These data are intended to detect the presence or absence of contamination, support the risk assessment, and assist in the understanding of the Site soil characteristics for the RD/RA processes.

As a general rule for the Site-wide investigations, geotechnical samples will only be collected fron onsite locations. These samples will provide data on site-specific conditions and are not required as part of the background investigations. These data will support the evaluations of remedial action alternatives such as potential for migration or attenuation and surface water infiltration.

During remedial investigations at Mound Plant Operable Units 1 through 8, soil properties will be required to be collected on a site-specific basis. The extent of the soils investigation program for each operable unit will be determined by the intensity of data previously collected and the nature of the contamination present at a specific site. Specific soil investigations within the plant are scheduled to be performed by operable units responsible for geographic plant areas (see Figure 1.2).

Table VIII.9. Analytical Levels for Soil Investigations

Task	Purpose	Media	Field Parameters	Parameters	Analytical Level[a]
Characterization of regional soils Phase I	Collection of basic chemical data for soil types that occur on the Site to support the selection of background locations	Soil	- Location - Soil type - Stratigraphic data		I I I
				- TAL inorganics - Bismuth - Fluoride - TCL pesticides/PCBs - Nitrate/nitrite - Chloride - Sulfate - Isotopic plutonium (238,239/240) - Isotopic thorium (228,230,232) - Isotopic uranium (234/235,238) - Tritium - Strontium-90 - Gamma spectrometry - pH - Total organic carbon	IV IV IV IV IV IV IV V V V V V V III III
Phase II	Establish background chemical characteristics of Site soils	Soil	- Location - Soil type - Stratigraphic dta		I I I
				- TAL Inorganics - Bismuth - Fluoride - TCL pesticides/PCBs - Nitrate/nitrite - Chloride - Sulfate - Isotopic plutonium (238,239/240) - Isotopic thorium (228,230,232) - Isotopic uranium (234/235,238) - Strontium-226 - Tritium - Gamma spectrometry - pH - Total organic carbon	IV IV IV IV IV IV IV V V V V V V III III

Table VIII.9. (page 2 of 3)

Task	Purpose	Media	Field Parameters	Parameters	Analytical Level[a]
Sample soils in downwind directions, in major quadrants, and in areas of suspected contamination.	Characterize nature and extent of airborne deposited contamination, and identify presence or absence of contamination.		- Location		I
			- Soil series		I
			- Lithologic logs		I
				- VOCs	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Semivolatile organic compounds	IV
				- TCL pesticides/PCB	IV
				- USATHAMA explosives	V
				- Chloride	IV
				- Nitrate/nitrite	IV
				- Sulfate	IV
				- Isotopic plutonium (238,239/240)	V
				- Isotopic thorium (228,230,232)	V
				- Isotopic uranium (234/235,238)	V
				- Tritium	V
				- Strontium-90	V
				- Gamma spectrometry	V
				- Cation exchange capacity	III
				- Permeability test	III
				- Clay mineralogy	III
				- Specific gravity	III
				- Particle size distribution	III
				- Moisture content	II
				- Organic content	II
				- Relative density	III
				- Maximum density	III
				- pH	III
				- Total organic carbon	III

Table VIII.9. (page 3 of 3)

Task	Purpose	Media	Field Parameters	Parameters	Analytical Level[a]
Sample groundwater at seeps in conjunction with soil sampling at seeps.		Groundwater (seeps)	- Temperature		II
			- pH		II
			- Specific conductivity		II
			- Dissolved oxygen		II
			- Redox potential		II
			- Flow rate		II
				- VOCs	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Semivolatile organic compounds	IV
				- TCL pesticides/PCBs	IV
				- USATHAMA explosives	IV
				- Chloride	IV
				- Nitrate/nitrite	IV
				- Sulfate	IV
				- Isotopic plutonium (238,239/240)	V
				- Isotopic thorium (228,230,232)	V
				- Isotopic uranium (234/235,238)	V
				- Radium-226	V
				- Tritium	V
				- Americium-241	V
				- Strontium-90	V
				- Gamma spectrometry	V
				- Total dissolved solids	III
				- Total suspended solids	III
				- Ammonia	III
				- Nutrients (TKN, TP)	III
				- Total organic carbon	III
				- Alkalinity	III

[a]As defined in "Data Quality Objectives for Remedial Response Activities," EPA-540/G-87/003, discussed in Section 15.
PCB - polychlorinated biphenyl
TAL - Target Analyte List
TCL - Target Compound List
TKN - total Kjeldahl nitrogen
TP - total phosphorous
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
VOC - volatile organic compound

Air Act, Mound Plant performs and reports the results of AIRDOS-EPA and CAP-88 to assess the maximum distance of radionuclide concentration and effective dose equivalent to the public (see section 10 of this work plan). These models indicate the maximum concentrations from airborne deposition may lie at distances of 2,000 to 3,000 ft (700 to 1,000 meters) from the plant, but because of the episodic nature of emissions, the directions may not be predictable. The sampling strategy is, therefore, to obtain data in all directions rather than simply to the north-northeast, the prevailing wind direction. This strategy will provide the maximum data for the risk assessment. Regional soil samples will be collected in multiple directions. Specifications for the airborne depositional investigation is summarized in Table VIII.10.

It is proposed to sample for airborne contaminants along 16 radial compass vectors (N, NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW, W, WNW, NW, and NNW) from the security fence line out to a maximum of 100,000 ft at 500-ft, 1,000-ft, or 25,000-ft increments depending on analytical parameters described below. Sampling will be keyed to process information and the two primary sources, the SM/PP Hill and Main Hill stacks. Sampling will be conducted radially from a point midway between the SM/PP and Main Hill stacks (plant locus). Identified sample locations within 10,000 ft of the locus (inclusive) are shown in Figure 8.6. Identified sample locations greater than 10,000 ft from the locus are shown in Figure 8.7. If samples cannot be collected at a given location because of cultural interference (e.g., a road or building), the sample location will be adjusted to the nearest acceptable location. Sample locations will be away from any overhead lines, trees or buildings, surface water channels, rills or other drainages. No geotechnical samples will be taken as part of this investigation.

Sampling for chemical constituents will be conducted at the security fence line and at a distance of 1,000 ft from the fence line along each of the 16 radial compass vectors. All of the chemicals suspected would have resulted from low concentration emissions from fumehoods, ventilation ducts or other low altitude sources. One surface (0 to 0.5 ft) and one subsurface (1.5 to 2.0 ft) sample will be collected at each location. In addition, the soil interval between the surface and subsurface samples will be screened with a PID and a FIDLER. As screening dictates, an additional sample may be selected for sample analysis. No geotechnical samples will be collected as part of the background soil investigations. All geotechnical samples will be collected onsite.

A total of 32 surface and 32 subsurface samples will be submitted to the laboratory for chemical analysis. All of the 1,000-ft and security fence line samples will be analyzed for the analytical parameters shown in Table VIII.10. Sampling and analyses will also be performed for a host of minor radionuclides that are not known to have been stacked. These radionuclides were involved with aqueous processes and are not expected to be found in the airborne depositional plume. Samples intended for the analysis of radium-226, strontium-90, and gamma spectrometry will be collected at the 32 locations described for chemical constituents. The results of the analyses will be used to determine the presence or absence of such

Table VIII.10. Specifications for Airborne Depositional Investigation

CHEMICAL AND MISCELLANEOUS RAD TABLE (AQUEOUS DEPOSITION)

Environmental Samples

Surface soil samples[a]

Number:	32
Location:	16 at security fence and 16 at 1,000 ft
Depth:	0 to 0.5 ft
Analytical parameters:	Analytical parameter list and 20% for USATHAMA explosives

Subsurface soil samples[b]

Number:	32
Location:	16 at security fence line and 16 at 1,000 ft
Depths:	1.5 to 2.0 ft
Analytical parameters:	Analytical parameter list and 20% for USATHAMA explosives

Quality Control Samples

Trip Blanks

Number:	1 per cooler containing VOCs
Analytical parameters:	VOCs

Equipment Rinsate Blanks

Number:	1 per 10 geochemical samples
Analytical Parameters:	Analytical parameter list

Field Ambient Blanks

Number:	1 per 20 geochemical samples
Analytical parameters:	VOCs

Field Duplicates

Number:	1 per 10 geochemical samples
Analytical parameters:	Analytical parameter list

Matrix Spike/Matrix Spike Duplicates

Number:	1 per 20 geochemical samples
Analytical parameters:	Analytical parameter list (double volume for most parameters; triple volume for VOCs)

Analytical Parameter List
VOCs
Semivolatile organic compounds
TCL pesticides/PCBs
TAL inorganics
Bismuth
Fluoride
Strontium-90
Gamma spectrometry
Nitrate/nitrite
Chloride
Sulfate

TRITIUM TABLE (VAPOR DEPOSITION)

Environmental Samples

Surface soil samples[a]

