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U.S. DOE FMPC OH6 890 008 976 (DEFICIENCIES FOUND DURING THE COMPREHENSIVE GROUNDWATER MONITORING EVALUATION OF 9/14 & 9/15)

12/20/93

USEPA/DOE-FN
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LETTER

H-1491 AR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

-5018

REPLY TO THE ATTENTION OF:

DEC 20 1993

HRE-8J

Mr. J. Phillip Hamric
United States Department of Energy
Feed Materials Production Center
P.O. Box 398705
Cincinnati, Ohio 45239-8705

RE: U.S. DOE FMPC
OH6 890 008 976

Dear Mr. Hamric:

On September 14 and 15, 1993, the United States Environmental Protection Agency (U.S. EPA) conducted a Comprehensive Groundwater Monitoring Evaluation (CME) at the United States Department of Energy Feed Material Production Center (OH6 890 008 976) in Fernald, Ohio. The purpose of the CME was to determine the facility's compliance with State standards for owners and operators of hazardous waste treatment, storage, and disposal facilities, specifically OAC 3645-65-90 through 3745-65-94. The above noted regulations pertain to groundwater monitoring.

U.S. EPA determined that there were no violations pertaining to groundwater monitoring at the time of the inspection. However the following deficiencies were noted.

1) Monitor Well 3106: The concrete pad appeared to be loose and "floating" and must be replaced;

2) Monitor Well 3431: The concrete pad appeared to be loose and "floating" and must be replaced; and

3) Monitor Well 3070: The teflon hose attached to the dedicated pump was crimped and damaged. It must be replaced.

U.S. EPA has the following reommendations.

1) Bumper guards should be installed around all monitor wells involved in the routine RCRA monitoring program. Considering the possibility of a well being damaged by farm or construction equipment the bumper guards appear as an appropriate precaution for longevety of the wells; and

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2) To increase comparability among samples all wells should have dedicated sampling pumps installed. This will provide more representative samples, simplify decontamination procedures, and save sampling time.

If you have any questions concerning the above matter, please contact Mr. James Saric of my staff at (312) 886-0992.

Sincerely yours,

Laura L. Lodison for

Joseph M. Boyle, Chief
RCRA Enforcement Branch

cc: Mike Savage, OEPA

RCRA COMPREHENSIVE GROUNDWATER MONITORING EVALUATION

OF

UNITED STATES DEPARTMENT OF ENERGY
FEED MATERIALS PRODUCTION CENTER

FERNALD, OHIO

U.S. EPA I.D.# OH6 890 008 976

BY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SEPTEMBER 23, 1993

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I. GENERAL INFORMATION

A. Purpose

The purpose of this report is to document the results of a Comprehensive Groundwater Monitoring Evaluation (CME) conducted at the Fernald Feed Materials Production Center (FMPC), Fernald, Ohio. A CME is an in depth evaluation of the groundwater monitoring program employed at a facility that manages hazardous waste in a surface impoundment, landfill or land treatment unit. A CME is designed to evaluate a facility's compliance with state hazardous waste groundwater monitoring regulations contained in Ohio Administrative Code (OAC) Rules 3745-65-90 through 3745-65-94, and 40 CFR Subpart F.

B. Site Inspection

A site inspection of the facility was conducted on September 14 and 15, 1993, by representatives of the United States Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OEPA). James Saric represented U.S. EPA and Mike Proffitt represented OEPA Southwest District Office, Division of Ground Water. The facility was represented by Allen Lydic, Kathy Nickel, Mark Cherry, and Kathy Little of the United States Department of Energy (U.S. DOE).

C. Information Sources

This report is based upon an extensive record review and the inspection of the facility conducted on September 14 and 15, 1993. In addition to correspondence contained in OEPA and U.S. EPA files and information gathered during the inspection, the following documents provided information upon which this report is based:

Spieker, A., 1968. Ground Water Hydrology and Geology of the Lower Great Miami River, Ohio. USGS Professional Paper 605-A.

U.S. DOE, 1987, RCRA Ground Water Monitoring Report, Volume 3- Round 3, Dames and Moore, March 1987

U.S. DOE, 1987, RCRA Ground Water Monitoring Report, Volume 4- Round 4, Dames and Moore, May 1987

U.S. DOE. 1987. Characterization Investigation Study, Roy F Weston, November 1987

U.S. DOE. 1988. RCRA Ground Water Monitoring Report. Volume 5- Round 5, Dames and Moore. November 1987

U.S. DOE, 1988. Remediation Investigation Feasibility Study Work Plan, Advanced Sciences Incorporated. March 1988

U.S. DOE, 1988. RI/FS Quality Assurance Project Plan, Volume V, Advanced Sciences Incorporated, March 1988

U.S. DOE, 1988, RCRA Ground Water Monitoring Report, Volume 6- Round 6, Westinghouse Materials Company of Ohio, March 1988

U.S. DOE, 1989, Ground Water Quality Assessment Program Plan Revision 1, Westinghouse Materials Company of Ohio, March 1989

U.S. DOE, 1989, RCRA Part B Permit Application, September 1989

U.S. DOE, 1990, Feed Materials Production Center RCRA Annual Report (partial submittal), March 1990

Planing Research Corporation Environmental Management, Inc., June 26, 1989, CME for U.S. DOE FMPC, Fernald, Ohio

U.S. EPA, 1989, Notice of Violations for FMPC Fernald, Ohio OH6890008976

OEPA, 1990, CME for U.S. DOE FMPC, Fernald, Ohio

U.S. DOE, December 1991, Groundwater Monitoring Plan

U.S. DOE, July 1993, PSP for the Routine Groundwater Monitoring Program Along the downgradient Boundary of the FEMP

U.S. DOE , August 1993, Operations and maintenance Plan for the FEMP Monitoring Well Network

OEPA, September 10, 1993, Directors Final Findings and Orders

D. Inspection Checklists

Attached to this report are the Resource Conservation and Recovery Act (RCRA) Inspection Checklists: Appendix A; Comprehensive Ground Water Monitoring Evaluation Worksheet, Appendix A-1; Facility Inspection Form for Compliance With Interim Status Standards Covering Ground Water Monitoring, and Appendix A-2; Inspection Compliance Form For A Facility Which Has Determined It May Be Affecting Ground Water Quality, all of which were filled out for The RCRA regulated units at the Facility. The inspection checklists were also used to determine compliance with the Alternate Groundwater Monitoring Program (AMP).

II. SITE HISTORY AND OPERATIONS

FACILITY NAME: U.S.DOE Feed Materials Production Center, Fernald, Ohio

EPA I.D. NUMBER: OH6 890 008 976

A. Facility Location

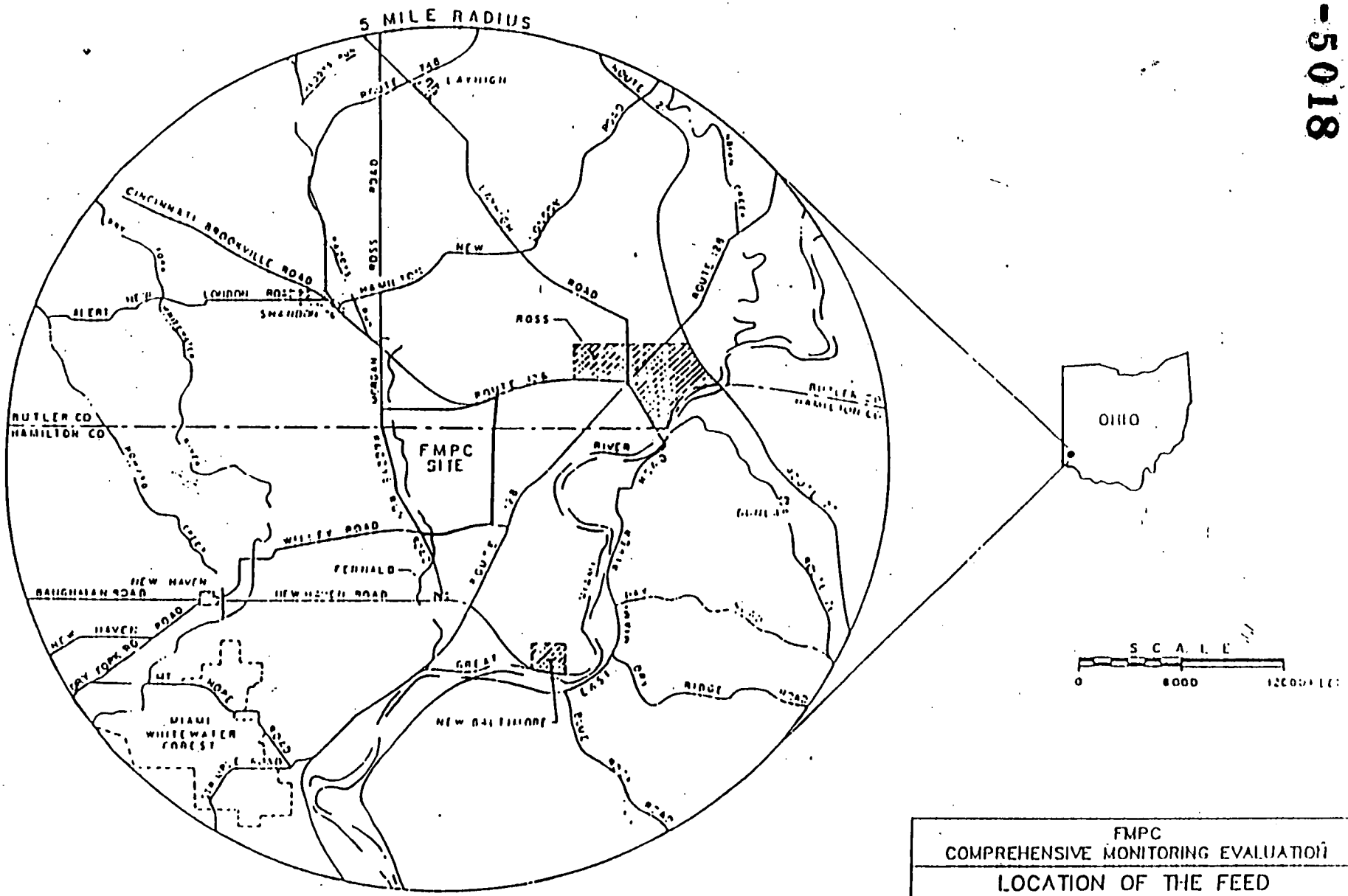
The FMPC facility is located 20 miles northwest of Cincinnati in the town of Fernald, Ohio (Figure 1). The facility occupies approximately 1,050 acres in a rural and agricultural setting. There are two surface water bodies in the FMPC site area: Paddys Run, an intermittent stream which recharges the sand and gravel aquifer, flows near the western boundary of the site; and the Great Miami River is approximately one (1) mile east of the site.

Much of the information presented below was presented in the 1989 CME prepared for the United States Environmental Protection Agency (U.S. EPA) by Planning Research Corporation Environmental Management, Inc. (PRC). According to the CME, PRC obtained this information from the Remediation Investigation/Feasibility Study (RI/FS) work plan (DOE, 1988), RI/FS Quality Assurance Project plan (QAPP)(U.S. DOE), 1988), and the Characterization Investigation Study (CIS) reports (U.S. DOE 1987).

B. Facility Description

The FMPC manufactures metallic uranium fuel elements, target cores, and other uranium products for use in reactors for U.S. DOE. Past activities also included processing small amounts of thorium. In addition, thorium from other facilities is stored at the facility. The RI/FS QAPP gives a detailed discussion of plant operations.

The FMPC site (Figure 2) is divided into three general areas: the Production Area, the Waste Pit/K65 area, and the suspect areas.



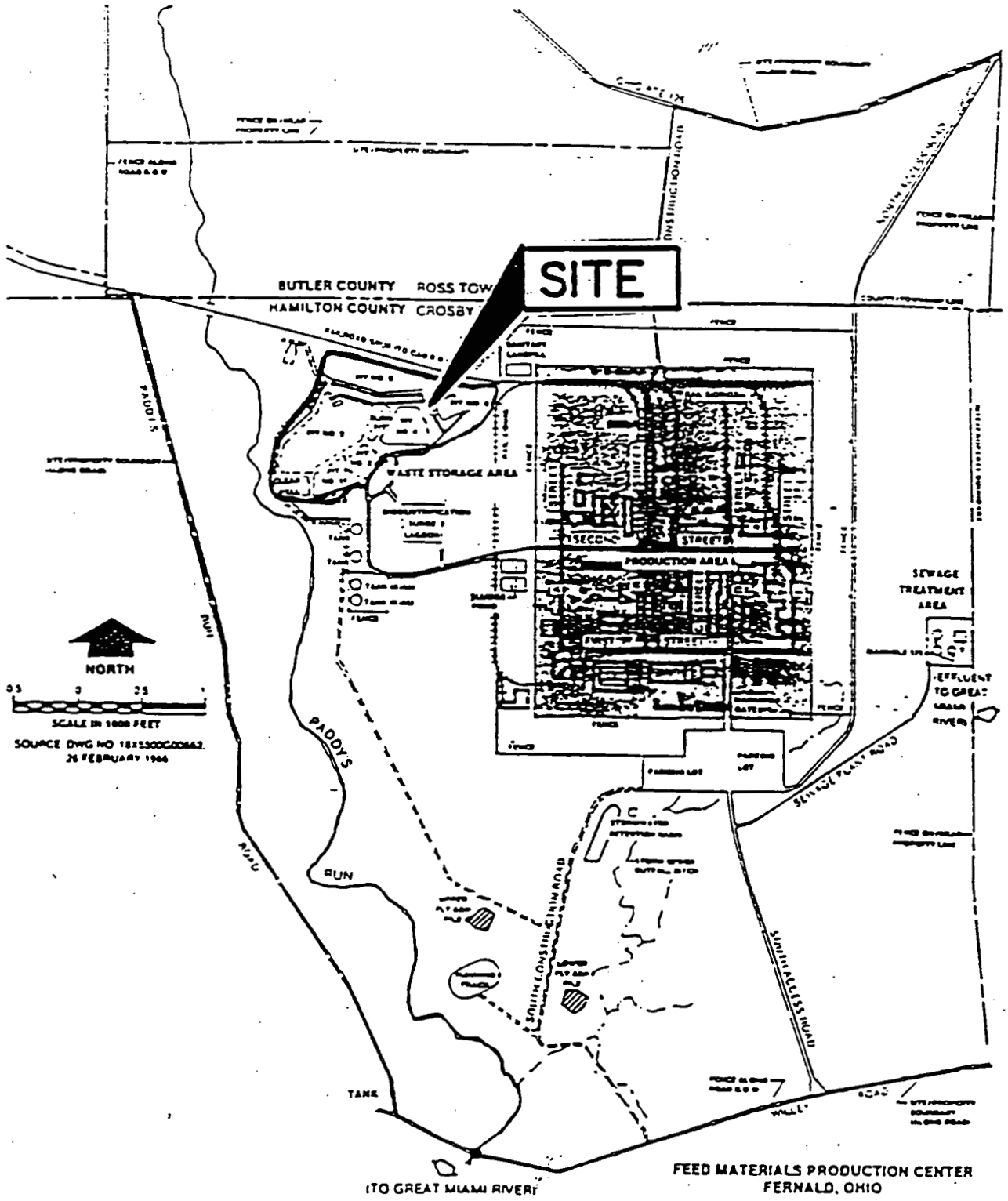
FMPC
COMPREHENSIVE MONITORING EVALUATION

LOCATION OF THE FEED MATERIALS PRODUCTION CENTER

CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F1.DWG

PRC ENVIRONMENTAL MANAGEMENT, INC.