Number:	211
Location:	500 ft intervals to 5,000 ft 1,000 ft intervals to 10,000 ft and 20% of locations from 25,000 ft to 100,000 ft at 25,000 ft intervals
Depth:	0 to 1.0 ft
Analytical Parameter:	Tritium

Subsurface soil samples[b]

Number:	211
Location:	500 ft intervals to 5,000 ft 1,000 ft intervals to 10,000 ft and 20% of locations from 25,000 ft to 100,000 ft at 25,000 ft intervals
Depth:	1.0 to 2.0 ft
Analytical parameter:	Tritium

Quality Control Samples

Equipment Rinsate Blanks

Number:	1 per 10 geochemical samples
Analytical parameters:	Tritium

Field Duplicates

Number:	1 per 10 geochemical samples
Analytical parameters:	Tritium

Matrix Spike/Matrix Spike Duplicates

Number:	1 per 20 geochemical samples
Analytical parameters:	Tritium (double volume)

RADIONUCLIDE TABLE (PARTICULATE DEPOSITION)

Environmental Samples

Surface soil samples[a]

Number:	262
Location:	500 ft intervals to 5,000 ft 1,000 ft intervals to 10,000 ft 25,000 ft intervals to 100,000 ft
Depth:	0 to 2 inches
Analytical parameter:	Isotopic plutonium (238, 239/240)

Subsurface soil samples[b]

Number:	262
Depth:	2 to 12 inches
Analytical parameter:	Isotopic plutonium (238, 239/240)

Quality Control Samples	
Equipment Rinsate Blanks	
Number:	1 per 10 geochemical samples
Analytical parameters:	Isotopic plutonium (238, 239/240)
Field Duplicates	
Number:	1 per 10 geochemical samples
Analytical parameters:	Isotopic plutonium (238, 239/240)
Matrix Spike/Matrix Spike Duplicates	
Number:	1 per 20 geochemical samples
Analytical parameters:	Isotopic plutonium (238, 239/240) (double volume)
URANIUM/THORIUM	
Environmental Samples	
Surface soil samples[a]	
Number:	77
Location:	At the security fence line, at 500 ft, at 1,000 ft, and at 20% of the additional 1,000-ft intervals to a maximum of 10,000 ft
Depth:	0 to 2 inches
Analytical Parameters:	Isotopic uranium (234/235, 238) and isotopic thorium (228, 230, 232)
Quality Control Samples	
Equipment Rinsate Blanks	
Number:	1 per 10 geochemical samples
Analytical parameters:	Isotopic uranium (234/235, 238) and isotopic thorium (228, 230, 232)
Field Duplicates	
Number:	1 per 10 geochemical samples
Analytical parameters:	Isotopic uranium (234/235, 238) and isotopic thorium (228, 230, 232)
Matrix Spike/Matrix Spike Duplicates	
Number:	1 per 20 geochemical samples
Analytical parameters:	Isotopic uranium (234/235,238) and isotopic thorium (228, 230, 232) (double volume)

[a]Surface soil samples will be obtained according to Mound Plant ER Program SOP 5.2, Soil Sampling with a Spade and Scoop (revision 3).
[b]Subsurface soil sampling will be performed according to Mound Plant ER Program SOP 5.3, Subsurface Solid Sampling with Hand Auger and Thin-Wall Sampler (revision 2).
PCB - polychlorinated biphenyl
TAL - Target Analyte List
TCL - Target Compound List
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
VOC - volatile organic compound

Table VIII.11. Specifications for NPDES Outfall 001 Soil Investigation

Drilling Program

Number of Boreholes:	6 to 7
Drilling Technique:	Cable-tool or air-rotary
Depths:	15 - 30 ft
Total Footage:	90 - 210 ft

Environmental Samples

Subsurface soil samples -- Geochemical[a]

Number:	18 to 42
Analytical Parameters:	Analytical parameter list; plus 20% of samples biased for USATHAMA explosives

Subsurface soil samples -- Geotechnical/Mineralogical[a]

Number:	12 to 14 (assume 2 stratigraphic units expected/borehole)
Analytical Parameters:	Particle size distribution (sieve and hydrometer analysis), organic content, cation exchange capacity, permeability, clay mineralogy (by X-ray diffraction), pH, specific gravity, relative density, maximum density, and moisture content.

Quality Control Samples

Trip Blanks

Number:	1 per cooler containing VOCs
Analytical parameters:	VOCs

Equipment Rinsate Blanks

Number:	1 per 10 geochemical samples
Analytical Parameters:	Analytical parameter list

Field Ambient Blanks

Number:	1 per 20 geochemical samples
Analytical parameters:	VOCs

Field Duplicates

Number:	1 per 10 geochemical samples
Analytical parameters:	Analytical parameter list

Matrix Spike/Matrix Spike Duplicates

Number:	1 per 20 geochemical samples
Analytical parameters:	Analytical parameter list (double volume for most parameters; triple volume for VOCs)

Analytical Parameter List
VOCs
Semivolatile organic compounds
TAL inorganics
Bismuth
Fluoride
TCL pesticides/PCBs
Isotopic plutonium (238, 239/240)
Isotopic thorium (228, 230, 232)
Isotopic uranium (234/235, 238)
Strontium-90

Table VIII.11 (page 2 of 2)

Analytical Parameter List (continued)
Tritium
Gamma spectrometry
Nitrate/nitrite
Chloride
Sulfate
Total organic carbon

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[a]Subsurface soil sampling will be performed according to Mound Plant ER Program SOP 5.3, Subsurface Solid Sampling with Hand Auger and Thin-Wall Sampler (revision 0) (DOE 1991a).
PCB - polychlorinated biphenyl
TAL - Target Analyte List
TCL - Target Compound List
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
VOC - volatile organic compound

dust emissions and localized contaminated areas on-plant. No stack emissions are known and widespread areas of contamination are not suspected. Sampling will be performed at the security fence line, at the 500-ft interval, at the 1,000-ft interval, as well as at 20% of the additional 1,000-ft intervals to a maximum of 10,000 ft. At all locations, one surface sample (0 to 2 inches) will be collected for a total of 77 surface samples submitted for analysis of isotopic thorium and uranium. Additional sampling may be required if widespread contamination is encountered.

8.3.2. Investigation of Potentially Contaminated Soils Along NPDES Outfall 001

The presence or extent of contaminants in the soil adjacent to, or below, the NPDES Outfall 001 pipeline is unknown. Leaks in the pipeline have recently been identified, but the installation of a plastic liner in the early 1980s probably eliminated the pipeline as an active source. However, for 35 years of operation prior to installation of the plastic liner, leaking pipes may have allowed wastewater to contaminate soils, especially along the vitric clay pipe interval. In order to initially characterize the possible soil contamination, a soil sampling program will be conducted along the Outfall 001 pipeline.

Leakage from the pipeline could be caused by a rupture in the line, or through the joint where two lengths of pipe come together. Six sample locations have been identified on the basis of construction transition and at random locations along the vitrified clay portion of the pipeline (Figure 8.8).

A sampling location has been placed near manhole 7 due to a leak observed in the area in 1990 during maximum river stage (leak was river water). This location is also a point on the pipeline where the pipe material changes from cast iron to vitric clay. The sample location at manhole 5 was selected due to pipe material change. The remaining four locations along the pipe will identify potential soil contamination associated with the vitric clay pipe which, due to construction, presents a higher leakage potential. If the area around manhole 4 is accessible, an optional seventh sampling location may be added to the program, due to change in pipe material and size of pipe at this location. Borings for wells 0323 and 0324 (described in Section 6.3) below the WD building will provide data near manhole 1. Boreholes will be drilled at these locations in order to collect geochemical, geotechnical, and mineralogical samples.

Geochemical samples will be collected at least every 5 ft until bedrock or the water table (estimated to be at 30 ft) is encountered. Analytical parameters are shown in Table VIII.11.

One sample from each stratigraphic unit encountered will be selected for geotechnical/mineralogical analysis. These data will provide information on potential contaminant transport and attenuation through the soil profile. Sample collection, however, will depend on the physical availability of core samples. Since

Table VIII.12. Specifications for Investigation of Background Soil Conditions

PHASE I BACKGROUND LOCATIONS NEAR (< 1 MILE) MOUND PLANT:

Environmental Samples

Surface soil samples[a]

Number:	48 (3 at each of 16 locations)
Depth:	0 to 0.5 ft
Analytical parameters:	Analytical parameter list, plus molybdenum and lithium

Subsurface soil samples

Number:	48 (3 at each of 16 locations)
Depths:	1.5 to 2.0 ft
Analytical parameters:	Analytical parameter list, plus molybdenum and lithium

Quality Control Samples

Equipment Rinsate Blanks

Number:	1 per 10 geochemical samples
Analytical parameters:	Analytical parameter list

Field Duplicates

Number:	1 per 10 geochemical samples
Analytical parameters:	Analytical parameter list

Matrix Spike/Matrix Spike Duplicates

Number:	1 per 20 geochemical samples
Analytical parameters:	Analytical list (double volume for all parameters)

PHASE II BACKGROUND LOCATIONS:

Surface soil samples[a]

Number:	To be determined
Depth:	0 to 0.5 ft
Analytical parameters to be considered:	To be determined

Subsurface soil samples[b]

Number:	To be determined
Depths:	1.5 to 2.0 ft
Analytical parameters to be considered:	To be determined

Analytical Parameter List

TCL pesticides/PCBs	Isotopic plutonium (238, 239/240)
TAL inorganics	Isotopic thorium (228, 230, 232)
Bismuth	Isotopic uranium (234/235, 238)
Fluoride	Strontium-90
Total organic carbon	Tritium
Nitrate/nitrite	Gamma spectrometry
Chloride	Sulfate
pH	

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[a]Surface soil samples will be obtained according to Mound Plant ER Program SOP 5.2, Soil Sampling with a Spade and Scoop (revision 3).

[b]Subsurface soil sampling will be performed according to Mound Plant ER Program SOP 5.3, Subsurface Solid Sampling with Hand Auger and Thin-Wall Sampler (revision 2).

PCB - polychlorinated biphenyl

TAL - Target Analyte List

TCL - Target Compound List

Table VIII.13. Specifications for Main Hill Seeps Soil Investigation

Environmental Samples

Surface soil samples[a]

Number:	24
Depth:	0 to 0.5 ft
Analytical Parameters:	Analytical parameter list plus 20% of samples biased for USATHAMA explosives

Groundwater (seeps) samples

Number:	8
Analytical Parameters:	Analytical parameter list plus total dissolved solids, total suspended solids, ammonia, nutrients (TKN, TP), alkalinity; field parameter list

Subsurface soil samples -- Geochemical[b]

Number:	16
Depth:	1.5 to 2.0 ft; 3.5 to 4.0 ft
Analytical Parameters:	Analytical parameter list plus 20% of samples biased for USATHAMA explosives

Subsurface soil samples -- Geotechnical/Mineralogical[b]

Number:	8
Analytical Parameters:	Particle size distribution (sieve and hydrometer analysis), organic content, cation exchange capacity, permeability, clay mineralogy (by X-ray diffraction), pH, specific gravity, moisture content, relative density, and maximum density

Quality Control Samples

Trip Blanks

Number:	1 per cooler containing VOCs
Analytical parameters:	VOCs

Equipment Rinsate Blanks

Number:	1 per 10 geochemical samples
Analytical Parameters:	Analytical list below

Field Ambient Blanks

Number:	1 per 20 geochemical samples
Analytical parameters:	VOCs

Field Duplicates

Number:	1 per 10 geochemical samples
Analytical parameters:	Analytical list below

Matrix Spike/Matrix Spike Duplicates

Number:	1 per 20 geochemical samples
Analytical parameters:	Analytical list below (double volume for most parameters; triple volume for VOCs)

Analytical Parameter List

VOCs
Semivolatile organic compounds
TAL inorganics
TAL inorganics (dissolved in water)
Bismuth
Fluoride
TCL pesticides/PCBs

Table VIII.13. (page 2 of 2)

Analytical Parameter List (continued)	Field Parameter List (Water)
Isotopic plutonium (238, 239, 240)	Temperature
Isotopic thorium (228, 230, 232)	pH
Isotopic uranium (234/235, 238)	Specific conductivity
Radium-226 (water only)	Dissolved oxygen
Americium-241 (water only)	Redox potential
Strontium-90	Flow rate
Tritium	
Gamma spectrometry	
Nitrate/nitrite	
Chloride	
Sulfate	
Total organic carbon	

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[a]Surface soil samples will be obtained according to Mound Plant ER Program SOP 5.2, Soil Sampling with a Spade and Scoop (revision 3).
[b]Subsurface soil sampling will be performed according to Mound Plant ER Program SOP 5.3, Subsurface Solid Sampling with Hand Auger and Thin-Wall Sampler (revision 2).
PCB - polychlorinated biphenyl
TAL - Target Analyte List
TCL - Target Compound List
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
VOC - volatile organic compound

Investigations along the plant drainage ditch will be limited to confirming or augmenting existing data. The ponds and settling basins have been sampled so that waste management decisions could be made concerning the disposal of accumulated sediments (IT 1987). Although the water discharged through this system is sampled routinely for NPDES Outfall 002 requirements (EG&G 1989a), water samples will be collected to fulfill the requirements of CERCLA. The drainage ditch itself will be investigated along its length to determine the nature and extent of contamination, as previous studies were limited to plutonium (Rogers 1975), as described above. The latter investigation will be coordinated with investigations of the hydrogeology, as the plant drainage ditch may be incised into a small tongue of the Buried Valley aquifer.

Sampling from other watersheds will include a complete suite of analyses, as minimal data are available for these areas. Data on the stream discharge from the new property will also be obtained by the renovation and activation of a weir box where the stream crosses the plant fence line. Little is known about the physical stream characteristics of this subwatershed, which drains to the overflow creek via the Miami-Erie Canal and the Great Miami River.

The investigations of the south part of the Miami-Erie Canal are intended to provide a comprehensive investigation of the sediment systems on and adjacent to Mound Plant and are based on the hydraulic characteristics of the system. The limited investigations of the south canal are not intended to replace any of the investigations that may occur within Operable Unit 4 of the RI/FS (see section 3).

Some sample locations have yet to be determined, and sampling will be conducted in a second phase. Results of the regional soils investigation are required to identify additional locations for background sampling and maximum impact to the public. The background locations will be located outside the zone of influence from Mound Plant stack emissions, whereas locations within the zone are required to assess the maximum effects of erosion and sedimentation of contaminated soil on the public. The reconnaissance field investigation around the perimeter of the plant will determine what locations require sampling to assess the impact on the immediate community. The determination of these sampling locations will require the approval of the project managers.

The analytical levels for these investigations are shown in Table IX.7. Laboratory parameters may vary, dependent upon specific sampling objectives and proximity to potential or known source areas. These data are intended to identify the presence or absence of contamination in the Mound Plant watersheds, to support the assessment of off-plant contaminant transport, and to provide preliminary data for the RD/RA.

As a general rule, geotechnical sampling will be focused on onsite locations to provide Site-specific data for evaluation of remediation alternatives. All attempts will be made to collect samples for geotechnical analysis representative of the area but unlikely to be highly contaminated. Particle size distribution, however, will be measured for all sediment samples to provide a measure of sediment type for comparison purposes (sand, silt, etc.).

Limited surface water sampling is planned at this time for NPDES Outfall 001. This outfall is an operational discharge that is currently being monitored by Mound Plant. No sediment sampling will be performed specifically for this outfall.

Table IX.7. Analytical levels for Surface Water and Sediment Investigations

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of on-plant and off-plant surface water and sediments	Establish surface transport of contamination to support risk assessment and selection of remedial action alternatives.	Sediments	- Volume (depth, area)		I
			- Stratigraphic data		I
				- VOCs	IV
				- TCL pesticides/PCBs	IV
				- Semivolatile organic compounds	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Lithium	IV
				- Molybdenum	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Gamma spectrometry	V
				- Strontium-90	V
				- Tritium	V
				- USATHAMA explosives	V
				- Nitrate/nitrite	IV
				- Chloride	IV
				- Sulfate	IV
				- Particle size distribution	III
				- Specific gravity	III
				- Cation exchange capacity	III
				- pH	III
				- Total organic carbon	III
				- Moisture content	III
				- Organic content	III
				- Permeability	III
				- Relative density	III
				- Maximum density	III
		Surface water (high and low flow)	- Temperature		II
			- pH		II
			- Specific conductivity		II
			- Dissolved oxygen		II
			- Redox potential		II
			- Flow rate		II

Table IX.7. (page 2 of 3)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of onsite and offsite surface water and sediments.	Establish surface transport of contamination to support risk assessment and selection of remedial action alternatives.	Surface water (high and low flow) (continued)		- VOCs	IV
				- TCL pesticides/PCBs	IV
				- Semivolatile organic compounds	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Lithium	IV
				- Molybdenum	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Radium-226	V
				- Strontium-90	V
				- Americium-241	V
				- Gamma spectrometry	V
				- Tritium	V
				- Nutrients (TKN, TP)	IV
				- Nitrate/nitrite	IV
				- Chloride	IV
				- Sulfate	IV
				- Total suspended solids	III
				- Total dissolved solids	III
				- USATHAMA explosives	V
				- Ammonia	III
				- Total organic carbon	III
				- Alkalinity	III
		Water (impounded)	- Temperature		II
			- pH		II
			- Specific conductivity		II
			- Dissolved oxygen		II
			- Redox potential		II
				- VOCs	IV
				- TCL pesticides/PCBs	IV
				- Semivolatile organic compounds	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV

Table IX.7. (page 3 of 3)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of onsite and offsite surface water and sediments.	Establish surface transport of contamination to support risk assessment and selection of remedial action alternatives.	Water (impounded) (continued)		- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Radium-226	V
				- Americium-241	V
				- Gamma spectrometry	V
				- Strontium-90	V
				- Tritium	III
				- Nutrients (TKN, TP)	V
				- USATHAMA explosives	IV
				- Nitrate/nitrite	IV
				- Chloride	IV
				- Sulfate	III
				- Total suspended solids	III
				- Total dissolved solids	V
				- Total organic carbon	IV
				- Ammonia	III
				- Alkalinity	

[a]As defined in "Data Quality Objectives for Remedial Response Activities," EPA-540/G-87/003, discussed in Section 15.