Figure 1 PRC 1989



FMPC COMPREHENSIVE MONITORING EVALUATION		
MAP OF THE FEED MATERIALS PRODUCTION CENTER		
CREATED: 7/26/89	REVISED: 7/26/89	FMPCF2.DWG
PRC ENVIRONMENTAL MANAGEMENT, INC		

Figure 2 PRC 1989

The waste storage area (Waste Pit/K65 Area) was the principal waste storage area at the FMPC facility. This area includes six waste storage pits and is located in the northwest portion of the facility.

There currently exist some 48 RCRA hazardous waste units throughout the waste pit/K-65 area, the production area, and other suspect areas (Table 1). However, U.S. DOE is currently submitting information and negotiating with OEPA to reduce the number of RCRA regulated units at the facility.

C. Regulatory History

U.S. DOE began operations at the FMPC in early 1950 when National Lead of Ohio (NLO) entered into a contract to operate the facility. National Lead of Ohio operated the facility from 1951 to January 1, 1986. At that time, Westinghouse Materials Company of Ohio (WMCO) began managing the facility under contract to U.S. DOE until December 1, 1992. Currently, the facility is being managed under the Fernald Environmental Management and Restoration Contract which is led by Flor-Daniel. All production operations at the FMPC offically ceased in 1991.

The FMPC is subject to RCRA regulations because (1) it stores hazardous waste in numerous tanks and containers and (2) disposed of hazardous waste in land based disposal units after November 1980. However, facility compliance with the RCRA regulations that apply to storage and handling of hazardous substances is outside the scope of U.S. EPA's CME. The CME focused on the OAC 3745-65-90 through OAC 3745-65-94 and 40 CFR Subpart F regulations that apply to the land based disposal units, and compliance with the September 10, 1993, OEPA Directors Final Findings and Orders.

On December 2, 1988, U.S. DOE, the United States Department of Justice, and the Ohio Attorneys General's Office entered a Consent Decree. The groundwater issue discussed in this document concerned U.S. DOE's preparation of an acceptable Ground Water Quality Assessment Program Plan (GWQAPP). The first draft of this document was reviewed by OEPA; and U.S. DOE was given 45 days to incorporate OEPA's comments into the final draft GWQAPP.

The FMPC's groundwater detection monitoring program for Waste Pit No.4 began in August 1985. Initial background concentrations were established based on data from four sampling rounds from August 1985 through November 1986. U.S. DOE confirmed, based on statistical comparisons, that the FMPC facility could be affecting groundwater quality and notified U.S.EPA of such on November 13, 1987. On November 25, 1987, U.S. DOE submitted a groundwater quality assessment program plan (GWQAPP) to U.S.EPA stating that Waste Pit No.4 would be assessed as part of the site's ongoing RI/FS. However, U.S. EPA noted several inadequacies with the plan, and U.S. DOE submitted a revised GWQAPP on March 23, 1989.

In June 1989, PRC conducted a Comprehensive Ground Water Monitoring Evaluation of the FMPC program. The span of the CME begins in 1985 with the installation of monitoring wells for Waste Pit No. 4, and ends with the 1988 Round 6 RCRA Ground Water Quality Assessment Program

TABLE 1

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FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Hazardous Waste Management Units (HWMUs)

- HWMU No. 1 — Fire Training Facility
- ~~HWMU No. 2 — Parts Cleaner in Welding Shop (Maintenance Bldg 12)~~ (Removed)
- HWMU No. 3 — Waste Oil Storage in Garage
- HWMU No. 4 — Drum Storage Area Near Loading Dock (Lab Bldg)
- HWMU No. 5 — Drum Storage Area South of W-26 (Lab Bldg)
- HWMU No. 6 — Drummed HF Residue/Associated Storage Areas Inside Plant 4
- HWMU No. 7 — Drummed HF Residue/Associated Storage Areas Northwest of Plant 4
- HWMU No. 8 — Drummed HF Residue/Associated Storage Areas South of Cooling Towers
- HWMU No. 9 — Nitric Acid Rail Car and Area
- HWMU No. 10 — NAR System Components
- HWMU No. 11 — Tank Farm Sump
- HWMU No. 12 — Wheelabrator (Bldg 66)
- HWMU No. 13 — Wheelabrator Dust Collector (Bldg 66)
- HWMU No. 14 — Box Furnace
- HWMU No. 15 — Oxidation Furnace #1
- HWMU No. 16 — Primary Calciner
- HWMU No. 17 — Plant 8 East Drum Storage Pad
- HWMU No. 18 — Plant 8 West Drum Storage Pad
- HWMU No. 21 — Hilco Oil Recovery
- HWMU No. 22 — Abandoned Sump West of Pilot Plant
- HWMU No. 23 — Well Drilling Storage Area
- ~~HWMU No. 24 — Equipment Storage Area~~ (Removed)

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
Hazardous Waste Management Units (HWMUs)
(continued)

- HWMU No. 25 — Plant 1 Storage Building (Bldg 67)
- HWMU No. 26 — Detrex Still
- HWMU No. 27 — Waste Pit No. 4
- HWMU No. 28 — Trane Thermal Liquid Incinerator
- HWMU No. 30 — Barium Chloride Salt Treatment Facility
- HWMU No. 31 — Tank for Bulk Storage Solvents, T-5
- HWMU No. 32 — Tank for Bulk Storage Solvents, T-6
- HWMU No. 36 — Storage Pad North of Plant 6
- HWMU No. 38 — HF Tank Car

C:\WP51\DOCS\HWMULIST CLM
September 15, 1993

13

TABLE 1

• ~~HWMU No. 39~~	~~Clearwell~~ (Removed)
• HWMU No. 40	Bio-Surge Lagoon
• HWMU No. 41	Sludge Drying Beds
• HWMU No. 42	Waste Pit No. 5
• ~~HWMU No. 43~~	~~Lime Sludge Ponds~~ (Removed)
• ~~HWMU No. 44~~	~~Coal Pile Runoff Basin~~ (Removed)
• HWMU No. 45	UST No. 5
• HWMU No. 46	Uranyl Nitrate Tanks (NFS Storage Area)
• HWMU No. 47	Uranyl Nitrate Tanks (North of Plant 2)
• HWMU No. 48	Uranyl Nitrate Tanks (Southeast of Plant 2)
• HWMU No. 49	Uranyl Nitrate Tanks (Digestion Area)
• HWMU No. 50	Uranyl Nitrate Tanks (Raffinate Bldg)
• HWMU No. 51	Experimental Treatment Facility (ETF)
• HWMU No. 52	North and South Solvent Tanks (Pilot Plant)
• HWMU No. 53	Safe Geometry Digestion Sump (Plant 1)

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September 15, 1993

Annual Report for FY-1988 for FMPC Waste Pit 4. The CME concluded with the following violations:

1) The initial background period continued over 16 months, not the 12 months specified (OAC 37-65-92(D)(1));

2) The original detection monitoring wells completed in the till (TP- designated wells) were constructed in test pits but not cased in a manner that would maintain the integrity of the monitoring well (OAC 3745-65-91(C));

3) During detection monitoring, water level measurements were not taken at each well for each sampling period (OAC 3745-65-92(E));

4) U.S. DOE did not immediately resample the ground water after the first semiannual detection monitoring period (round 5), when statistically significant changes were detected in the water quality. The wells were resampled in round 6, but there is no indication that samples were split or that statistical determinations were made (OAC 3745-65-93(C)(2));

5) The assessment monitoring wells selected to monitor the till aquifer are located at the perimeter of the waste pit area, but not adjacent to Waste Pit No. 4. These perimeter wells are not sufficient to determine the concentrations of hazardous constituents (including RCRA hazardous constituents or other hazardous constituents of concern)i.e., uranium) in the ground water (OAC 3745-65-93 (D)(4)(b)) or characterize the contaminant plume (OAC 3745-70-14(C)(4));

6) The locations of the assessment monitoring wells completed in the till aquifer do not define the extent of the contaminant plume; no additional plans are presented in the GWQAPP or annual report for investigating the outer boundary of the plume past the perimeter wells (OAC 3745-65-93(D)(4)(a));

7) The GWQAPP does not specify sampling or analytical procedures for all constituents, specifically TOX and TOC (OAC 374565-93(D)(3)(b);

8) DOE failed to adequately implement portions of the assessment program by not conducting the required analyses in sampling rounds 1 and 2 as specified in the GWQAPP (OAC 3745-65-93(D)(4)); and

9) The annual report for the assessment program did not include the analytical results for several wells listed in the GWQAPP (OAC 3745-65-94(B)(2)).

On April 9. 1990. OEPA conducted a CME with the following violations:

1) The FMPC has not defined the extent of the contaminant plume. Perimeter wells used in the detection monitoring program have shown contamination. however, FMPC has not submitted any data to show that the Groundwater Assessment Program has been able to define the extent of the contaminant plume (OAC 3745-65-93 (D)(4)(a));

2) The FMPC has not determined the concentarations of teh hazardous waste constituents in the groundwater. The FMPC has not submitted any data concering the concentrations of these constituents to OEPA (OAC 3745-65-93(D)(4)(b));

3) Annual groundwater Monitoring reports should be submitted to OEPA by March first of each year. FMPC has not submitted any annual groundwater monitoring reports to OEPA (OAC 3745-65-75(F)); and

4) FMPC has failed to submit the RCRA Groundwater Assessment Program annual report on March 1, 1990. FMPC has not calculated the rate of migration of hazardous waste or hazardous waste constituents in the groudwater during the reporting period. FMPC was to include this informatio in the 1989 Annual Groudwater Assessment Monitoring Proigram Report, which was to be submitted to OEPA by March 1, 1990 (OAC 3745-65-94(B)(2)).

In December 1991, U.S. DOE submitted a Groundwater Monitoring Plan (GMP) to OEPA for approval. This plan outlined U.S. DOE's approach for RCRA groundwater monitoring at the facility, which included establishing Waste Management Areas and using three lines of monitoring wells to meet the RCRA groundwater monitoring requirements.

Through dialogue with OEPA it became apparent that the GMP could not meet the substantive requirements of 40 CFR Subpart F. However, considering the extensive site-wide groundwater monitoring investigations on-going under CERCLA, which had been in progress since 1988, and the fact that the RCRA and CERCLA programs were duplicating efforts, U.S. DOE proposed that an Alternate approach be established for the RCRA groundwater monitoring program.

On May 12, 1993, U.S. DOE submitted a letter to OEPA requesting an Alternate groundwater Monitoring Program (AMP) be established pursuant to OAC 3745-65-90(D), which included both a routine RCRA monitoring program and information gathered during the CERCLA investigations.

On September 10, 1993, OEPA issued Directors Final Findings and Orders which approved an alternate groundwater monitoring system for RCRA groundwater monitoring at the FEMP (Appendix B). The AMP allows for the quarterly monitoring of 33 wells along the facility boundary and encompasses all data from the CERCLA Remedial Investigation for Operable Unit 5.

III. SITE AND REGIONAL GEOLOGY

The information concerning site and regional geology of the FMPC site has been obtained from the 1989 CME prepared by PRC and the 1990 CME prepared by OEPA. Most of the available geologic information is synthesized in the Hydrogeologic Study of FMPC Discharge to the Great Miami River, U.S. DOE, 1988. In addition, U.S. DOE is in the process of conducting a site-wide RI/FS that includes the advancement of several hundred soil borings, installation of hundreds of monitoring wells, and groundwater modeling. The general regional geologic setting is described by the topography, bedrock geology, and surficial geology. The site-specific geologic setting focuses on the two surficial geologic units: (1) surface till and (2) underlying outwash sand and gravel deposits.

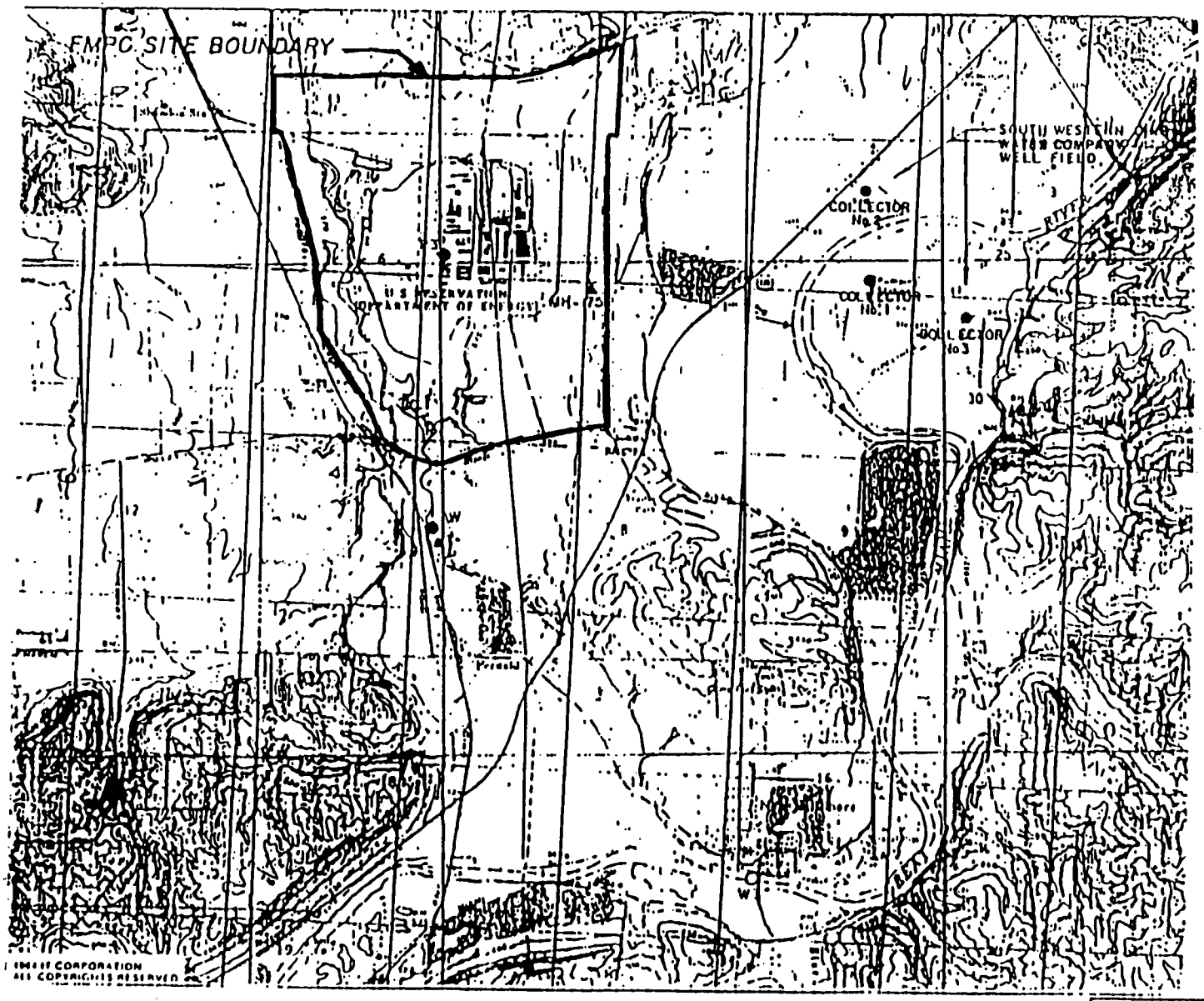
A. Regional Geology

The topography in the FMPC area consists of a relatively flat glacial till plain approximately 580 feet above mean sea level (MSL) between several bedrock outcrops that reach elevations of over 800 feet MSL. The FMPC is located on the glacial till plain. The surface elevation of the glacial deposits ranges from 600 feet west of the FMPC to 540 feet at the Great Miami River east of the site (Figure 3).