Notes:
Explosives includes the 11 USATHAMA explosives: HMX; RDX; 1,3,5-TNB; 1,3-DNB; NB; Tetryl; 2A,4,6-DNT; 2,4,6-TNT; 2,6-DNT; 2,4-DNT; and PETN.
Onsite screening for plutonium-238 and thorium-232 is performed using a FIDLER detection system calibrated to detect these isotopes.
PCBs - polychlorinated biphenyls.
TAL - Target Analyte List, includes dissolved total metals and cyanide.
TCL - Target Compound List.
TKN - total Kjeldahl nitrogen.
TP - total phosphorus
VOC - volatile organic compound.

9.3.1. Investigation of the Storm Water Retention and Discharge System

As part of the field investigations of the storm water retention and discharge system, surface water and sediment samples will be collected from the NPDES Outfalls 001 and 002, the asphalt-lined pond, the retention basins, and the overflow pond. Near surface and subsurface soil samples will be collected from the plant drainage ditch to determine the nature and extent of contamination. Subsurface soil samples cannot be collected beneath the basins or ponds because the integrity of the bottoms of these structures may be compromised. The bottoms of these structures would also serve as barriers to downward migration of contaminants. Analytical results will be incorporated into the hydrogeologic investigations, because the ditch may be incised into deposits contiguous with the Buried Valley aquifer. Geotechnical samples will be taken to provide data for evaluation of surface water infiltration to groundwater.

The surface water and sediments within the SRDS will be sampled seasonally, once in April and once in October. These sampling periods roughly correspond to the wetter and drier parts of the year at Mound Plant. If conditions permit, the settling ponds and basins will be sampled during both high and low flow events. During high flow conditions, sediment sources may be different than during low flow. The high flow conditions may allow greater dilution of dissolved compounds, if they are present, and a greater sediment capacity due to increased velocity.

Surface water samples from standing bodies of water will be collected by one of two methods, depending on the presence of a thermocline. A thermocline is the horizontal plane in a thermally stratified lake located at the depth where temperature decreases most rapidly with depth. The thermocline can be detected by lowering a temperature probe through the water column. The presence of a thermocline may prevent mixing of waters vertically through the pond, producing two chemically distinct water layers. In this instance, a water sample will be collected from the mid-depth of each of the water layers above and below the thermocline. These water samples will be submitted for separate analysis. If a thermocline is not detected, the surface water sample will be collected at mid-depth of the entire water column. In either case, a sample will be collected by a sampling device capable of collecting a discrete sample (e.g., Kemmerer bottle).

The analytical parameter list for surface water, sediment, and subsurface soil sampling for the SRDS system is presented in Table IX.8.

9.3.1.1. Investigation at the Asphalt-Lined Pond

The 1987 investigation at the asphalt-lined pond involved composite sampling to characterize the general contaminant characteristics of the water and sediment in the pond. For this investigation, discrete surface water samples will be collected from the asphalt-lined pond to characterize chemical constituents and to

Table IX.8. Analytical Specifications for the Surface Water and Sediment Investigations

ENVIRONMENTAL SAMPLES

SRDS/NPDES INVESTIGATION:

Surface Water Samples[a]

Sample Location/Number:	ALL LOCATIONS SAMPLED TWICE - Asphalt-lined pond (3 plus 1 influent) - Plant drainage ditch (3) - Retention basins (3) - Overflow pond (3 plus 2 possible influent) - NPDES Outfall 002 (1) - NPDES Outfall 001 (2) - Miami-Erie Canal (5)
Analytical Parameters:	Analytical parameter list plus molybdenum, lithium, and USATHAMA explosives; field parameter list

Sediment Samples--Geochemical

Sample Location/Number:	ALL LOCATIONS SAMPLED TWICE - Asphalt-lined pond (5) - Plant drainage ditch (8) - Retention basins (7) - Overflow pond (5) - NPDES Outfall 002 (4) - Miami-Erie Canal (7)
Analytical Parameters:	Analytical parameter list plus molybdenum, lithium, and USATHAMA explosives

Sediment Samples--Geotechnical

Sample Location/Number:	- Asphalt-lined pond (3) - Plant drainage ditch (3) - Retention basins (3) - Overflow pond (3) - NPDES Outfall 002 (2) - Miami-Erie Canal (7)
Analytical Parameters:	Particle size distribution, specific gravity, and cation exchange capacity

Subsurface Soil Samples[b]--Geochemical

Sample Location/Number:	- Plant drainage ditch (6-18) - Miami-Erie Canal (7)
Depth:	- Plant drainage ditch: every 5 ft to water table or bedrock - Miami-Erie canal: 0.5 to 2.0 ft
Analytical Parameters:	Analytical parameter list plus molybdenum, lithium, and USATHAMA explosives

GREAT MIAMI RIVER AND SOUTH POND INVESTIGATIONS:

Surface Water Samples[a]

Sample Locations/Number:	ALL LOCATIONS SAMPLED TWICE - Great Miami River (4) - Miamisburg South Pond (3)
Analytical Parameters:	Analytical parameter list; field parameter list

Sediment Samples--Geochemical

Sample/Location Number:	ALL LOCATIONS SAMPLED TWICE - Great Miami River (12) - Miamisburg South Pond (3)
Analytical Parameters:	Analytical parameter list

Sediment Samples-Geotechnical

Sample Location/Number:	- Great Miami River (12) - Miamisburg South Pond (3)
Analytical Parameters:	Particle size distribution on all samples plus pH, specific gravity, and cation exchange capacity on South Pond samples

Table IX.8. (page 3 of 5)

INVESTIGATION OF OTHER DRAINAGES:

Surface Water Samples[a]

Sample Location/Number:	ALL LOCATIONS SAMPLED TWICE - Area watershed drainages (approx. 30) - Trunk stream (1) - Zone of influence - 2 ponds (6-12), 2 streams (4)
Analytical Parameters:	Analytical parameter list, but only 20% of samples for USATHAMA explosives and semivolatile organic compounds; field parameter list

Sediment Samples

Sample Location/Number:	ALL LOCATIONS SAMPLED TWICE EXCEPT LOW LYING AREA - Area watershed drainages (approx. 50) - Low lying areas (approx. 23) - Ephemeral stream (15) - Trunk stream (5) - Zone of influence - 2 ponds (10), 2 streams (6)
Analytical Parameters:	Analytical parameter list, but only 20% of samples for USATHAMA explosives and semivolatile organic compounds; samples greater than 15 pCi/g thorium for rare earths (not to exceed 3 samples)

Subsurface Soil Samples[b]**--Geochemical**

Sample Location/Number:	- Low lying area (approx. 12) - Ephemeral stream (approx. 12) - Trunk stream (approx. 12)
Depth:	Every 5 ft to water table or bedrock
Analytical Parameters:	Analytical parameter list, but only 20% of samples for USATHAMA explosives and semivolatile organic compounds

Subsurface Soil Samples--Geotechnical

Sample Location/Number:	One sample from each distinct stratigraphic horizon - Low lying area (approx. 4-6) - Ephemeral stream (approx. 4-6) - Trunk stream (approx, 4-6)
Depth:	Dependent on stratigraphy

Analytical Parameters:	Cation exchange capacity, moisture content, particle size distribution (sieve and hydrometer), organic content, permeability, relative density, maximum density and specific gravity

QUALITY CONTROL SAMPLES

Trip Blanks

Number:	1 per cooler containing VOCs
Analytical Parameter:	VOCs

Equipment Rinsate Blanks

Number:	1 per 10 geochemical samples.
Analytical Parameters	Analytical parameter list

Field Ambient Blanks

Number:	1 per 20 geochemical samples
Analytical Parameters:	VOCs

Field Duplicates

Number:	1 per 10 geochemical samples
Analytical Parameters:	Analytical parameter list

Matrix Spike/Matrix Spike Duplicates

Number:	1 per 20 geochemical samples
Analytical Parameters:	Analytical parameter list (double volume for most parameters; triple volume for VOCs).