The geology of the FMPC area generally consists of 150 to 200 feet of Pleistocene age glacial deposits overlying Ordovician shale bedrock (Figure 4). The bedrock consists of predominantly flat-lying Ordovician shale with thin, interbedded layers of limestone. This shale is part of the Cincinnatian Series and has a total thickness of approximately 800 feet. Prior to the glacial events of the Illinoisan and Wisconsin Periods, the ancestral Great Miami River eroded the bedrock surface and created an entrenched valley approximately 200 feet deep. This bedrock valley is 1/2 to 2 miles wide with a broad flat bottom and steep walls forming a "U" shape. During the subsequent Illinoisan and Wisconsinan (Pleistocene) glacial events, the valley was filled with glaciofluvial sand and gravel deposited by the melt waters of the retreating glaciers. Interbedded in the sand and gravel deposits are glacial till deposits of limited areal extent consisting of poorly sorted pebbles and cobbles in a clay matrix.

B. Site Geology

The geology of the FMPC site consists of a surficial glacial till unit overlying the regional glacial outwash deposit below. The glacial till is approximately 20 to 40 feet thick, with the base of the till generally at 540 feet MSL. The till composition varies both horizontally and vertically. In general, the till consists of low permeability silty clay with some sand and pebbles. Within the till are lenses of highly permeable sand and "flowing sands" (unconsolidated sand which tends to fill the interior of the hollow stem auger during drilling). To the east and south, the till grades into a silty sand deposit described as Pleistocene lake deposit. The till unit is extensive to the north and west to at least the limits of the boring program. However, Paddys Run has eroded the glacial till in the northwest and the glacial lake deposit in the southwest, exposing the underlying sand and gravel outwash deposit.



FMPC
COMPREHENSIVE MONITORING EVALUATION

TOPOGRAPHY
OF FMPC AREA

CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F3.DWG

PRC ENVIRONMENTAL MANAGEMENT, INC.

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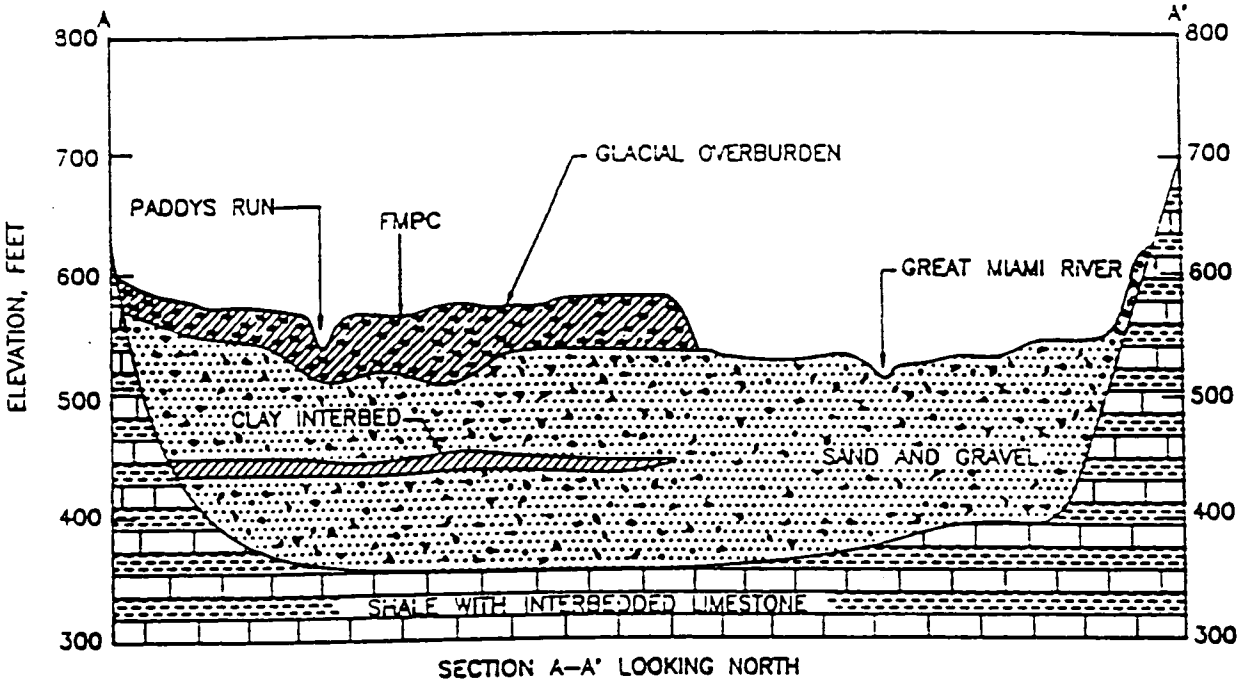
FIGURE 4

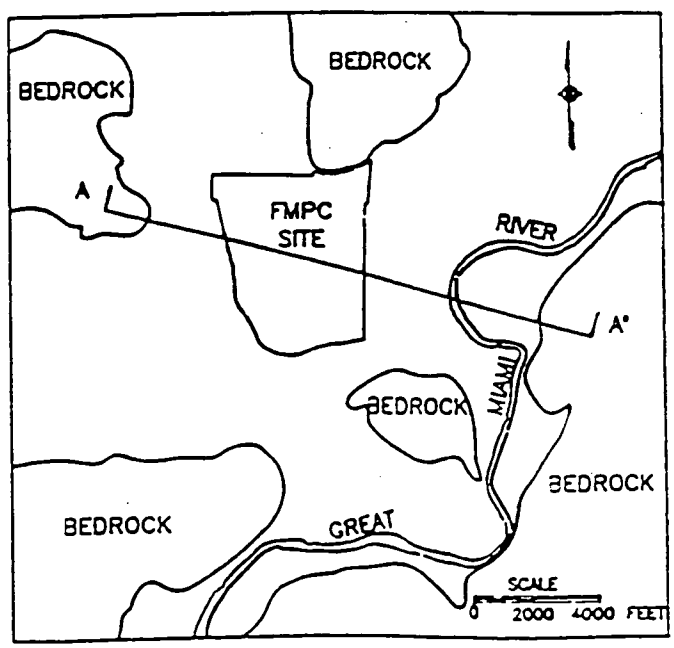
Schematic Cross Section of Buried Channel



SECTION A–A' LOOKING NORTH

NOTE:

INFORMATION CONCERNING THE DEPTH AND ATTITUDE OF THE BEDROCK SHALE WAS OBTAINED FROM IT CORPORATION DRAWING 303317–8208.



LOCATION OF CROSS SECTION

602A_XSECTION_BP_FND

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Underlying the glacial till and lake deposits is a sequence of highly permeable sand and gravel outwash deposits approximately 160 feet thick, with the base at about 380 feet MSL. In the vicinity of the waste pit and western production area, this sand and gravel unit is reported to be divided by a greenish-black silty clay approximately 10 to 20 feet thick and commonly referred to as the "blue clay". However, based on the boring logs generated from the RI/FS, this unit is not contiguous and instead may represent several discontinuous clay units at approximately the same elevation. Thus it would not be considered an aquitard.

C. Regional Hydrogeology

As with the geology described above, most of the available regional hydrogeology information is synthesized in the Hydrogeologic Study of the FMPC Discharge to the Great Miami River Study (U.S. DOE, 1988). The hydrogeology of the sand and gravel unit has been reasonably well defined, however, the hydrogeology of the glacial till unit is very complex and has not been completely characterized. In addition, surface water bodies play a large role in the regional and site hydrogeology.

The regional hydrogeology consists of a highly permeable glacial outwash sand and gravel aquifer within a bedrock valley. Portions of the sand and gravel aquifer are overlain by low permeability glacial till and lake plain aquifer. Since the glacial till aquifer is not regionally extensive, it is not discussed in this section.

Groundwater in the sand and gravel buried valley aquifer (Great Miami Aquifer) flows from the west, north, and east toward the intersection of several buried bedrock valleys (Figure 5). Groundwater exits in this area by flowing southwest through a branch of the buried valley aquifer near New Baltimore, Ohio. The Southern Ohio Water Company (SOWC) pumping wells produce a pronounced and persistent cone of depression and alters the natural ground water flow significantly.

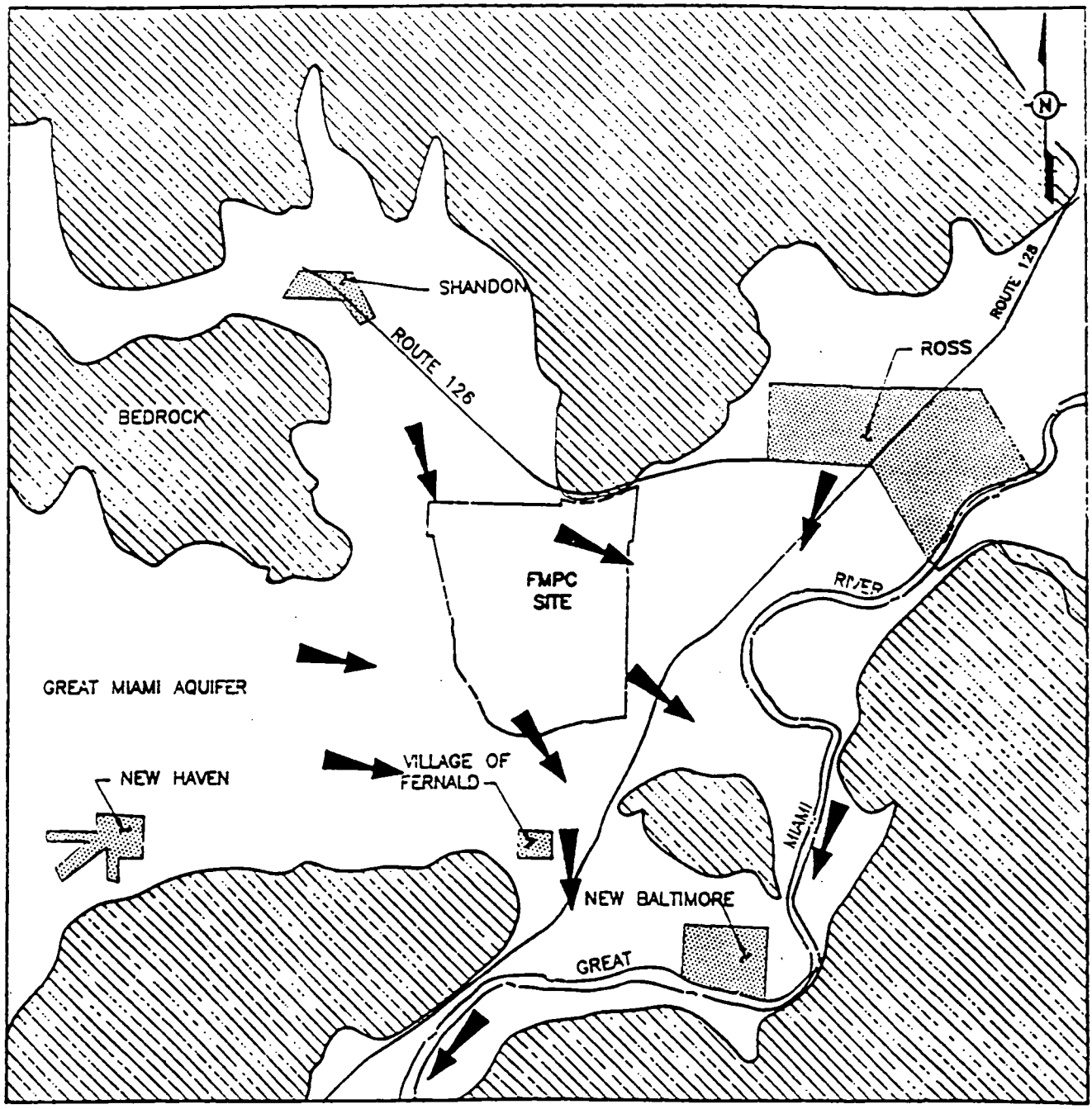
The hydrogeologic characteristics of the sand and gravel buried valley aquifer have been reported by Spieker (1968). Transmissivity values range from 4,700 to 67,000 square feet per day (ft^2/day). Spieker estimated the storage coefficient to be about 0.2. Individual wells in the area are capable of pumping up to 3,000 gallons per minute (gpm). U.S. DOE has recently completed a pump test in the sand and gravel aquifer which may more accurately estimate transmissivity.

Two surface water bodies are of concern in the FMPC site vicinity: Paddys Run and the Great Miami River. Paddys Run, an intermittent stream that extends along the entire western edge of the FMPC, receives surface water runoff and seep water from the waste pit area. When Paddys Run is filled with surface water, it flows south and eventually discharges to the Great Miami River. The northern stretch of Paddys Run is underlain by the glacial till deposit, which impedes (to some extent) surface water recharge to the underlying sand and gravel aquifer. The southern reach of Paddys Run has eroded through the glacial till, and surface water freely recharges the sand and gravel aquifer. The Great Miami River is a major surface water body approximately 4000 feet east of the FMPC. This river flows southwest and exhibits meandering patterns with sharp directional changes over short

FIGURE 5

-5018

Generalized Groundwater Flow in Buried Channel Aquifer



0021

distances.

D. Site Hydrogeology

The site hydrogeology consists of 2 aquifers: a perched aquifer in the surficial glacial till unit, underlain by a highly permeable regional sand and gravel buried valley aquifer. Under an RI/FS study, the facility has completed several wells in each aquifer; "1000" series wells are completed in the glacial till aquifer, whereas "2000", "3000", and "4000" series wells are completed in the regional sand and gravel aquifer.

The hydrogeology of the surficial glacial till aquifer is very complex in regard to both the composition of the hydrogeologic unit (and sub-units within the till) and the ground water flow pattern. The till is a very complex glacial unit with numerous lenses of sand and gravel. Some of the sand lenses are very loose and under pressure; these areas are termed "flowing sands." Insufficient information is available to determine the lateral extent and interconnection between the sand lenses. In any event, these lenses can act as significant pathways of ground water (and contaminant) migration. During the RI/FS field activities, slug tests were performed of the till wells to define horizontal hydraulic conductivity. The hydraulic conductivities range from a relatively high value (1.6×10^{-3} cm/sec) to a relatively low value (2.5×10^{-6} cm/sec). Additional slug tests were conducted in till monitoring wells during the summer of 1993, but the results are not yet available.

The entire till aquifer is a perched aquifer because unsaturated sand and gravel occurs between the till and the underlying saturated buried valley sand and gravel aquifer. No information is available regarding the amount of recharge the till aquifer contributes to the underlying sand and gravel aquifer

The occurence of groundwater in the till is also very complex. Some wells are dry whereas other wells in the same area and of equal depth contain water. In addition, the water table elevations in some wells located in the waste pit area fluctuate greatly over time, while other wells in the same general area have relatively constant water table elevations.

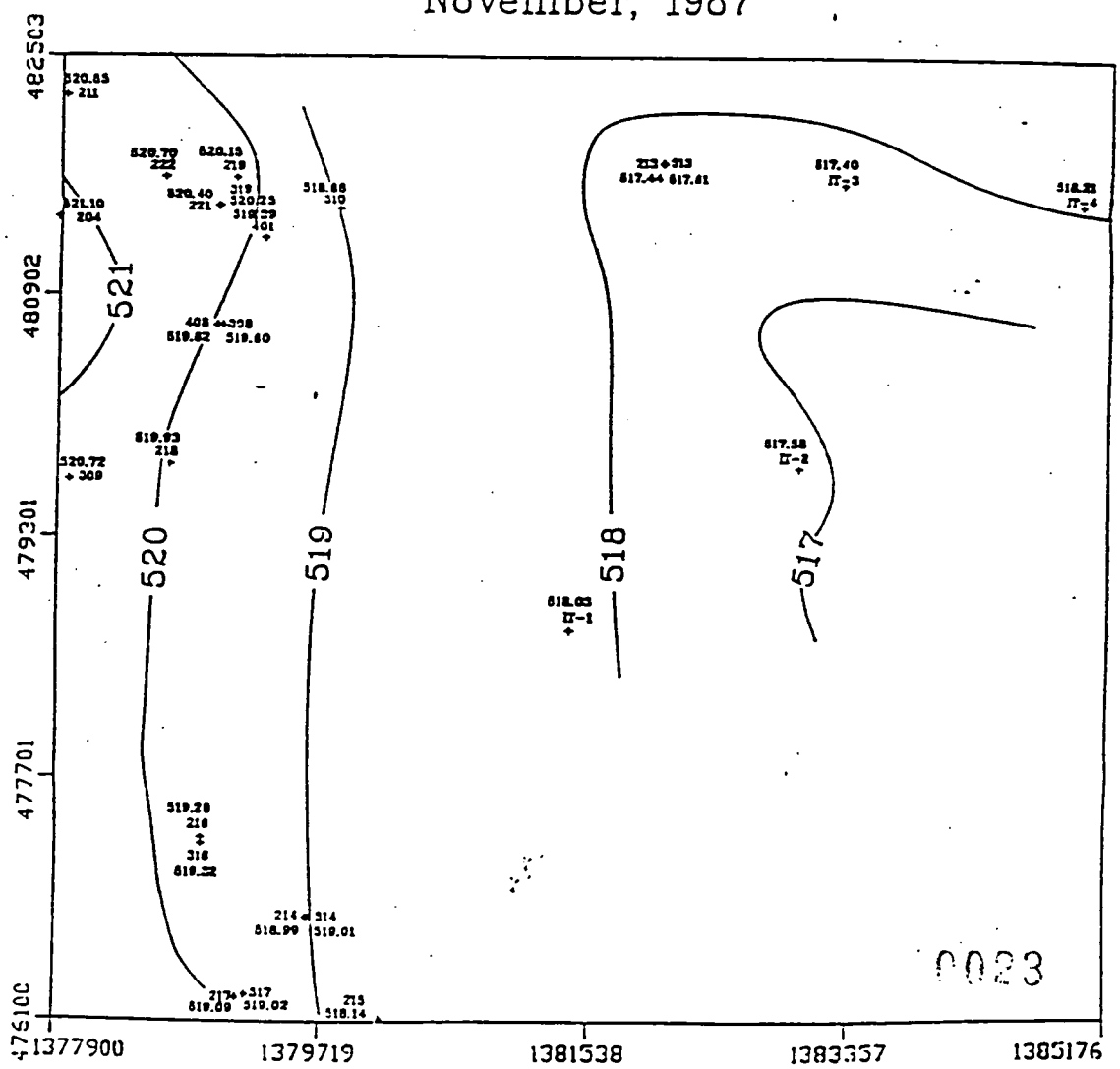
PRC constructed a contour map of the water table elevations in the till wells for May 1988 (water table elevations were obtained from the RI/FS database). The contour shows a pronounce ground water mound centered around Waste Pit No.4. The water table map prepared by PRC is in general agreement with the water table map presented in the Ground Water Quality Assessment Program Annual Report for Round 6, 1988 (Figures 6a and 6b). PRC also used information from the database (DOE, 1989f) to contour water levels of subsequent months. These maps showed that the ground water mound dissipates in the fall and winter, but that a ground water high still remaining in the area of Waste Pit No.4.

The groundwater in the sand and gravel aquifer basically is unconfined (the lower portion of this aquifer may be semiconfined depending on the characteristics and extent of the blue clay). Ground water flow in the sand and gravel aquifer is generally to the east (Figure 7) at an estimated rate of 70 feet/year.

FIGURE 6a

Department of Energy
FMPC
Pieziometric Surface Contour Map

RCRA Ground Water Monitoring Report
Round 6
November, 1987



Water Table Elevation — Upper Sand and Gravel

Contour interval = 1 foot

Figure 6a DOE 1989

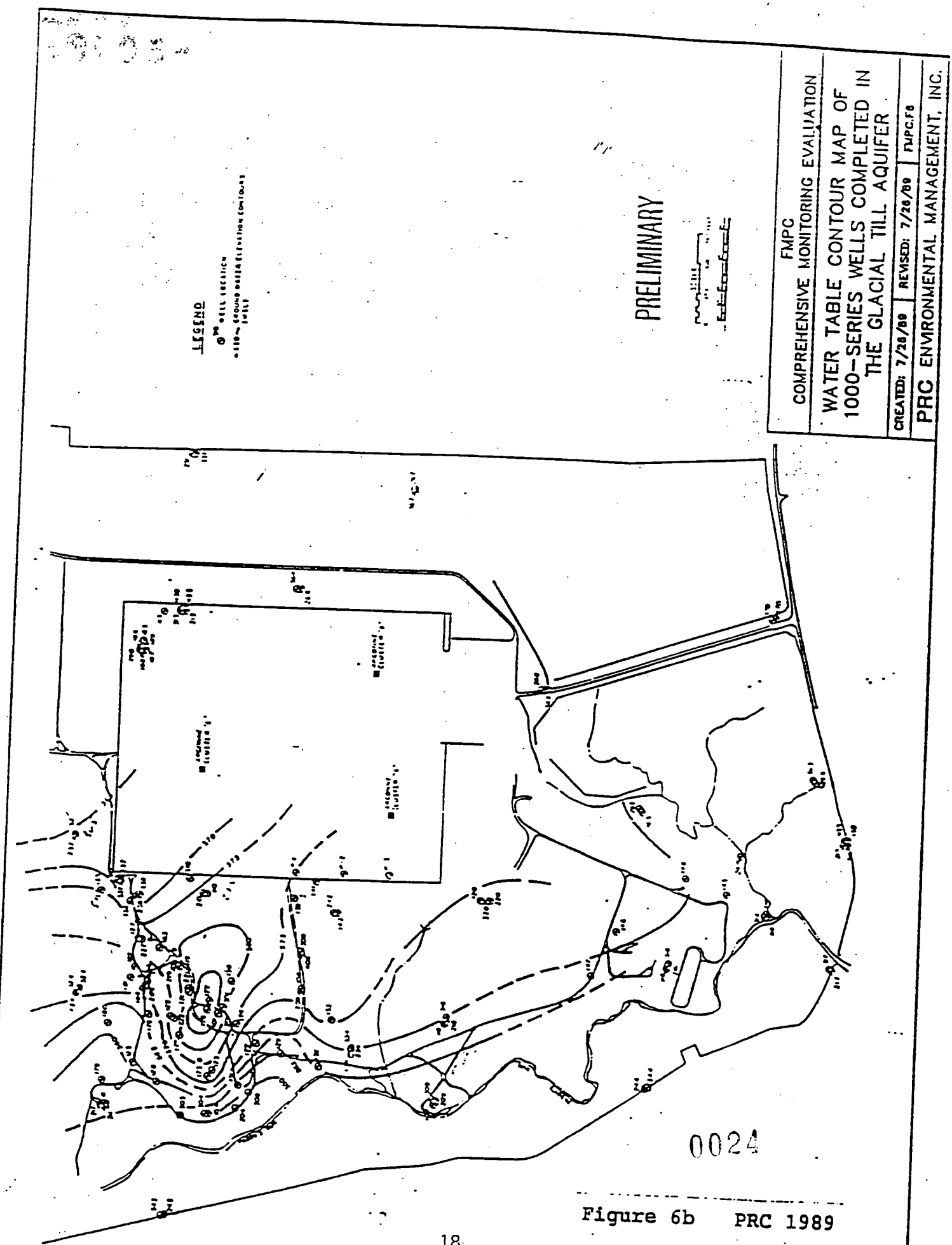


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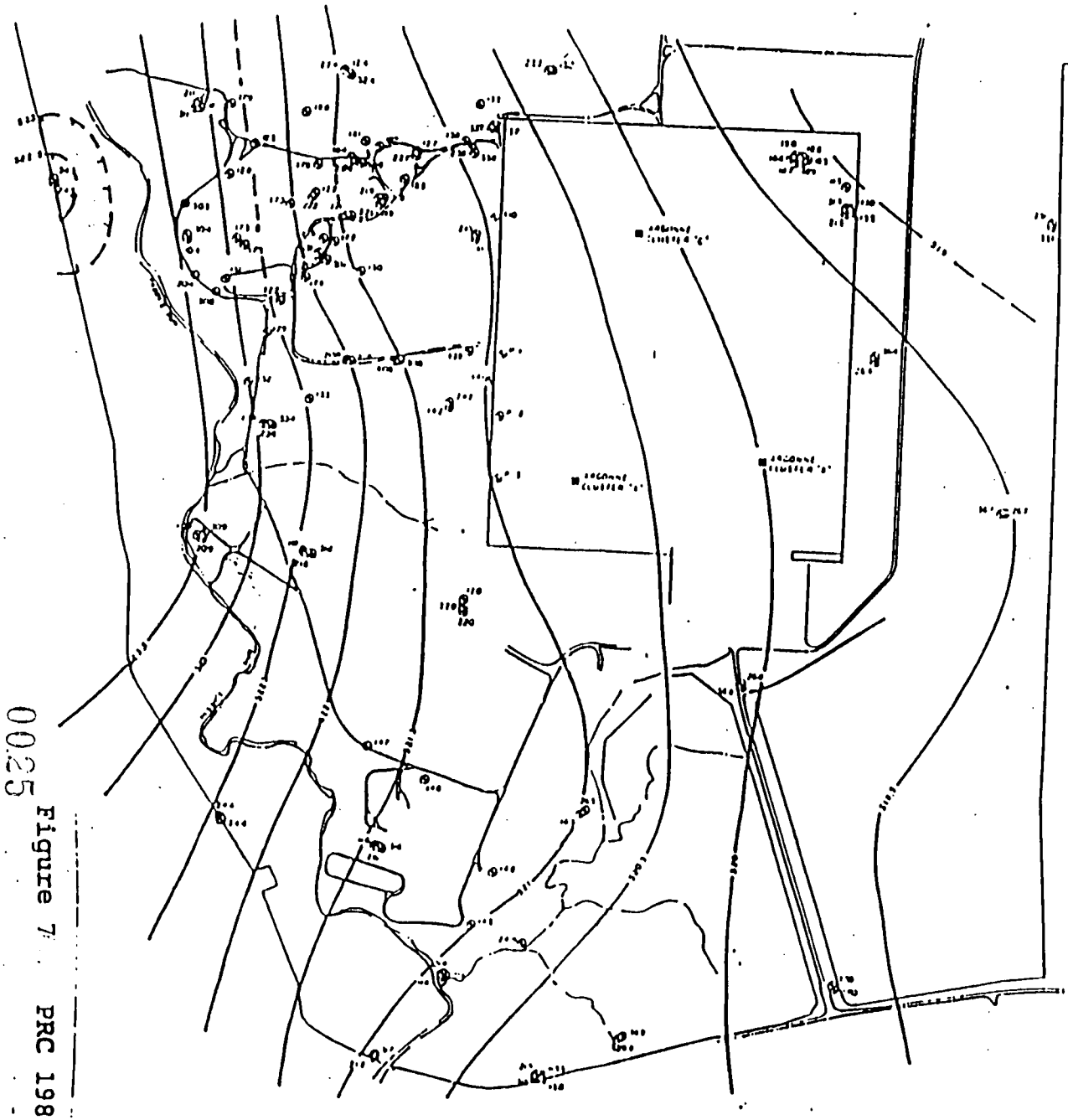
Figure 6b PRC 1989



LEGEND:

PRELIMINARY

FMPC
COMPREHENSIVE MONITORING EVALUATION

WATER TABLE CONTOUR MAP OF THE 200-SERIES WELLS COMPLETED IN THE SAND AND GRAVEL AQUIFER

CREATED: 7/26/89	REVISED: 7/26/89	FMPC.F7

PRC ENVIRONMENTAL MANAGEMENT, INC.

Figure 7 PRC 1989

IV. RCRA GROUND WATER MONITORING PROGRAM

Information concerning the RCRA Hazardous Waste Ground Water Monitoring program is based upon all ground water data submitted to OEPA through the Round 6 1988 sampling; the Ground Water Quality Assessment Program Plan (U.S. DOE, 1989) submitted to Ohio EPA; the Groundwater Monitoring Plan (U.S. DOE, 1990); the Project Specific plan for the Routine Groundwater Monitoring Program Along the Downgradient Boundary of the FEMP (U.S. DOE, 1993), and the September 10, 1993, OEPA Directors Final Findings and Orders.

A. GroundWater Monitoring History

The Fernald FMPC began its RCRA ground water monitoring program in August 1985. Round one sampling, which included sampling 43 monitoring wells, began in August 1985 and was completed in January 1986.

The second round of sampling was completed in May 1986. This phase, as well as all following phases to date, occurred over a shorter period of time than that of round 1. This round included sampling 42 monitoring wells. Round 3 was completed in August 1986 and included sampling 42 monitoring wells. Round 4 was completed in November 1986. This round included sampling 40 monitoring wells on and off site. Round 5 was completed in May 1987 and included 41 monitoring wells. Round 6 was completed in December 1987 and included sampling 40 monitoring wells. Monitoring wells used for the individual sampling rounds are listed in Table 2.

During the first year, DOE was to sample the RCRA monitoring wells quarterly in order to establish background concentrations as described in 40 CFR 265.92 b 3 c1 (OAC 37-65-92 (D)(1)). The first sampling round was extended over a 5 month period, and the next three sampling rounds occurred at 3 month intervals. The total period of time used to establish background concentrations was 16 months.