ANALYTICAL PARAMETER LIST

VOCs
Semivolatile organic compounds
TAL inorganics
Bismuth
Fluoride
TCL pesticides/PCBs
Isotopic plutonium (238, 239/240)
Isotopic thorium (228, 230, 232)
Isotopic uranium (234/235, 238)
Strontium-90
Tritium
Gamma spectrometry
Nitrate/nitrite
Chloride

FIELD PARAMETER LIST

pH
Temperature
Dissolved oxygen
Redox potential
Specific conductivity
Flow rate (if available)

ANALYTICAL PARAMETER LIST (continued)

Sulfate
Total organic carbon

Surface Water Samples Only	Sediment Samples Only
Ammonia	Particle size distribution
Nutrients (TKN, TP)	pH
Total dissolved solids	
Total suspended solids	
Alkalinity	
TAL inorganics (dissolved)	
Radium-226	
Americium-241	

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[a]Surface soil samples will be obtained according to Mound Plant ER Program SOP 5.2, Soil Sampling with a Spade and Scoop (revision 3).

[b]Subsurface soil sampling will be performed according to Mound Plant ER Program SOPs 4.1, Soil Boring (revision 2), and 5.1, Soil and Rock Borehole Logging and Sampling (revision 1).

ER - Environmental Restoration
NPDES - National Pollution Discharge Elimination System
PCBs - polychlorinated biphenyls
SOP - Standard Operating Procedure
TAL - Target Analyte List
TCL - Target Compound List
TKN - total Kjeldahl nitrogen
TP - total phosphorus
USATHAMA - U.S. Army Toxic and Hazardous Materials Agency
VOC - volatile organic compound

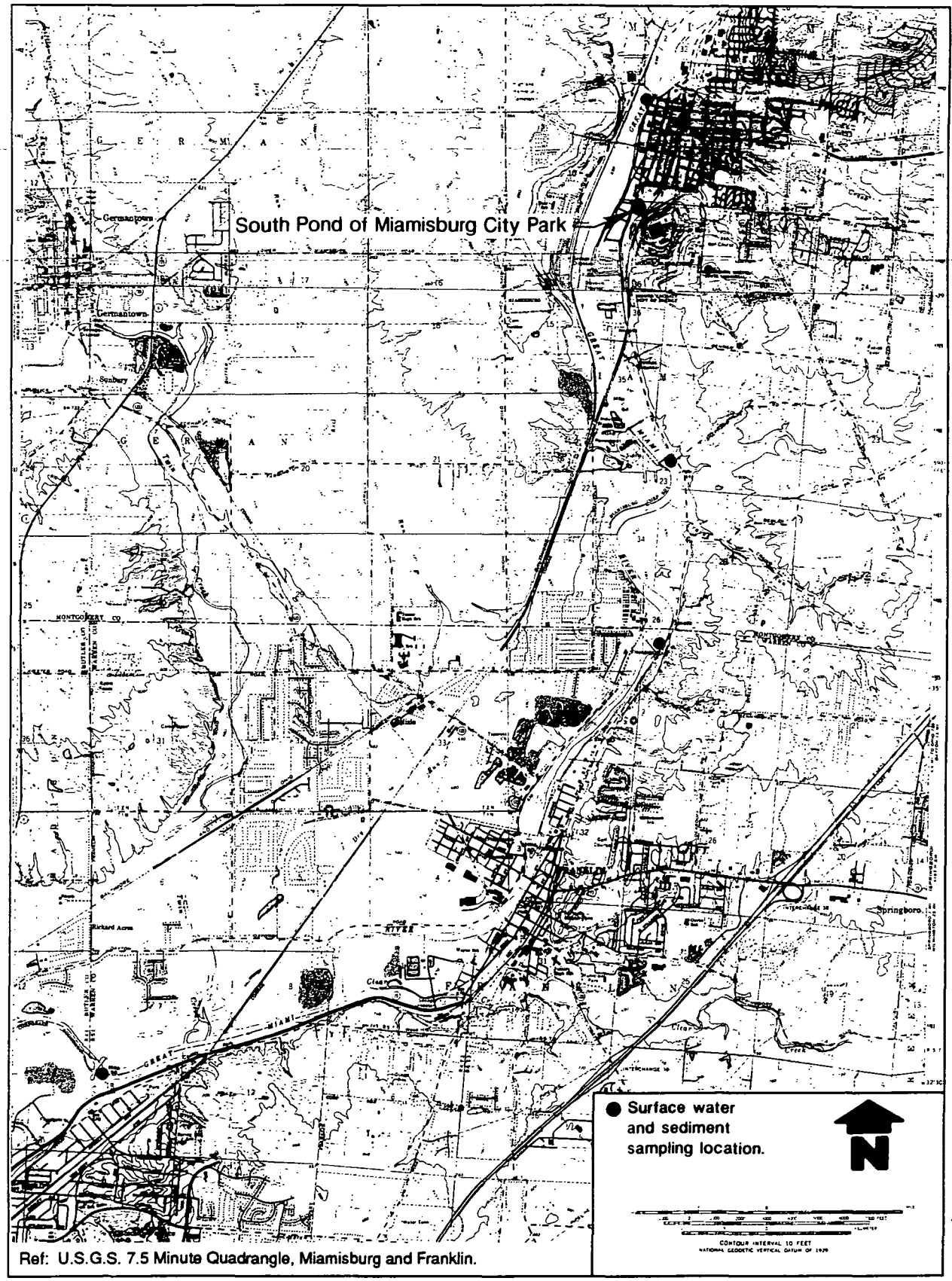

Figure 9.15. Sampling locations along the Great Miami River and in the South Pond of Miamisburg City Park (proposed).

9.3.3.2. Investigation of Watershed Drainages Within the Zone of Influence

For this field investigation, surface water and sediment samples will be collected from selected drainages, ponds, and seeps identified in the reconnaissance survey within a 1-mile radius of the Mound Plant locus. The samples will be collected to assess the vertical and horizontal extent of potential contaminants along ephemeral drainages, ponds, and seeps within and adjacent to Mound Plant. The specific drainages, ponds, and seeps to be sampled will be selected from the data collected during reconnaissance field investigations and regional soil depositions, and will be located to assess the impact of potentially contaminated surface water on the immediate community surrounding the plant. The locations will be mutually agreed upon by the project managers. The types of data to be evaluated are prioritized below:

- contaminated sediments within drainages and ponds (based on elevated instrument readings),
- the potential for significant runoff during rainfall events,
- drainages that flow off-plant,
- drainages or ponds that receive the most tributary flow,
- areas of dominant sediment deposition or surface water infiltration, and
- drainage discharge points.

Surface water and sediment samples will be collected in each drainage and pond. For the purpose of this work plan, it will be assumed that a total of 10 drainages and/or ponds will be identified within the 1-mile radius and that no more than 30 surface water and 50 sediment samples will be collected. Because there may be ephemeral drainages or seasonal ponds, surface water may only be available for collection following a rainfall. If flow is occurring, flow rate measurements will be collected as part of the investigation.

Surface water samples will be collected from each sampling location using a device capable of retrieving shallow surface water (i.e., ladle, grab sampler). An extra sample from each location will be used to measure field parameters of temperature, pH, specific conductivity, dissolved oxygen, and redox potential. Surface water samples will be collected as discrete grab samples during both the April and October sampling events.

Individual sediment samples will be collected from the same locations identified for water sampling. At each sample location, one sediment sample will be collected for laboratory analysis. The grab sample will be collected from the ground surface to a depth of 0.5 ft. Sediment samples will be collected using a

trowel. Sediment and surface water analytical parameters are shown on Table IX.8. In keeping with the policy for all geotechnical sampling to be done onsite, the only geotechnical parameter from offsite locations will be particle size distribution. This parameter will provide a basis of comparison of sediment samples.