A statistical analysis was completed following Round 5 on the groundwater indicator parameters comparing upgradient and downgradient monitoring wells at Waste Pit No. 4. These analyses were done in accordance with procedures defined within Appendix IV of 40 CFR 264, the Technical Enforcement Guidance Document, and as required by 40 CFR 265.93 and OAC 3745-65-93. Consistent with these requirements, the Cochran's Approximation to the Behrens-Fisher Student's T-Test was employed to compare background and downgradient monitoring data for select Detection Program wells. Statistical analysis was completed comparing background till well 1012 to downgradient wells 1019, 1021, and 1022. Similarly, statistical analysis was completed comparing background well SW-2 to downgradient wells 2019, 3019, 2021, and 2022. These downgradient wells were selected for comparison because of their close proximity to Waste Pit No. 4 (U.S. DOE, 1989)

The results of the statistical analysis completed on the first four rounds of RCRA Detection Monitoring appear in Appendix E-II of the RCRA Part B Permit Application, 1989.

Table 2

RCRA Monitoring Wells Sampled for RCRA Program

-5018

Monitoring Wells	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
MW-10d		X	X	X		
MW-10	X	X	X	X	X	X
MW-11	X	X	X	X	X	X
MW-12	X	X	X	X	X	X
MW-13d	X	X	X	X	X	X
MW-13s	X	X	X	X	X	X
MW-14d	X	X	X	X	X	X
MW-14s	X	X	X	X	X	
MW-15d	X	X			X	X
MW-15s	X	X	X	X	X	X
MW-16d	X	X	X	X	X	X
MW-16s	X	X	X	X	X	X
MW-17d	X	X	X	X	X	X
MW-17s	X	X	X	X	X	X
MW-18d	X	X	X	X	X	X
MW-18s	X	X	X	X	X	X
MW-19d	X	X	X	X	X	X
MW-19s	X	X	X	X	X	X
MW-1d	X	X	X	X	X	X
MW-1s	X	X	X	X	X	X
MW-20d	X	X	X	X	X	X
MW-20s			X	X	X	X
MW-21s	X	X	X	X	X	X
MW-22s	X	X	X	X	X	X
MW-3	X	X	X	X	X	X
MW-4	X	X	X	X	X	X
MW-5	X	X	X	X	X	X
MW-8d	X	X	X	X	X	X
MW-8s	X	X	X	X	X	X
MW-9	X	X	X	X	X	X
OS-1	X	X	X	X	X	X
OS-1a	X	X	X	X	X	X
OS-2	X	X	X	X	X	X
OS-3	X	X	X	X	X	X
P1	X	X	X	X	X	X
P2	X	X	X	X	X	X
P3	X	X			X	X
SW-1	X					
SW-2	X	X	X	X	X	X
TP-19	X	X	X	X	X	X
TP-20	X	X	X	X	X	X
TP-21	X	X	X	X	X	X
TP-22	X	X	X	X	X	X

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Table 2

RCRA Monitoring Wells Sampled for RCRA Program

Monitoring Wells	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6
MW-15d		X	X	X		
MW-10	X	X	X	X	X	X
MW-11	X	X	X	X	X	X
MW-12	X	X	X	X	X	X
MW-13d	X	X	X	X	X	X
MW-13s	X	X	X	X	X	X
MW-14d	X	X	X	X	X	X
MW-14s	X	X	X	X	X	
MW-15d	X	X			X	X
MW-15s	X	X	X	X	X	X
MW-16d	X	X	X	X	X	X
MW-16s	X	X	X	X	X	X
MW-17d	X	X	X	X	X	X
MW-17s	X	X	X	X	X	X
MW-18d	X	X	X	X	X	X
MW-18s	X	X	X	X	X	X
MW-19d	X	X	X	X	X	X
MW-19s	X	X	X	X	X	X
MW-1d	X	X	X	X	X	X
MW-1s	X	X	X	X	X	X
MW-20d	X	X	X	X	X	X
MW-20s			X	X	X	X
MW-21s	X	X	X	X	X	X
MW-22s	X	X	X	X	X	X
MW-3	X	X	X	X	X	X
MW-4	X	X	X	X	X	X
MW-5	X	X	X	X	X	X
MW-8d	X	X	X	X	X	X
MW-8s	X	X	X	X	X	X
MW-9	X	X	X	X	X	X
OS-1	X	X	X	X	X	X
OS-1a	X	X	X	X	X	X
OS-2	X	X	X	X	X	X
OS-3	X	X	X	X	X	X
P1	X	X	X	X	X	X
P2	X	X	X	X	X	X
P3	X	X			X	X
SW-1	X					
SW-2	X	X	X	X	X	X
TP-19	X	X	X	X	X	X
TP-20	X	X	X	X	X	X
TP-21	X	X	X	X	X	X
TP-22	X	X	X	X	X	X

In general, the statistical evaluation indicated the following for the glacial till unit:

Total Organic Carbon (TOC) concentrations significantly increased in all downgradient wells.

In all downgradient wells pH significantly decreased in comparison to the upgradient well.

Specific conductance significantly increased in two of the three downgradient wells (Wells 1019 and 1022) as compared to the upgradient well. (U.S. DOE, 1989)

The statistical evaluation of the data collected from the background and downgradient wells in the sand and gravel aquifer indicated to following:

Specific conductance significantly increased in all downgradient wells as compared to the background well.

pH significantly decreased in one downgradient well (Well 3019) as compared to the background well. (DOE, 1989)

Once DOE established that a significant change in ground water quality had occurred, additional ground water samples from those downgradient wells where a significant difference was detected should have been resampled as described in 40 CFR 265.93(c)(2) (OAC 3745-65-93 (c)(2)). DOE did not resample the monitoring wells until round 6.

Currently, U.S. DOE samples 33 monitoring wells, defined under the AMP, quarterly for the Target Analyte List of constituents in Table 3.

B. Monitoring Well Locations

The RCRA detection monitoring system is no longer used because the facility operates under assessment monitoring as specified in the September 10, 1993, OEPA Directors Final Findings and Orders. The RCRA Alternate Monitoring Program (AMP) is an assessment monitoring program which uses all of the data gathered in the CERCLA Remedial Investigation for Operable Unit 5 plus 33 monitoring wells along the east and south property boundaries of the FEMP. The AMP well locations are discussed in the Project Specific Plan for the Routine Groundwater Monitoring Along the Downgradient Boundary of the FEMP (U.S. DOE, July 1993).

The AMP monitoring wells, identified on Figure 8 are as follows:

Thirty-three monitoring wells completed in the sand and gravel aquifer (Great Miami Aquifer) located along the eastern and southern boundaries of the FEMP. (2051, 2070, 2106, 2398, 2417, 2424, 2426, 2429, 2430, 2431, 2432, 2733, 2754, 3067, 3069, 3070, 3106, 3398, 3417, 3424, 3425, 3426, 3429, 3431, 3432, 3733, 4067, 4398, 4424, 4425, 4426, and 4432)

TABLE 3
TARGET ANALYTE LIST

Inorganics:

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

General Chemistry:

Alkalinity	Ammonia	Chloride
Fluoride	Nitrate	pH
Phenols	Phosphorous (total)	Specific conductance
Sulfate	Sulfide	Temperature
Total Organic Carbon (TOC)	Total Organic Halogens (TOX)	Total Organic Nitrogen (TON)

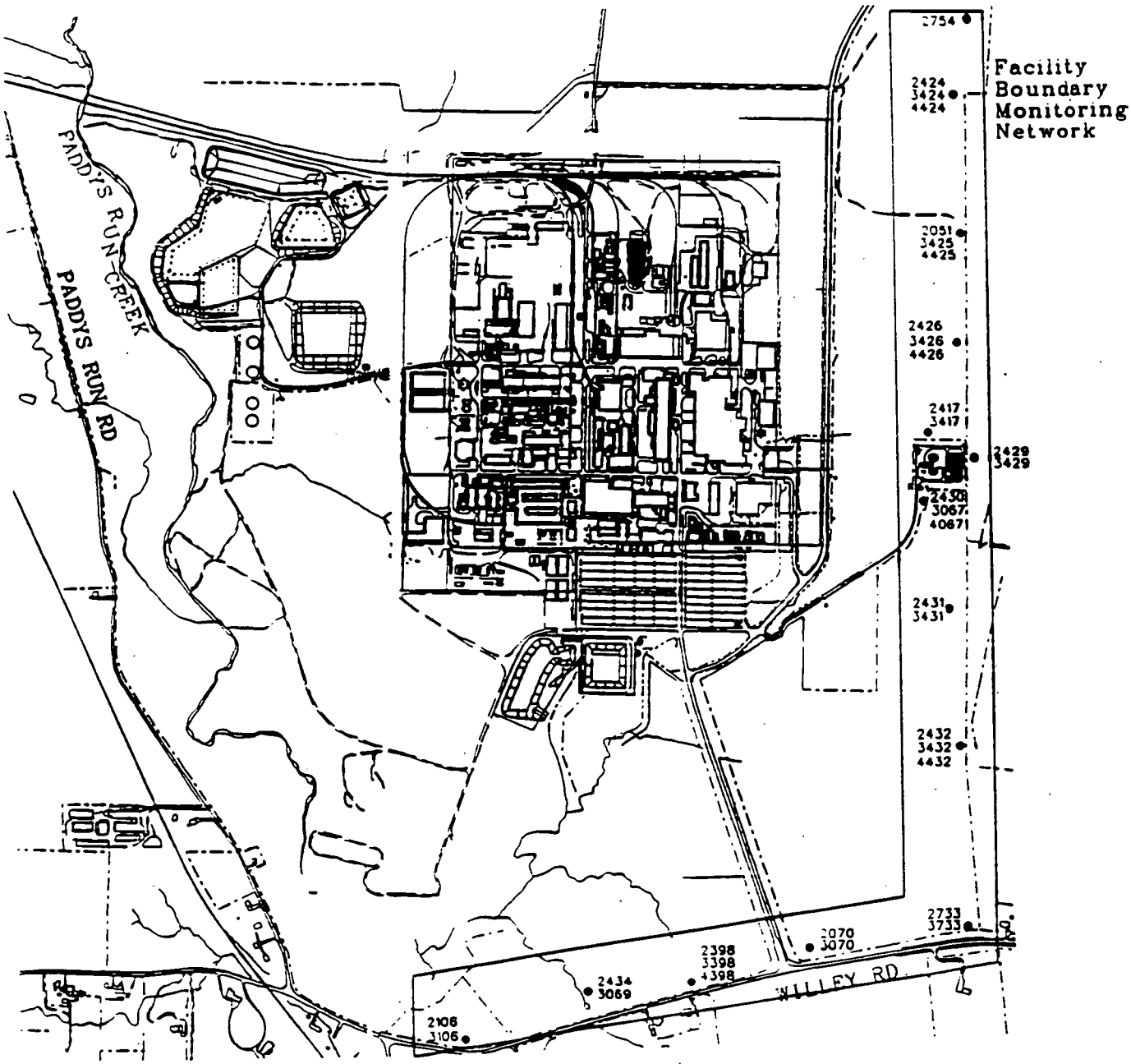
Volatile Organics:

1,1-Dichloroethane	1,1-Dichloroethene
1,1,1-Trichloroethane	1,1,2-Trichloroethane
1,1,2,2-Tetrachloroethane	1,2-Dichloroethane
1,2-Dichloroethylene	1,2-Dichloroethene (total)
1,2-Dichloropropane	2-Butanone
2-Hexanone	4-Methyl-2-Pentanone
Acetone	Benzene
Bromodichloromethane	Bromoform
Bromomethane	Carbon disulfide
Carbon tetrachloride	Chlorobenzene
Chloroethane	Chloroform
Chloromethane	cis-1,3-Dichloropropane
Dibromochloromethane	Ethylbenzene
Methylene chloride	Styrene
Tetrachloroethene	Toluene
Total xylenes	trans-1,3-Dichloropropene
Trichloroethene	Vinyl acetate
Vinyl chloride	

Radiological:

Gross Alpha	Gross Beta	Radium 226
Radium-228	Technetium-99	Thorium-228
Thorium-230	Thorium-232	Total Thorium
Total Uranium	Uranium-234	Uranium-235/236
Uranium-238		

FIGURE 8
ROUTINE GROUNDWATER MONITORING LOCATIONS



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CRUS/ROUTINE/BJS

The 2000, 3000, and 4000 series wells are completed in the Great Miami Aquifer at depths indicated in figure 9.

C. Monitoring Well Installation and Construction

Monitoring wells were installed and constructed consistent with the Site-Wide CERCLA QAPP (SCQ). A diagram illustrating monitor well construction is included in Figure 10.

The well casings are four-inch diameter, 316 stainless steel with flush-thread joints. The well screens are 5-15 feet in length and constructed of stainless steel with a 0.01 inch slot. Screen sand pack material is medium or coarse quartz sand, which was determined by the sieve analysis completed on the lithologic materials. Volclay grout was used to seal the annular space. A five-foot length of 1/4-inch iron pipe was used as a protective casing, which was fitted with a hinged cap, hasp and lock. A mixture of cement, sand, and potable water was placed between the well riser and the outer protective casing to a height just below the drain hole. The top of the inside casing was finished with a stainless steel cap. A three-foot by three-foot four-inch concrete apron was installed around the protective casing.

V. SAMPLING AND ANALYSIS PLAN

A. Review of Plan

All monitor wells were purged and sampled for selected site-specific parameters using sampling procedures specified in SCQ Section 6.2. All analyses were conducted by a contracted laboratory using procedures which meet the standards for the analytical support levels as established in the SCQ.

B. Field Inspection

Groundwater sampling was observed at wells 3067, 4067, 2431 during the site inspection. The sampling team followed appropriate procedures in the SCQ, the Project Specific Plan for the FEMP Boundary wells, and the Operation and Maintence Plan for the FEMP Monitoring Well Network.

C. Groundwater Quality

Round 6 sampling confirmed groundwater was impacted by Pit 4. Elevated levels of sodium, sulfate, total dissolved solids, conductivity, gross alpha, gross beta, radium, uranium, phenolics, chloride, nitrate, potassium, strontium, and 1,1,1 trichloroethane were noted by Ohio EPA when compared to background (Tables 4a, 4b, 4c, 4d). Though not all of these parameters are RCRA hazardous waste constituents, all solid waste originating from a RCRA regulated unit which has RCRA hazardous waste disposed of in it are hazardous wastes subject to assessment monitoring 40 CFR 261.3(c)(2)(i).

FIGURE 9

-5018

Groundwater Monitoring Well Completion Depths

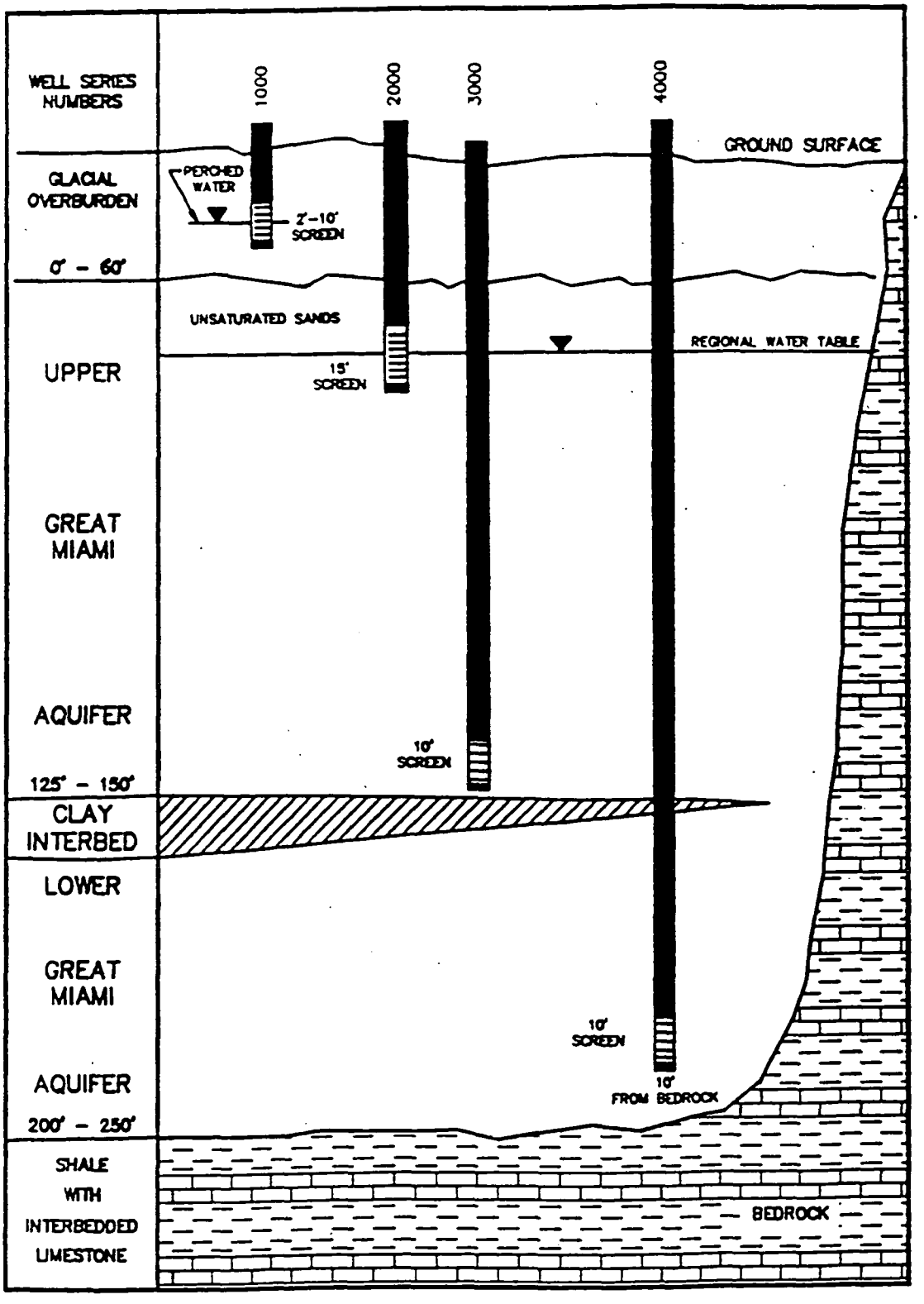

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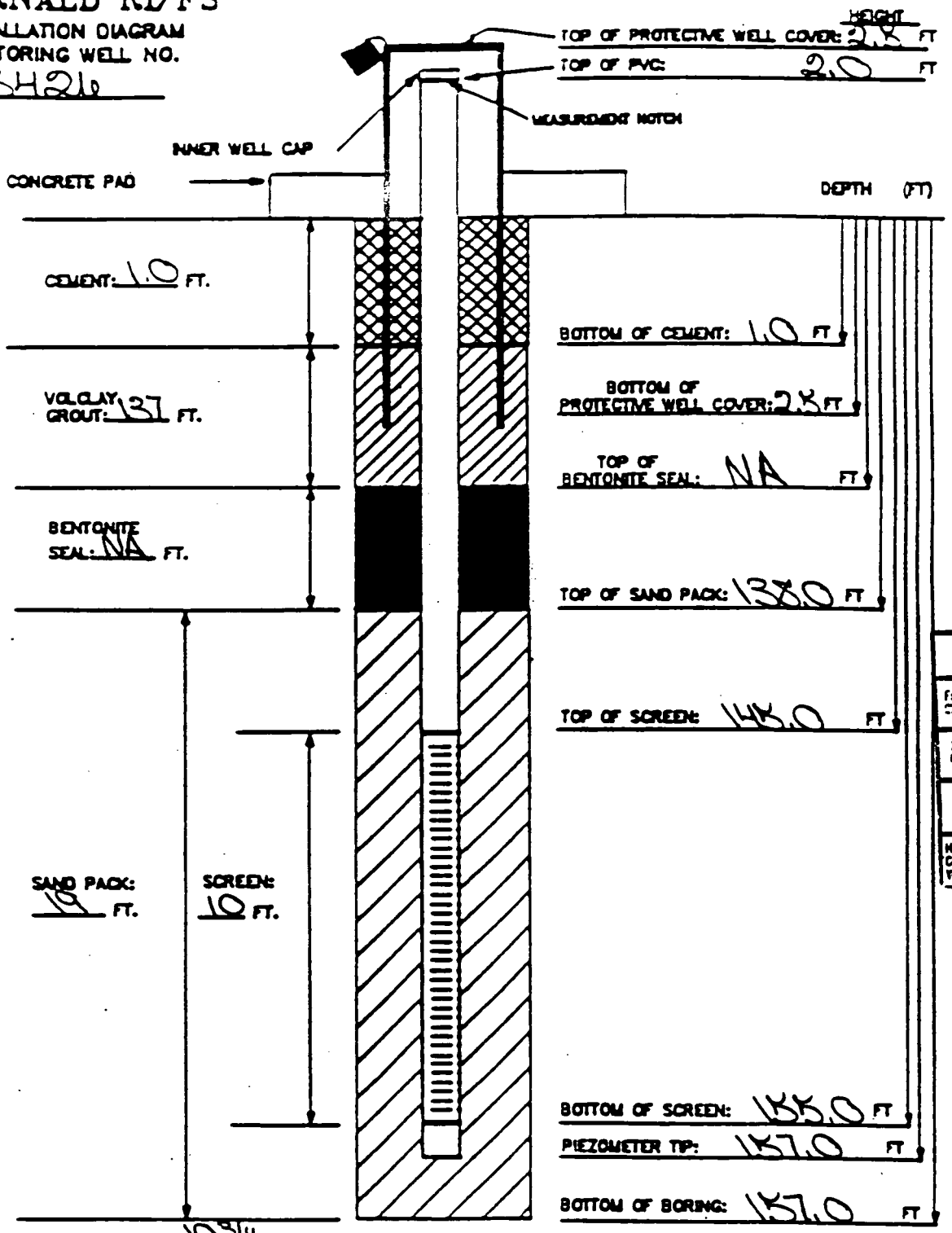
FIGURE 10

INSTALLATION DATE: 11/20/93

FERNALD RI/FS

INSTALLATION DIAGRAM
MONITORING WELL NO. 3426



BOREHOLE DIAMETER: 10 3/4 INCHES

MATERIALS USED:
SAND TYPE AND QUANTITY: 3 bag 4/30, 6 bag 10/20
BENTONITE PELLETS (5-GALLON BUCKETS): NA
BAGS OF VOLCLAY GROUT: 4 bags 50 lb 11/20/93
AMOUNT OF CEMENT: 1 bag
AMOUNT OF WATER USED: 200 gal
OTHER: 27 soil drums
1 water drum

NOTES:
1) RISER PIPE IS 4 in 1.5 lb stainless steel ~~6-INCH SCHEDULE 40 PVC PIPE, FLUSH-THREADED JOINTS~~
2) SCREEN IS 4 inch stainless steel ~~6-INCH SCHEDULE 40 PVC PIPE WITH 0.020-INCH SLOTS~~
3) LOWER END OF SCREEN IS CAPPED WITH AN END CAP OR THREADED SUMP.
4) WATER DEPTH/DATE: 13.34' 11/23/93

TASK: 04.27

GEOLOGIST/ENGINEER: D. O'Brien

0034

2/17/93

Table 4a

All results in parts per million

1-5018

Contaminants	P-1
Chloride	
Sodium	
Sulfate	140
Phenolics	
Nitrate	
Potassium	
TDS	
Conductivity	1020
1,1,2,2-Tetrachloroethene	
Chloroethene	
Bromoform	
cis-1,2-Dichloroethene	
1,1 Dichloroethane	
1,2-Dichlorobenzene	
Gross Alpha	
Gross Beta	6
Radium 226	
Radium 228	
Uranium	
Strontium 90	

0035

Sodium	410		
Sulfate	330	220	410
TDS	2450		1340
Conductivity	5310		2240
1,1,2,2-Tetrachloroethane	1.54		
Chloroethane	0.27		
Bromoform	0.91		
cis-1,2-Dichloroethene	29.5		
1,1 Dichloroethane	15		
1,2-Dichlorobenzene	0.63		
Gross Alpha		964	149
Gross Beta		3310	930
Radium 226		23	4
Uranium		6440	4230

-5018

0036

TABLE 4c

Contaminants	MW-9	MW-14d	MW-15s	MW-20s	OS-1	OS-2	OS-3
Chloride							
Sodium							
Sulfate							
Phenolics	0.006						
Nitrate	1.54	1.46	1.93	2.04	2.04	2.21	
Potassium							
TDS							
Conductivity							
1,1,2,2-Tetrachloroethene							
Chloroethene							
Bromoform							
cis-1,2-Dichloroethane							
1,1,1 Trichloroethane			5.13				
1,1 Dichloroethane							
1,2-Dichlorobenzene							
Gross Alpha			33		59	59	
Gross Beta	19	17	95	21	104	97	23
Radium 226						1	
Radium 228							
Uranium		13	269		376	319	204
Strontium 90							

TABLE 4d

Contaminants	MW-3	MW-4	MW-10	MW-13s	MW-13d	MW-15s	MW-16	MW-21s	MW-22s
Chloride			33		64				
Sodium			132						
Sulfate	92		732	116	382	92	420	83	198
Phenolics		0.006							
Nitrate			71						
Potassium			14.3						
TDS			2000		660		900	930	864
Conductivity							1100	1200	1220
1,1,2,2-Tetrachloroethane									
Cloroethene									
Bromoform									
cis-1,2-Dichloroethane									
1,1 Dichloroethane									
1,2-Dichlorobenzene									
Gross Alpha	2900					9		31	3
Gross Beta	14100		62			1230		2770	1220
Radium 226	16								
Radium 228	294							12	
Uranium	11700					7		9	
Strontium 90								23	

0038

The Target Analyte List of constituents to be sampled as part of the AMP encompass Groundwater Quality Parameters, Groundwater Contamination Parameters, Drinking Water Parameters, and other Site-Specific Parameters.

VI. RCRA Groundwater Assessment Monitoring Program

The Fernald FMPC was placed into assessment phase monitoring on November 13, 1987, when DOE notified U.S. EPA that a release from Waste Pit No. 4 had been confirmed.

DOE designed a Ground Water Assessment Program Plan (GWAPP) to fulfill requirements in 40 CFR 265 Subpart F (OAC 3745-65-90). After several revisions, a GWAPP was agreed upon by Ohio EPA, U.S. EPA, and DOE in March 1989.

VII. RCRA Alternate Groundwater Monitoring Program

Under the September 10, 1993, OEPA Final Directors Findings and Orders, U.S. DOE was required to monitor thirty-three wells along the eastern and southern property boundaries of the FEMP. The AMP also requires incorporation of all groundwater data gathered during the CERCLA Remedial Investigation for Operable Unit 5.

U.S. DOE must submit annual reports to OEPA documenting the rate and extent of contamination. However, the Remedial Investigation Report for Operable Unit 5, which is scheduled to be submitted on June 24, 1994, will be the first determination of the rate and extent of contamination.

VIII. SITE INSPECTION

A site inspection was conducted on September 14 and 15, 1993, by James Saric (U.S. EPA) and Mike Proffitt OEPA-SWDO to determine the structural integrity of the 33 RCRA monitoring wells used in AMP. The monitoring wells which were inspected were 2051, 2070, 2106, 2398, 2417, 2424, 2426, 2429, 2430, 2431, 2432, 2733, 2754, 3067, 3069, 3070, 3106, 3398, 3417, 3424, 3425, 3426, 3429, 3431, 3432, 3733, 4067, 4398, 4424, 4425, 4426, and 4432.

All monitoring wells inspected were in a similar condition. They were protected with a locking metal casing, and set in a concrete pad. All casings were locked and in good condition.

Groundwater sampling was observed at wells 3067, 4067, 2431 during the site inspection. The sampling team did an excellent job sampling the wells, and correctly followed the procedures of the SCQ, the Project Specific Plan for the FEMP Boundary wells, and the Operation and Maintence Plan for the FEMP Monitoring Well Network.

IX. COMPLIANCE STATUS SUMMARY

This section of the Comprehensive Ground Water Monitoring Evaluation evaluates the Fernald FMPC's compliance in conjunction with Ohio hazardous waste regulations and the Code of Federal Regulations.

A. VIOLATIONS

There were no violations noted during the inspection. For additional information, the attached RCRA checklists should be consulted.

B. DEFICIENCIES

The following deficiencies were noted during the inspection.

Monitor Well 3106:	The concrete pad appeared to be loose and "floating" and must be replaced;
Monitor Well 3431:	The concrete pad appeared to be loose and "floating" and must be replaced; and
Monitor Well 3070:	The teflon hose attached to the dedicated pump was crimped and damaged. It must be replaced.

C. RECOMMENDATIONS

Based upon the monitor well inspection U.S. EPA recommends the following;

1) Bumper guards should be installed around all monitor wells involved in the routine RCRA monitoring program. Considering the possibility of a well being damaged by farm or construction equipment the bumper guards appear as an appropriate precaution for longevety of the wells.

2) To increase comparability among samples all wells should have dedicated sampling pumps installed. This will provide more representative samples, simplify decontamination procedures, and save sampling time.

APPENDIX A

COMPREHENSIVE GROUND-WATER MONITORING EVALUATION WORKSHEET

The following worksheets have been designed to assist the enforcement officer/ technical reviewer in evaluating the ground-water monitoring system an owner/operator uses to collect and analyze samples of ground water. The focus of the worksheets is technical adequacy as it relates to obtaining and analyzing representative samples of ground water. The basis of the worksheets is the final RCRA Ground Water Monitoring Technical Enforcement Guidance Document which describes in detail the aspects of ground-water monitoring which EPA deems essential to meet the goals of RCRA. Appendix A is not a regulatory checklist. Specific technical deficiencies in the monitoring system can, however, be related to the regulations as illustrated in Figure 4.3 taken from the RCRA Ground-Water Monitoring Compliance Order Guide (COG) (included at the end of the appendix). The enforcement officer, in developing an enforcement order, should relate the technical assessment from the worksheets to the regulations using Figure 4.3 from the COG as a guide.