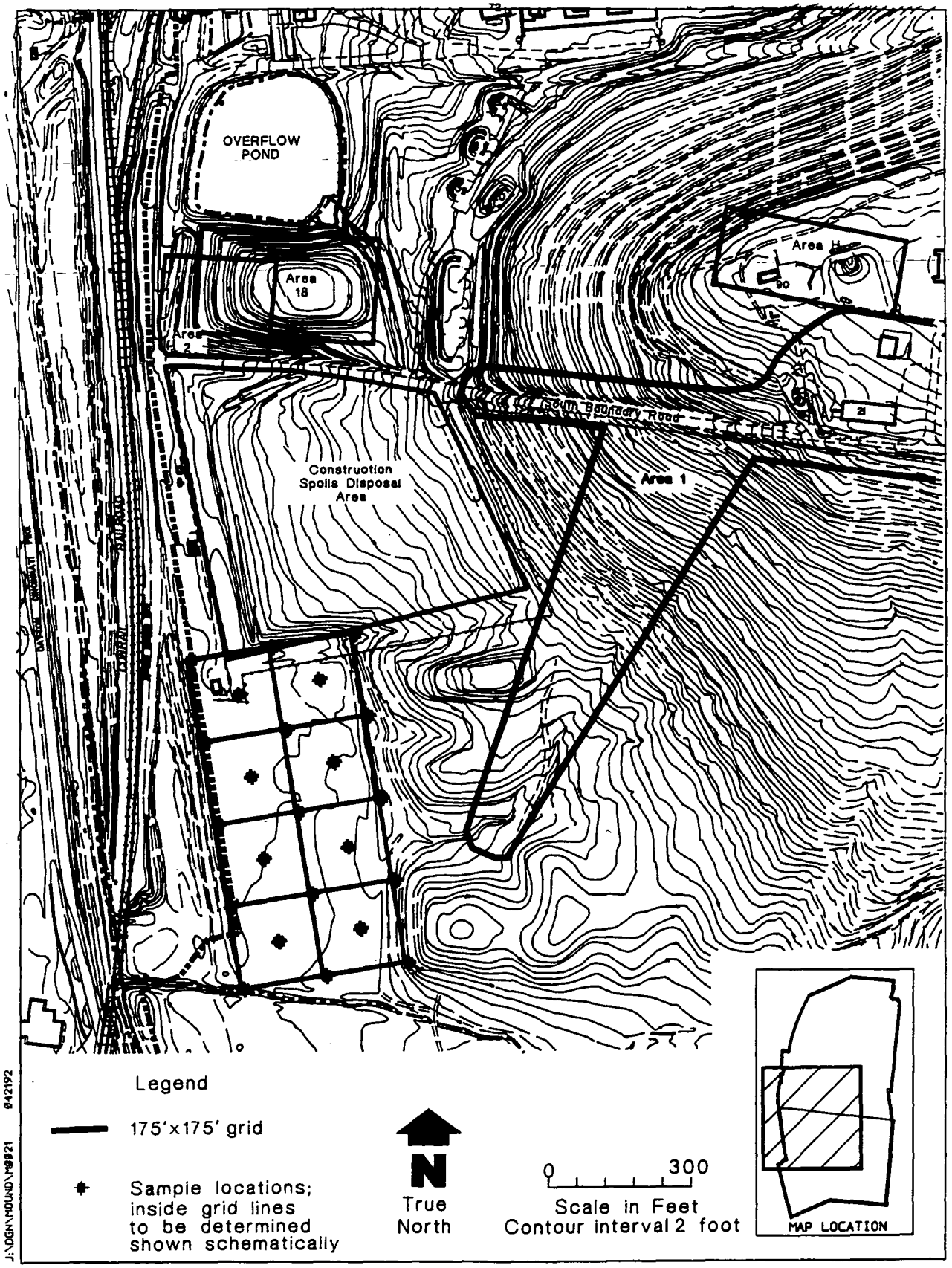

Figure 9.16. New property, low-lying area with 175-ft by 175-ft grid with systematic and biased sample locations (proposed).

9.3.3.4. Zone of Influence of Airborne Contaminants on Surface Waters

The distribution of airborne contaminants around the Mound Plant was identified in the 1970s by the collection of soil samples. The samples were collected along several compass directions and at varying distances from the Mound Plant. A zone of plutonium-238 influence was identified that corresponded with the prevailing wind direction and also possibly the diurnal wind patterns. The zone of influence was found to generally trend in a southwest to northeast direction from the Mound Plant (DOE 1991e).

As part of this investigation, the impact of radiological species on surface water features in the zone of influence will be evaluated. Two ponds and streams within this zone of influence will be identified in the field for sampling in Phase II. Both a pond and stream southwest and northeast of the Mound Plant will be identified. Locations will be within a 3-mile distance from the plant and will be located to assess the maximum impact on the public. Locations will be determined from the maximum soil concentrations found during the regional soil investigations and air emission investigation results (see section 8 of this work plan). The locations will be mutually agreed upon by the project managers. Three water samples and five sediment samples will be collected from each pond, and two water samples and three sediment samples will be collected from each stream. The sample will be collected twice, during both the April and October sampling events. All samples will be discrete grab samples. Samples will be collected in a grid pattern similar to that used for the other ponds and streams being sampled during this investigation. Sample methods, including field parameters, will be the same as presented earlier in this section. The only geotechnical parameter measured will be particle size distribution, to allow comparison between sediment types (sand, silt, etc.). No geotechnical parameter will be collected from offsite locations.

9.3.4. Background Investigation

As part of the assessment of background chemistry and surface water quality, surface water and sediment samples will be collected from four locations: two from river and stream settings and two from small ponds (Figure 9.19). The sampling locations currently subjected to background sampling by Mound Plant include:

- the Great Miami River approximately 17 miles north-northeast of Mound Plant (39° 51' 18.5"N, 84° 10' 17"W).
- an unnamed pond along Diamond Mill Road approximately 6 miles northwest of Mound Plant (39° 41' 12"N, 84° 22' 00"W).
- the creek above the unnamed pond along Diamond Mill Road (39° 41' 12"N, 84° 22' 00"W).
- the unnamed pond in the State Game Preserve 32 miles southeast of Mound Plant (39° 11' 12"N latitude and 83° 53' 30"W longitude).

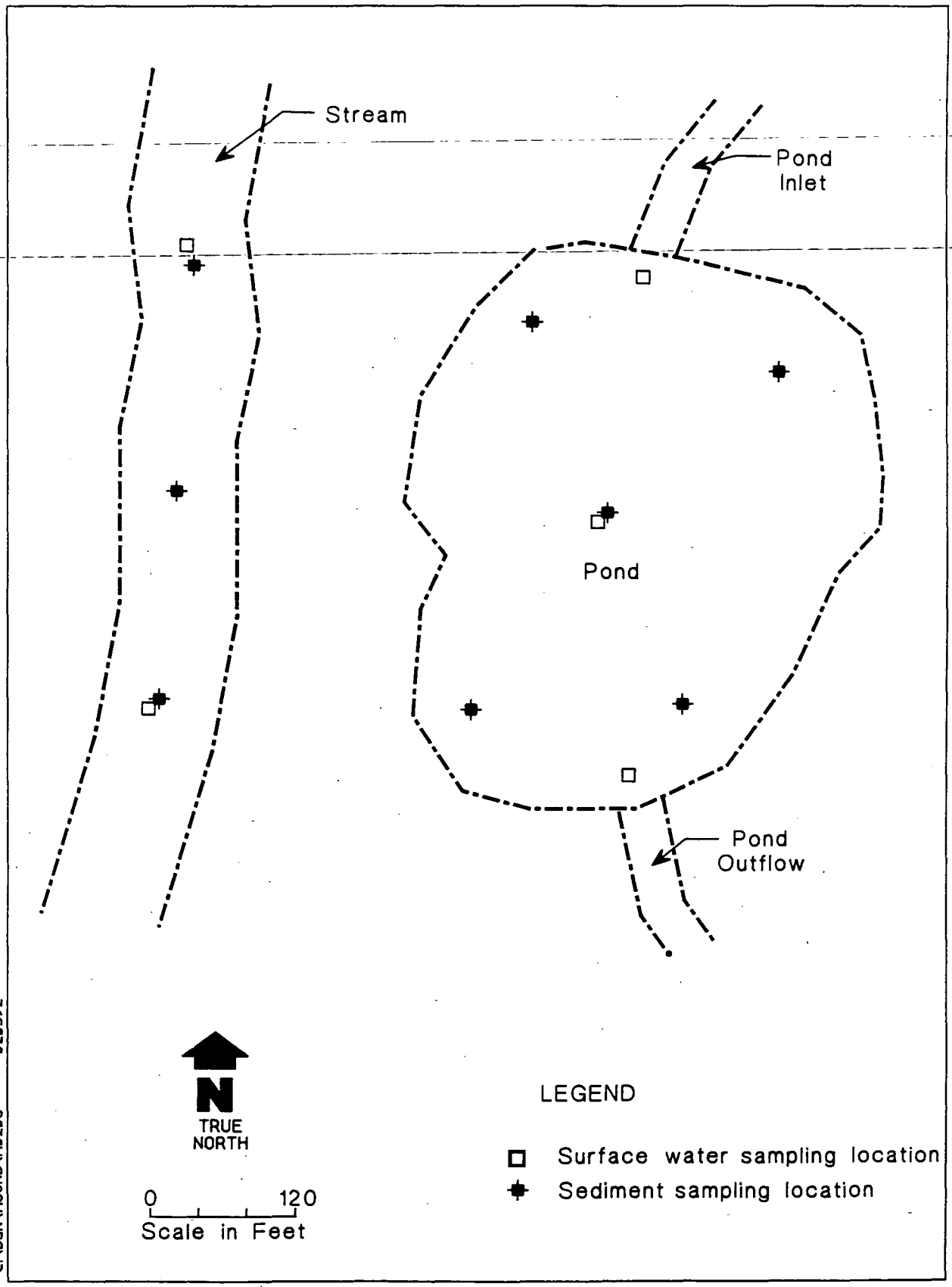

Figure 9.20. Proposed sampling locations on a typical background pond and stream (location to be determined).