Comprehensive Ground-Water Monitoring Evaluation	Y/N
I. Office Evaluation Technical Evaluation of the Design of the Ground-Water Monitoring System	
A. Review of Relevant Documents	
1. What documents were obtained prior to conducting the inspection:	
a. RCRA Part A permit application?	Y
b. RCRA Part B permit application?	Y
c. Correspondence between the owner/operator and appropriate agencies or citizen's groups?	Y
d. Previously conducted facility inspection reports?	Y
e. Facility's contractor reports?	Y
f. Regional hydrogeologic, geologic, or soil reports?	Y
g. The facility's Sampling and Analysis Plan?	Y
h. Ground-water Assessment Program Outline (or Plan, if the facility is in assessment monitoring)?	Y
i. Other (specify) ALTERNATE MONITORING PLAN 0041	

Y = YES
N = NO
N S = NOT SPECIFIED
* = COMMENT NUMBER

	Y/N
B. Evaluation of the Owner/Operator's Hydrogeologic Assessment	
1. Did the owner/operator use the following direct techniques in the hydrogeologic assessment:	
a. Logs of the soil borings/rock corings (documented by a professional geologist, soil scientist, or geotechnical engineer)?	Y
b. Materials tests (e.g., grain-size analyses, standard penetration tests, etc.)?	Y
c. Piezometer installation for water level measurements at different depths?	N
d. Slug tests?	Y
e. Pump tests?	Y
f. Geochemical analyses of soil samples?	Y
g. Other (specify) (e.g., hydrochemical diagrams and wash analysis)	
2. Did the owner/operator use the following indirect techniques to supplement direct technique data:	
a. Geophysical well logs?	N
b. Tracer studies?	N
c. Resistivity and/or electromagnetic conductance?	N
d. Seismic Survey?	N
e. Hydraulic conductivity measurements of cores?	N
f. Aerial photography?	Y
g. Ground penetrating radar?	N
h. Other (specify)	
3. Did the owner/operator document and present the raw data from the site hydrogeologic assessment?	Y
4. Did the owner/operator document methods (criteria) used to correlate and analyze the information?	Y
5. Did the owner/operator prepare the following:	Y
a. Narrative description of geology?	Y
b. Geologic cross sections?	Y
c. Geologic and soil maps?	N
d. Boring/coring logs?	Y
e. Structure contour maps of the differing water bearing zone and confining layers?	Y
f. Narrative description and calculation of ground-water flows?	Y

	Y/N
g. Water table/potentiometric map?	
h. Hydrologic cross sections?	Y
6. Did the owner/operator obtain a regional map of the area and delineate the facility?	Y
If yes, does this map illustrate: a. Surficial geology features?	Y
b. Streams, rivers, lakes, or wetlands near the facility?	Y
c. Discharging or recharging wells near the facility?	Y
7. Did the owner/operator obtain a regional hydrogeologic map?	Y
If yes, does this hydrogeologic map indicate: a. Major areas of recharge/discharge?	Y
b. Regional ground-water flow direction?	Y
c. Potentiometric contours which are consistent with observed water level elevations?	Y
8. Did the owner/operator prepare a facility site map?	Y
If yes, does the site map show: a. Regulated units of the facility (e.g., landfill areas, impoundments)?	Y
b. Any seeps, springs, streams, ponds, or wetlands?	Y
c. Location of monitoring wells, soil borings, or test pits?	Y
d. How many regulated units does the facility have? 48	
If more than one regulated unit then, • Does the waste management area encompass all regulated units?	NA*
• Is a waste management area delineated for each regulated unit?	N
C. Characterization of Subsurface Geology of Site	
1. Soil boring/test pit program:	
a. Were the soil borings/test pits performed under the supervision of a qualified professional?	Y
b. Did the owner/operator provide documentation for selecting the spacing for borings?	Y
c. Were the borings drilled to the depth of the first confining unit below the uppermost zone of saturation or ten feet into bedrock?	Y
d. Indicate the method(s) of drilling: 0043	

-50	Y/N
Auger (hollow or solid stem) X Mud rotary ____ Reverse rotary ____ Cable tool X Jetting ____ Other (specify) ____	
e. Were continuous sample corings taken?	N
f. How were the samples obtained (check method[s]) • Split spoon X • Shelby tube, or similar ____ • Rock coring ____ • Ditch sampling ____ • Other (explain) ____	
g. Were the continuous sample corings logged by a qualified professional in geology?	Y
h. Does the field boring log include the following information: • Hole name/number?	Y
• Date started and finished?	Y
• Driller's name?	Y
• Hole location (i.e., map and elevation)?	Y
• Drill rig type and bit/auger size?	Y
• Gross petrography (e.g., rock type) of each geologic unit?	Y
• Gross mineralogy of each geologic unit?	Y
• Gross structural interpretation of each geologic unit and structural features (e.g., fractures, gouge material, solution channels, buried streams or valleys, identification of depositional material)?	Y
• Development of soil zones and vertical extent and description of soil type?	Y
• Depth of water bearing unit(s) and vertical extent of each?	Y
• Depth and reason for termination of borehole?	Y
• Depth and location of any contaminant encountered in borehole?	Y
• Sample location/number?	Y
• Percent sample recovery?	Y
• Narrative descriptions of: —Geologic observations?	Y
—Drilling observations?	Y
i. Were the following analytical tests performed on the core samples: • Mineralogy (e.g., microscopic tests and x-ray diffraction)?	N
• Petrographic analysis: —degree of crystallinity and cementation of matrix?	N
—degree of sorting, size fraction (i.e., sieving), textural variations?	N
—rock type(s)?	N

	Y/N
—soil type?	Y
—approximate bulk geochemistry?	N
—existence of microstructures that may effect or indicate fluid flow?	N
• Falling head tests?	Y
• Static head tests?	U
• Settling measurements?	N
• Centrifuge tests?	N
• Column drawings?	N
D. Verification of Subsurface Geological Data	
1. Has the owner/operator used indirect geophysical methods to supplement geological conditions between borehole locations?	N
2. Do the number of borings and analytical data indicate that the confining layer displays a low enough permeability to impede the migration of contaminants to any stratigraphically lower water-bearing units?	N
3. Is the confining layer laterally continuous across the entire site?	N
4. Did the owner/operator consider the chemical compatibility of the site-specific waste types and the geologic materials of the confining layer?	Y
5. Did the geologic assessment address or provide means for resolution of any information gaps of geologic data?	Y
6. Do the laboratory data corroborate the field data for petrography?	NA
7. Do the laboratory data corroborate the field data for mineralogy and subsurface geochemistry?	NA
E. Presentation of Geologic Data	
1. Did the owner/operator present geologic cross sections of the site?	Y
2. Do cross sections: 0045	
a. identify the types and characteristics of the geologic materials present?	Y
b. define the contact zones between different geologic materials?	Y
c. note the zones of high permeability or fracture?	Y
d. give detailed borehole information including:	

	Y/N
• location of borehole?	Y
• depth of termination?	Y
• location of screen (if applicable)?	Y
• depth of zone(s) of saturation?	Y
• backfill procedure?	N
3. Did the owner/operator provide a topographic map which was constructed by a licensed surveyor?	Y
4. Does the topographic map provide:	
a. contours at a maximum interval of two-feet?	Y
b. locations and illustrations of man-made features (e.g., parking lots, factory buildings, drainage ditches, storm drain, pipelines, etc.)?	Y
c. descriptions of nearby water bodies?	Y
d. descriptions of off-site wells?	Y
e. site boundaries?	Y
f. individual RCRA units?	N
g. delineation of the waste management area(s)?	NA
h. well and boring locations?	Y
5. Did the owner/operator provide an aerial photograph depicting the site and adjacent off-site features?	Y
6. Does the photograph clearly show surface water bodies, adjacent municipalities, and residences and are these clearly labelled?	Y
F. Identification of Ground-Water Flowpaths	
1. Ground-water flow direction	
a. Was the well casing height measured by a licensed surveyor to the nearest 0.01 foot?	Y
b. Were the well water level measurements taken within a 24 hour period?	Y
c. Were the well water level measurements taken to the nearest 0.01 foot?	Y
d. Were the well water levels allowed to stabilize after construction and development for a minimum of 24 hours prior to measurements?	Y
e. Was the water level information obtained from (check appropriate one):	
• multiple piezometers placed in single borehole? ____	
• vertically nested piezometers in closely spaced separate boreholes? ____	
• monitoring wells? X	

0046

	Y/N
f. Did the owner/operator provide construction details for the piezometers?	N
g. How were the static water levels measured (check method[s]). • Electric water sounder X • Wetted tape ____ • Air line ____ • Other (explain) ____	
h. Was the well water level measured in wells with equivalent screened intervals at an equivalent depth below the saturated zone?	Y
i. Has the owner/operator provided a site water table (potentiometric) contour map?	Y
If yes, • Do the potentiometric contours appear logical and accurate based on topography and presented data? (Consult water level data)	Y
• Are ground-water flow-lines indicated?	N
• Are static water levels shown?	Y
• Can hydraulic gradients be estimated?	Y
j. Did the owner/operator develop hydrologic cross sections of the vertical flow component across the site using measurements from all wells?	N
k. Do the owner/operator's flow nets include: • piezometer locations?	NA
• depth of screening?	NA
• width of screening?	NA
• measurements of water levels from all wells and piezometers?	NA
2. Seasonal and temporal fluctuations in ground-water a. Do fluctuations in static water levels occur? If yes, are the fluctuations caused by any of the following:	Y
—Off-site well pumping	N
—Tidal processes or other intermittent natural variations (e.g., river stage, etc.)	N
—On-site well pumping	N
—Off-site, on-site construction or changing land use patterns	N
—Deep well injection	N
—Seasonal variations	Y
—Other (specify) ____	
b. Has the owner/operator documented sources and patterns that contribute to or affect the ground-water patterns below the waste management area?	Y
c. Do water level fluctuations alter the general ground-water gradients and flow directions?	Y
d. Based on water level data, do any head differentials occur that may indicate a vertical flow component in the saturated zone?	Y

	Y/N
e. Did the owner/operator implement means for gauging long term effects on water movement that may result from on-site or off-site construction or changes in land-use patterns?	N
3. Hydraulic conductivity a. How were hydraulic conductivities of the subsurface materials determined?	
• Single-well tests (slug tests)?	Y
• Multiple-well tests (pump tests)	Y
• Other (specify) _____	
b. If single-well tests were conducted, were they done by: • Adding or removing a known volume of water?	NA
• Pressurizing well casing?	NA
c. If single well tests were conducted in a highly permeable formation, were pressure transducers and high-speed recording equipment used to record the rapidly changing water levels?	NA
d. Since single well tests only measure hydraulic conductivity in a limited area, were enough tests run to ensure a representative measure of conductivity in each hydrogeologic unit?	NA
e. Are the owner/operator's slug test data (if applicable) consistent with existing geologic information (e.g., boring logs)?	NA
f. Were other hydraulic conductivity properties determined?	N
g. If yes, provide any of the following data, if available: • Transmissivity _____ • Storage coefficient _____ • Leakage _____ • Permeability _____ • Porosity _____ • Specific capacity _____ • Other (specify) _____	
4. Identification of the uppermost aquifer a. Has the extent of the uppermost saturated zone (aquifer) in the facility area been defined? If yes,	Y*
• Are soil boring/test pit logs included?	Y
• Are geologic cross-sections included?	Y
b. Is there evidence of confining (competent, unfractured, continuous, and low permeability) layers beneath the site? If yes,	N
• how was continuity demonstrated? _____	
c. What is the hydraulic conductivity of the confining unit? (cm/sec.)	NA
d. How was it determined?	NA

	Y/N
e. Does potential for other hydraulic communication exist (e.g., lateral discontinuity between geologic units, facies changes, fracture zones, cross cutting structures, or chemical corrosion/alteration of geologic units by leachate)? If yes or no, what is the rationale? THE CONFINING LAYER IS OF LOWER PERMEABILITY, BUT IT IS SATURATED. VERTICAL MIGRATION OF CONTAMINANTS COULD OCCUR INTO LOWER AQUIFERS.	Y
G. Office Evaluation of the Facility's Ground-Water Monitoring System—Monitoring Well Design and Construction: These questions should be answered for each different well design present at the facility. 1. Drilling Methods a. What drilling method was used for the well? • Hollow-stem auger ☒ • Solid-stem auger ☐ • Mud rotary (water) ☐ • Air rotary ☐ • Reverse rotary ☐ • Cable tool ☒ • Jetting ☐ • Air drill w/ casing hammer ☐ • Other (specify) _____	
b. Were any cutting fluids (including water) or additives used during drilling? If yes, specify: • Type of drilling fluid _____ • Source of water used _____ • Foam _____ • Polymers _____ • Other _____	N
c. Was the cutting fluid, or additive, identified?	NA
d. Was the drilling equipment steam-cleaned prior to drilling the well? • Other methods _____	Y
e. Was compressed air used during drilling? If yes, • was the air filtered to remove oil?	N
f. Did the owner/operator document procedure for establishing the potentiometric surface? If yes, • how was the location established?	Y
g. Formation samples	

0049

	Y/N
• Were formation samples collected initially during drilling?	Y
• Were any cores taken continuously?	N
• If not, at what interval were samples taken?	NA
• How were the samples obtained? X Split spoon X Shelby tube — Core drill — Other (specify)	
• Identify if any physical and/or chemical tests were performed on the formation samples (specify) ASTM STANDARD PENETRATION TESTS OVA SCREENING	
2. Monitoring Well Construction Materials a. Identify construction materials (by number) and diameters (ID/OD) Material / Diameter • Primary Casing: STAINLESS STEEL / 4" • Secondary or outside casing (double construction): / • Screen: STAINLESS STEEL / 4"	
b. How are the sections of casing and screen connected? • Pipe sections threaded	Y
• Couplings (friction) with adhesive or solvent	
• Couplings (friction) with retainer screws	
• Other (specify)	
c. Were the materials steam-cleaned prior to installation? • If no, how were the materials cleaned?	Y
3. Well Intake Design and Well Development a. Was a well intake screen installed?	Y
• What is the length of the screen for the well? 5 - 15'	
• Is the screen manufactured?	Y
b. Was a filter pack installed?	Y
• What kind of filter pack was employed? SAND	
• Is the filter pack compatible with formation materials?	Y
• How was the filter pack installed? DIRECT PLACEMENT IN ANNULUS	

0050

	Y/N
• What are the dimensions of the filter pack? 2 - 4' ABOVE SCREEN	
• Has a turbidity measurement of the well water ever been made?	Y
• Have the filter pack and screen been designed for the in-situ materials?	Y
c. Well development • Was the well developed?	Y
• What technique was used for well development? X Surge block — Bailer — Air surging X Water pumping — Other (specify)	
4. Annular Space Seals a. What is the annular space in the saturated zone directly above the filter pack filled with: X Sodium bentonite (specify type and grit) — Cement (specify neat or concrete) — Other (specify)	
b. Was the seal installed by: — Dropping material down the hole and tamping — Dropping material down the inside of hollow-stem auger — Tremie pipe method X Other (specify) DIRECT PLACEMENT IN ANNULUS	
c. Was a different seal used in the unsaturated zone? If yes,	Y
• Was this seal made with? X Sodium bentonite (specify type and grit) — Cement (specify neat or concrete)- Other (specify)	
• Was this seal installed by? — Dropping material down the hole and tamping — Dropping material down the inside of hollow stem auger X Other (specify) PRESSURE GROUTING WITH TREMIE PIPE	
d. Is the upper portion of the borehole sealed with a concrete cap to prevent infiltration from the surface?	Y
e. Is the well fitted with an above-ground protective device and bumper guards?	Y
f. Has the protective cover been installed with locks to prevent tampering?	Y