Table IX.9. Analytical Specifications for Background Investigations of Surface Water and Sediment

Phase I

Environmental Samples

Surface Water Samples[a]

Sample Location/Number:	ALL LOCATIONS SAMPLED TWICE - Great Miami River (1) - Diamond Mill Road Pond (3-6) - Game Preserve Pond (3-6) - Diamond Mill Road Stream (2)
Analytical Parameters:	Analytical parameter list; field parameter list; Great Miami River locations--analytical parameter list plus VOCs and semivolatile organic compounds

Sediment Samples

Sample/Location Number:	ALL LOCATIONS SAMPLED TWICE - Great Miami River (3) - Diamond Mill Road Pond (5) - Game Preserve Pond (5) - Diamond Mill Road Stream (3)
Analytical Parameters:	Analytical parameter list; Great Miami River locations--analytical parameter list plus VOCs and semivolatile organic compounds

Phase II

Surface Water Samples[a]

Sample Location/Number:	ALL LOCATIONS SAMPLED TWICE - Pond to be determined (3-6) - Stream to be determined (2)
Analytical Parameters:	Analytical parameter list; field parameter list

Sediment Samples

Sample Location/Number:	ALL LOCATIONS SAMPLED TWICE - Pond to be determined (5) - Stream to be determined (3)
Analytical Parameters:	Analytical parameter list

QUALITY CONTROL SAMPLES

Trip Blanks

Number:	1 in every cooler containing VOCs
Analytical Parameters:	VOCs

Equipment Rinsate Blanks

Number:	1 per group of 10 or fewer geochemical samples
Analytical Parameters:	Analytical parameter list

Field Ambient Blanks

Number:	1 per group of 20 or fewer geochemical samples
Analytical Parameters:	VOCs

Field Duplicates

Number:	1 per group of 10 or fewer geochemical samples
Analytical Parameters:	Analytical parameter list

Matrix Spike/Matrix Spike Duplicates

Number:	1 per group of 20 or fewer geochemical samples
Analytical Parameters:	Consistent with primary sample

ANALYTICAL PARAMETER LIST	FIELD PARAMETER LIST
TAL inorganics	pH
Bismuth	Temperature
Fluoride	Dissolved oxygen
Lithium	Redox potential
Molybdenum	Specific conductivity
TCL pesticides/PCBs	Flow rate
Isotopic plutonium (238, 239/240)	
Isotopic thorium (228, 230, 232)	
Isotopic uranium (234/235, 238)	
Strontium-90	
Tritium	
Gamma spectrometry	
Nitrate/nitrite	
Chloride	
Sulfate	
Total organic carbon	

Table IX.9. (page 3 of 3)

Surface Water Samples Only	Sediment Samples Only
Ammonia	Particle size distribution
Nutrients (TKN, TP)	pH
Total dissolved solids	
Total suspended solids	
Alkalinity	
TAL inorganics (dissolved)	
Radium-226	
Americium-241	

[a]Surface soil samples will be obtained according to Mound Plant ER Program SOP 5.2, Soil Sampling with a Spade and Scoop (revision 3).

ER - Environmental Restoration
PCBs - polychlorinated biphenyls
SOP - Standard Operating Procedure
TAL - Target Analyte List
TCL - Target Compound List
TKN - total Kjeldahl nitrogen
TP - total phosphorus
VOC - volatile organic compound

Henry's Law constant as an indicator of the tendency for a chemical to volatilize (EPA 1990c). Compounds with high octanol/water partition coefficients tend to avoid the aqueous phase and may remain in environmental soils longer. Conversely, compounds with low coefficients tend to move in the aqueous phase and are considered mobile and transitory in the groundwater. The Henry's Law constant, used in conjunction with the vapor pressure, represents a measure of the ability of a compound to volatilize from the aqueous phase.

Table XIII.2 is the list of Site-specific compounds selected on the basis of combined properties of significant usage, high toxicity, and persistence in the environment. The environmental samples described in this work plan and the accompanying FSP are designed to investigate the presence or absence of these compounds in the areas where they are most likely to occur. Three compounds are included that will be used as indicators of the possible presence or accumulation of cooling water chemicals in sediments along the plant drainage ditch. These are 2-benzyl-4-chlorophenol, tin and molybdenum. Fluoride is also considered an indicator parameter for the possible presence of several residual fluoric acid compounds. The group of explosive compounds will be sampled within the plant boundaries on a routine basis and outside the boundaries on a random basis, as these nitrate-rich compounds are not suspected of having accumulated in the environment. The investigation for the rare earth elements (lanthanides) is very limited, as these trace elements would have accompanied thorium and may only be detectable where thorium concentrations are highest.

Many of the compounds listed in Table XIII.2 are hazardous chemicals and may be detected by many common analytical methods; e.g., trichoroethene, also known as TCE, is detectable by many analytical methods as it is a common groundwater contaminant across the United States. Many of the metals listed are routinely part of the TAL and will be reported as such. The analytical methods in the accompanying QAPP are designed to ensure that accurate and precise analyses are performed for the parameters selected to support the risk assessment and remedial design processes.

The Site-specific radionuclides include tritium, plutonium, thorium, uranium, radium, and polonium. Tritium is an isotope of hydrogen and as such is most prevalent in water. All investigations will include tritium analyses. Plutonium-238 was the common isotope used in heat sources; minor constituents included plutonium-239 and -240 and americium-241, as described in the Site Scoping Reports (DOE 1991f, 1991p). Plutonium was the dominant particulate species emitted by historic practices and will be addressed in all media. Thorium and uranium were largely handled at the plant in the form of ores. The known thorium contamination is generally due to handling and storage of the thorium ores and the fugitive dust emissions associated with those processes. The Operable Unit 9 investigations of thorium contamination will address the dispersion of the dusts. Uranium ores were much less common at the plant (DOE 1991o), but some uranium is present from the radioactive decay of plutonium and will, therefore, be investigated in all media.

Table XIII.2. Site-Specific Compounds and Radionuclides for Mound Plant

Compound	Compound
Acetone	Antimony
Acetonitrile	Beryllium
Acrylonitrile	Bismuth
Ammonia	Cadmium
ANCO ALGAECIDE No. 1 (2-benzyl-4-chlorophenol) [a]	Chromium
ANCOOL 3310 (triazole) sodium molybdate[a,b]	Cobalt
Arsenic	Cyanide
Benzene	Copper
Calcium	Iron
Carbon disulfide	Lead
Carbon tetrachloride	Lithium
Chloroform	Magnesium
Cresols (methylphenol)	Manganese
Diethyl benzene	Mercury
Fluoride	Nickel
Freon-TF (Freon 113, trichlorotrifluoroethane)	Selenium
Hexane	Silver
High explosives	Vanadium
PETN	Zinc
RDX	Actinium-227
HMX	Americium-241
Iodomethane	Bismuth-207
Methylene chloride	Bismuth-210m
Methyl ethyl ketone (2-butanone)	Cesium-137
Methyl isobutyl ketone (4-methyl-2-pentanone)	Cobalt-60
NALCO 2532 bis(tributyltin) oxide[a]	Plutonium-238,239/240
PCBs	Radium-226
Phenol	Strontium-90
Potassium	Thorium-228, 230, 232
Sodium	Tritium
Tetrachloroethane	Uranium-234/235, 238
Toluene	Rare earths (lanthanides)
Tribromomethane (bromoform)	Nitrate-nitrite
Trichloroethane	Nitrite
Trichloroethene	Chloride
Xylene	Sulfate
Aluminum	

Notes:
[a]Indicator compound
[b]Analyze for molybdenum in the TAL method, not for the molybdate; analyze for tin, not for the oxide.
HMX - Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (cyclotetramethylenetetranitramine)
PETN - pentaerythritol tetranitrate
PCB - polychlorinated biphenyl
RDX - Hexahydro-1,3,5-trinitro-s-triazine (cyclotetramethylenetetranitramine)

Table XV.2. Summary DQO Analytical Levels for Site-Wide Operable Unit 9 Investigations

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Hydrogeology Characterization of the natural hydrogeologic system	Understand the hydrology in order to define potential transport pathways and to provide sufficient engineering data for development and screening of remedial action alternatives and the baseline risk assessment.	Subsurface soils and bedrock	- Lithologic logs - New well completion data		I I
				- VOCs - Semivolatile organic compounds - TCL pesticides/PCBs - TAL inorganics - Bismuth - Fluoride - USATHAMA explosives - Nitrate/nitrite - Chloride - Sulfate - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Strontium-90 - Gamma spectrometry - Tritium - Total organic carbon	IV IV IV IV IV IV V IV IV IV V V V V V V III
				- pH - Particle size distribution - Clay mineralogy - Cation exchange capacity - Permeability test - Relative density - Maximum density - Moisture content - Organic content - Specific gravity	III III III III III III III III III III
		Groundwater	- Temperature - pH - Specific conductivity - Dissolved oxygen - Redox potential - Water level - Aquifer tests - Pumping data - Precipitation data		II II II II II I I I I

Table XV.2. (page 2 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of on-plant and off-plant contamination including background wells	Determine the nature and extent of contamination and the concentration of potential contaminants.	Groundwater		- VOCs - Semivolatile organic compounds - TCL pesticides/PCBs - TAL inorganics - Bismuth - Fluoride - USATHAMA explosives - Nitrate/nitrite - Nitrite - Chloride - Sulfate - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Radium-226 - Strontium-90 - Americium-241 - Gamma spectrometry - Tritium - Total suspended solids - Total dissolved solids - Total organic carbon - Nutrients (TKN, TP) - Alkalinity	IV IV IV IV IV IV V IV III IV IV V V V V V V V III III III III III
Residential Characterization of residential wells	Identify potential for contamination of groundwater in public sector for risk assessment	Subsurface soils and bedrock	- Lithologic logs (if available) - Stratigraphy data (if available) - Well completion data (if available)		I I I
		Groundwater	- Temperature - pH - Specific conductivity - Dissolved oxygen - Redox potential - Water level - Aquifer tests (if available) - Pumping data (if available) - Precipitation data (if available)		II II II II II I I I I

Table XV.2. (page 3 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
		Groundwater		- VOCs	V
				- Semivolatile organic compounds	V
				- TCL pesticides/PCBs	V
				- TAL inorganics	V
				- Fluoride	V
				- Nitrate/nitrite	V
				- Nitrite	III
				- Chloride	V
				- Sulfate	V
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Radium-226	V
				- Americium-241	V
				- Gamma spectrometry	V
				- Tritium	V
				- Strontium-90	V
				- Total suspended solids	III
				- Total dissolved solids	III
				- Alkalinity	III
		Sediments (cistern)		- VOCs	IV
				- Semivolatile organic compounds	IV
				- TCL pesticides/PCBs	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Nitrate/nitrate	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Tritium	V
				- Gamma spectrometry	V
				- Strontium-90	V

Table XV.2. (page 4 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Soil Characterization of regional soils	Phase I: Collection of basic chemical data for soil types that occur on the Site to support selection of background locations	Soil	- Location - Soil type - Stratigraphic data		I I I
				- TAL inorganics - TCL pesticides/PCBs - Fluoride - Nitrate/nitrite - Chloride - Sulfate - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Tritium - Strontium-90 - Gamma spectrometry - pH - Total organic carbon	IV IV IV IV IV IV V V V V V V III III
	Phase II: Establish background chemical characteristics of Site soils	Soil	- Location - Soil type - Stratigraphic data		I I I
				- TAL inorganics - Fluoride - TCL pesticides/PCBs - Nitrate/nitrite - Chloride - Sulfate - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Strontium-90 - Tritium - Gamma spectrometry - pH - Total organic carbon	IV IV IV IV IV IV V V V V V V III III

Table XV.2. (page 5 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Sample soils in downwind directions, in major quadrants, and in areas of suspected contamination	Characterize nature and extent of airborne deposited contamination, and identify presence or absence of contamination.	Soil	- Location		I
			- Soil series		I
			- Stratigraphic data		I
				- VOCs	IV
				- TAL inorganics	IV
				- TCL pesticides/PCBs	IV
				- Bismuth	IV
				- Fluoride	IV
				- Semivolatile organic compounds	IV
				- USATHAMA explosives	V
				- Chloride	IV
				- Nitrate/nitrite	IV
				- Sulfate	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Tritium	V
				- Strontium-90	V
				- Gamma spectrometry	V
				- Cation exchange capacity	III
				- Permeability test	III
				- Clay mineralogy	III
				- Specific gravity	III
				- Particle size distribution	III
				- Moisture content	II
				- Organic content	II
				- Relative density	III
				- Maximum density	III
				- pH	III
				- Total organic carbon	III

Table XV.2. (page 6 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Sample groundwater at seeps in conjunction with soil sampling at seeps		Groundwater (seeps)	- Temperature		II
			- pH		II
			- Specific conductivity		II
			- Dissolved oxygen		II
			- Redox potential		II
			- Flow rate		II
				- VOCs	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Semivolatile organic compounds	IV
				- TCL pesticides/PCBs	IV
				- USATHAMA explosives	IV
				- Chloride	IV
				- Nitrate/nitrite	IV
				- Sulfate	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Radium-226	V
				- Tritium	V
				- Americium-241	V
				- Strontium-90	V
				- Gamma spectrometry	V
				- Total dissolved solids	III
				- Total suspended solids	III
				- Ammonia	III
				- Nutrients (TKN, TP)	III
				- Total organic carbon	III
				- Alkalinity	III

Table XV.2. (page 7 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Surface Water and Sediment Characterization of on-plant and off-plant surface water and sediments	Establish surface transport of contamination to support risk assessment and selection of remedial action alternatives.	Sediments	- Volume (depth, area) - Stratigraphic data		I I
				- VOCs - TCL pesticides/PCBs - Semivolatile organic compounds - TAL inorganics - Bismuth - Fluoride - Lithium - Molybdenum - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Strontium-90 - Gamma spectrometry - Tritium - USATHAMA explosives - Nitrate/nitrite - Chloride - Sulfate - Particle size distribution - Specific gravity - Cation exchange capacity - pH - Total organic carbon - Moisture content - Organic content - Permeability - Relative density - Maximum density	IV IV IV IV IV IV IV IV V V V V V V V IV IV IV III III III III III III III III III III

Table XV.2. (page 8 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of on-plant and off-plant surface water and sediments (continued)	Establish surface transport of contamination to support risk assessment and selection of remedial action alternatives (continued).	Surface water (high and low flow)	- Temperature		II
			- pH		II
			- Specific conductivity		II
			- Dissolved oxygen		II
			- Redox potential		II
			- Flow rate		II
				- VOCs	IV
				- TCL pesticides/PCBs	IV
				- Semivolatile organic compounds	IV
				- TAL inorganics	IV
				- Bismuth	IV
				- Fluoride	IV
				- Isotopic plutonium (238, 239/240)	V
				- Isotopic thorium (228, 230, 232)	V
				- Isotopic uranium (234/235, 238)	V
				- Radium-226	V
				- Strontium-90	V
				- Americium-241	V
				- Gamma spectrometry	V
				- Tritium	V
				- Nutrients (TKN, TP)	IV
				- Nitrate/nitrite	IV
				- Chloride	IV
				- Sulfate	IV
				- Total suspended solids	III
				- Total dissolved solids	III
				- USATHAMA explosives	IV
				- Ammonia	III
				- Total organic carbon	III
				- Alkalinity	III
		Water (impounded)	- Temperature		II
			- pH		II
			- Specific conductivity		II
			- Dissolved oxygen		II
			- Redox potential		II

Table XV.2. (page 9 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level[a]
Characterization of on-plant and off-plant surface water and sediments (continued)	Establish surface transport of contamination to support risk assessment and selection of remedial action alternatives (continued).	Water (impounded) (continued)		- VOCs - TCL pesticides/PCBs - Semivolatile organic compounds - TAL inorganics - Bismuth - Fluoride - Isotopic plutonium (238, 239/240) - Isotopic thorium (228, 230, 232) - Isotopic uranium (234/235, 238) - Radium-226 - Americium-241 - Gamma spectrometry - Strontium-90 - Tritium - Nutrients (TKN, TP) - USATHAMA explosives - Nitrate/nitrite - Chloride - Sulfate - Total suspended solids - Total dissolved solids - Total organic carbon - Ammonia - Alkalinity	IV IV IV IV IV IV V V V V V V V V IV V IV IV IV III III III III III
Ecological Ecological field assessments	Provide a detailed inventory of flora and fauna; identify sensitive environments, endangered species, and related food chains; define and delineate habitat types across the Site as wells as the types of communities typical of contaminated and noncontaminated areas.	Terrestrial fauna (reptiles, amphibians, mammals, and birds)	- Field biotic inventory (4 times/year) - Collect vouchers		I I
		Terrestrial flora (grass, forbs, shrubs, and trees)	- Field biotic inventory (4 times/year) - Collect vouchers - Map vegetation types		I I I
		Aquatic fauna (fish, macrobenthos)	- Field biotic inventory for abundance/diversity (2 times/year) - Collect vouchers		I I
		Aquatic flora (plants)	- Field biotic inventory for abundance/diversity (2 times/year) - Collect vouchers		I I

Table XV.2. (page 10 of 10)

Task	Purpose	Media	Field Parameters	Laboratory Parameters	Analytical Level*
Air Air Quality	To characterize emissions from contaminated sites	Air	Phase I: None Phase II: To be determined		

*As defined in "Data Quality Objectives for Remedial Response Activities," EPA-540/G-87/003, discussed in Section 15.

Notes:

Explosives include the 11 USATHAMA explosives: HMX; RDX; 1,3,5-TNB; 1,3-DNB; NB; Tetryl; 2A,4,6-DNT; 2,4,6-TNT; 2,6-DNT; 2,4-DNT; and PETN.

Onsite screening for plutonium-238 and thorium-232 is performed using a FIDLER detection system calibrated to detect these isotopes.

PCBs - polychlorinated biphenyls

TAL - Target Analyte List, includes dissolved and/or total metals and cyanide

TCL - Target Compound List

VOC - volatile organic compound