0031

	Y/N
H. Evaluation of the Facility's Detection Monitoring Program	
1. Placement of Downgradient Detection Monitoring Wells	
a. Are the ground-water monitoring wells or clusters located immediately adjacent to the waste management area?	N
b. How far apart are the detection monitoring wells?	VARIES
c. Does the owner/operator provide a rationale for the location of each monitoring well or cluster?	Y
d. Does the owner/operator identify the well screen lengths of each monitoring well or cluster?	Y
e. Does the owner/operator provide an explanation for the well screen lengths of each monitoring well or cluster?	Y
f. Do the actual locations of monitoring wells or clusters correspond to those identified by the owner/operator?	Y
2. Placement of Upgradient Monitoring Wells	
a. Has the owner/operator documented the location of each upgradient monitoring well or cluster?	Y
b. Does the owner/operator provide an explanation for the location(s) of the upgradient monitoring wells?	Y
c. What length screen has the owner/operator employed in the background monitoring well(s)? 5 - 15 FT	
d. Does the owner/operator provide an explanation for the screen length(s) chosen?	Y
e. Does the actual location of each background monitoring well or cluster correspond to that identified by the owner/operator?	Y
I. Office Evaluation of the Facility's Assessment Monitoring Program	
1. Does the assessment plan specify:	
a. The number, location, and depth of wells?	
b. The rationale for their placement and identify the basis that will be used to select subsequent sampling locations and depths in later assessment phases?	Y
2. Does the list of monitoring parameters include all hazardous waste constituents from the facility?	Y

0052

	Y/N
a. Does the water quality parameter list include other important indicators not classified as hazardous waste constituents?	Y
b. Does the owner/operator provide documentation for the listed wastes which are not included?	N
3. Does the owner/operator's assessment plan specify the procedures to be used to determine the rate of constituent migration in the ground-water?	Y
4. Has the owner/operator specified a schedule of implementation in the assessment plan?	Y
5. Have the assessment monitoring objectives been clearly defined in the assessment plan?	Y
a. Does the plan include analysis and/or re-evaluation to determine if significant contamination has occurred in any of the detection monitoring wells?	NA
b. Does the plan provide for a comprehensive program of investigation to fully characterize the rate and extent of contaminant migration from the facility?	Y
c. Does the plan call for determining the concentrations of hazardous wastes and hazardous waste constituents in the ground water?	Y
d. Does the plan employ a quarterly monitoring program?	Y
6. Does the assessment plan identify the investigatory methods that will be used in the assessment phase?	Y
a. Is the role of each method in the evaluation fully described?	Y
b. Does the plan provide sufficient descriptions of the direct methods to be used?	Y
c. Does the plan provide sufficient descriptions of the indirect methods to be used?	NA
d. Will the method contribute to the further characterization of the contaminant movement?	Y
7. Are the investigatory techniques utilized in the assessment program based on direct methods?	Y
a. Does the assessment approach incorporate indirect methods to further support direct methods?	NA
b. Will the planned methods called for in the assessment approach ultimately meet performance standards for assessment monitoring?	Y
c. Are the procedures well defined?	Y
d. Does the approach provide for monitoring wells similar in design and construction as the detection monitoring wells?	Y

	Y/N
e. Does the approach employ taking samples during drilling or collecting core samples for further analysis?	Y
8. Are the indirect methods to be used based on reliable and accepted geophysical techniques?	NA
a. Are they capable of detecting subsurface changes resulting from contaminant migration at the site?	NA
b. Is the measurement at an appropriate level of sensitivity to detect ground-water quality changes at the site?	NA
c. Is the method appropriate considering the nature of the subsurface materials?	NA
d. Does the approach consider the limitations of these methods?	NA
e. Will the extent of contamination and constituent concentration be based on direct methods and sound engineering judgment? (Using indirect methods to substantiate the findings.)	NA
9. Does the assessment approach incorporate any mathematical modeling to predict contaminant movement?	Y
a. Will site specific measurements be utilized to accurately portray the subsurface?	Y
b. Will the derived data be reliable?	Y
c. Have the assumptions been identified?	Y
d. Have the physical and chemical properties of the site specific wastes and hazardous waste constituents been identified?	Y
J. Conclusions	
1. Subsurface geology	
a. Have sufficient data been collected to adequately define petrography and petrographic variation?	Y
b. Has the subsurface geochemistry been adequately defined?	Y
c. Was the boring/coring program adequate to define subsurface geologic variation?	Y
d. Was the owner/operator's narrative description complete and accurate in its interpretation of the data?	Y
e. Does the geologic assessment address or provide means to resolve any information gaps?	Y
2. Ground-water flowpaths	
a. Did the owner/operator adequately establish the horizontal and vertical components of ground water flow?	N*

	Y/N
b. Were appropriate methods used to establish ground-water flowpaths?	Y
c. Did the owner/operator provide accurate documentation?	Y
d. Are the potentiometric surface measurements valid?	Y
e. Did the owner/operator adequately consider the seasonal and temporal effects on the ground-water?	Y
f. Were sufficient hydraulic conductivity tests performed to document lateral and vertical variation in hydraulic conductivity in the entire hydrogeologic subsurface below the site?	N*
3. Uppermost Aquifer a. Did the owner/operator adequately define the upper-most aquifer?	Y*
4. Monitoring Well Construction and Design a. Do the design and construction of the owner/operator's ground-water monitoring wells permit depth discrete ground-water samples to be taken?	Y
b. Are the samples representative of ground-water quality?	Y
c. Are the ground-water monitoring wells structurally stable?	Y
d. Does the ground-water monitoring well's design and construction permit an accurate assessment of aquifer characteristics?	Y
5. Detection Monitoring a. Downgradient Wells • Do the location, and screen lengths of the ground-water monitoring wells or clusters in the detection monitoring system allow the immediate detection of a release of hazardous waste or constituents from the hazardous waste management area to the uppermost aquifer?	NA
b. Upgradient Wells • Do the location and screen lengths of the upgradient (background) ground-water monitoring wells ensure the capability of collecting ground-water samples representative of upgradient (background) ground-water quality including any ambient heterogenous chemical characteristics?	Y
6. Assessment Monitoring 0055 a. Has the owner/operator adequately characterized site hydrogeology to determine contaminant migration?	Y
b. Is the detection monitoring system adequately designed and constructed to immediately detect any contaminant release?	NA

	Y/N
c. Are the procedures used to make a first determination of contamination adequate?	Y
d. Is the assessment plan adequate to detect, characterize, and track contaminant migration?	Y
e. Will the assessment monitoring wells, given site hydrogeologic conditions, define the extent and concentration of contamination in the horizontal and vertical planes?	Y
f. Are the assessment monitoring wells adequately designed and constructed?	Y
g. Are the sampling and analysis procedures adequate to provide a true measurement of contamination?	Y
h. Do the procedures used for evaluation of assessment monitoring data result in determinations of the rate of migration, extent of migration, and hazardous constituent composition of the contaminant plume?	Y
i. Are the data collected at sufficient frequency and duration to adequately determine the rate of migration?	Y
j. Is the schedule of implementation adequate?	Y
k. Is the owner/operator's assessment monitoring plan adequate?	Y
• If the owner/operator had to implement his assessment monitoring plan was it implemented satisfactorily?	Y
II. Field Evaluation	
A. Ground-Water Monitoring System	
1. Are the numbers, depths, and locations of monitoring wells in agreement with those reported in the facility's monitoring plan? (See Section 3.2.3.)	Y
B. Monitoring Well Construction	
1. Identify construction material material diameter a. Primary Casing STAINLESS STEEL 4" b. Secondary or outside casing _____	
2. Is the upper portion of the borehole sealed with concrete to prevent infiltration from the surface?	Y
3. Is the well fitted with an above-ground protective device?	Y
4. Is the protective cover fitted with locks to prevent tampering? If a facility utilizes more than a single well design, answer the above questions for each well design? 0056	Y

	Y/N
III. Review of Sample Collection Procedures	
A. Measurement of Well Depths /Elevation	
1. Are measurements of both depth to standing water and depth to the bottom of the well made?	Y
2. Are measurements taken to the 0.01 foot?	Y
3. What device is used? ELECTRONIC WATER LEVEL INDICATOR	Y
4. Is there a reference point established by a licensed surveyor?	Y
5. Is the measuring equipment properly cleaned between well locations to prevent cross contamination?	Y
B. Detection of Immiscible Layers	
1. Are procedures used which will detect light phase immiscible layers?	Y
2. Are procedures used which will detect heavy phase immiscible layers?	N
C. Sampling of Immiscible Layers	
1. Are the immiscible layers sampled separately prior to well evacuation?	NA
2. Do the procedures used minimize mixing with water soluble phases?	NA
D. Well Evacuation	
1. Are low yielding wells evacuated to dryness?	Y
2. Are high yielding wells evacuated so that at least three casing volumes are removed?	Y
3. What device is used to evacuate the wells? QED & SUBMERSIBLE PUMP	
4. If any problems are encountered (e.g., equipment malfunction) are they noted in a field logbook?	Y

	Y/N
E. Sample Withdrawal	
1. For low yielding wells, are samples for volatiles, pH, and oxidation/reduction potential drawn first after the well recovers?	Y
2. Are samples withdrawn with either flurocarbon/resins or stainless steel (316, 304 or 2205) sampling devices?	Y
3. Are sampling devices either bottom valve bailers or positive gas displacement bladder pumps? BLADDER PUMPS	
4. If bailers are used, is fluorocarbon/resin coated wire, single strand stainless steel wire, or monofilament used to raise and lower the bailer?	NA
5. If bladder pumps are used, are they operated in a continuous manner to prevent aeration of the sample?	Y
6. If bailers are used, are they lowered slowly to prevent degassing of the water?	NA
7. If bailers are used, are the contents transferred to the sample container in a way that minimizes agitation and aeration?	NA
8. Is care taken to avoid placing clean sampling equipment on the ground or other contaminated surfaces prior to insertion into the well?	Y
9. If dedicated sampling equipment is not used, is equipment disassembled and thoroughly cleaned between samples?	Y
10. If samples are for inorganic analysis, does the cleaning procedure include the following sequential steps: a. Nonphosphate detergent wash? b. Dilute acid rinse (HNO_3 or HCl)? c. Tap water rinse? d. Type II reagent grade water?	Y
11. If samples are for organic analysis, does the cleaning procedure include the following sequential steps:	
a. Nonphosphate detergent wash?	Y
b. Tap water rinse?	
c. Distilled/deionized water rinse?	
d. Acetone rinse?	
e. Pesticide-grade hexane rinse?	

	Y/N
12. Is sampling equipment thoroughly dry before use?	Y
13. Are equipment blanks taken to ensure that sample cross-contamination has not occurred?	Y
14. If volatile samples are taken with a positive gas displacement bladder pump, are pumping rates below 100 ml/min?	Y
F. In-situ or Field Analyses	
1. Are the following labile (chemically unstable) parameters determined in the field:	
a. pH?	Y
b. Temperature?	Y
c. Specific conductivity?	Y
d. Redox potential?	N
e. Chlorine?	N
f. Dissolved oxygen?	Y
g. Turbidity?	Y
h. Other (specify) _____	
2. For in-situ determinations, are they made after well evacuation and sample removal?	Y
3. If sample is withdrawn from the well, is parameter measured from a split portion?	NA
4. Are monitoring equipment calibrated according to manufacturer's specifications and consistent with SW-846?	Y
5. Are the date, procedure, and maintenance for equipment calibration documented in the field logbook?	Y
IV. Review of Sample Preservation and Handling Procedures	
A. Sample Containers	
1. Are samples transferred from the sampling device directly to their compatible containers?	Y

0059

	Y/N
2. Are sample containers for metals (inorganics) analyses polyethylene with polypropylene caps?	Y
3. Are sample containers for organics analysis glass bottles with fluorocarbonresin-lined caps?	Y
4. If glass bottles are used for metals samples are the caps fluorocarbonresin-lined?	Y
5. Are the sample containers for metal analyses cleaned using these sequential steps:	
a. Nonphosphate detergent wash?	NA*
b. 1:1 nitric acid rinse?	
c. Tap water rinse?	
d. 1:1 hydrochloric acid rinse?	
e. Tap water rinse?	
f. Distilled/deionized water rinse?	
6. Are the sample containers for organic analyses cleaned using these sequential steps:	
a. Nonphosphate detergent/hot water wash?	NA*
b. Tap water rinse?	
c. Distilled/deionized water rinse?	
d. Acetone rinse?	
e. Pesticide-grade hexane rinse?	
7. Are trip blanks used for each sample container type to verify cleanliness?	Y
B. Sample Preservation Procedures	
1. Are samples for the following analyses cooled to 4°C:	
a. TOC?	Y
b. TOX?	Y
c. Chloride?	Y
d. Phenols?	N
e. Sulfate?	Y
f. Nitrate?	Y
g. Coliform bacteria?	N
h. Cyanide?	Y
i. Oil and grease?	N
j. Hazardous constituents (261, Appendix VIII)	N

	Y/N
2. Are samples for the following analyses field acidified to pH <2 with HNO_3:	
a. Iron?	Y
b. Manganese?	Y
c. Sodium?	Y
d. Total metals?	Y
e. Dissolved metals?	Y
f. Fluoride?	Y
g. Endrin?	N
h. Lindane?	N
i. Methoxychlor?	N
j. Toxaphene?	N
k. 2,4, D?	N
l. 2,4,5 TP Silvex?	N
m. Radium?	Y
n. Gross alpha?	Y
o. Gross beta?	Y
3. Are samples for the following analyses field acidified to pH <2 with H_2SO_4:	
a. Phenols?	N
b. Oil and grease?	N
4. Is the sample for TOC analysis field acidified to pH <2 with HCl?	Y
5. Is the sample for TOX analysis preserved with 1 ml of 1.1 M sodium sulfite?	Y
6. Is the sample for cyanide analysis preserved with NaOH to pH >12?	Y
C. Special Handling Considerations	
1. Are organic samples handled without filtering?	Y
2. Are samples for volatile organics transfered to the appropriate vials to eliminate headspace over the sample?	Y
3. Are samples for metal analysis split into two portions?	N
4. Is the sample for dissolved metals filtered through a 0.45 micron filter?	NA
5. Is the second portion not filtered and analyzed for total metals?	NA
6. Is one equipment blank prepared each day of ground-water sampling?	Y

5018	Y/N
V. Review of Chain-of-Custody Procedures	
A. Sample Labels	
1. Are sample labels used?	Y
2. Do they provide the following information:	
a. Sample identification number?	Y
b. Name of collector?	Y
c. Date and time of collection?	Y
d. Place of collection?	Y
e. Parameter(s) requested and preservatives used?	Y
3. Do they remain legible even if wet?	Y
B. Sample Seals	
1. Are sample seals placed on those containers to ensure samples are not altered?	Y
C. Field Logbook	
1. Is a field logbook maintained?	Y
2. Does it document the following:	
a. Purpose of sampling (e.g., detection or assessment)?	Y
b. Location of well(s)?	Y
c. Total depth of each well?	Y
d. Static water level depth and measurement technique?	Y
e. Presence of immiscible layers and detection method?	Y
f. Collection method for immiscible layers and sample identification numbers?	Y
g. Well evacuation procedures?	Y
h. Sample withdrawal procedure?	Y
i. Date and time of collection?	Y
j. Well sampling sequence?	Y
k. Types of sample containers and sample identification number(s)?	Y
l. Preservative(s) used?	Y
m. Parameters requested?	Y
n. Field analysis data and method(s)?	Y
o. Sample distribution and transporter?	Y
p. Field observations?	Y

	Y/N
—Unusual well recharge rates?	Y
—Equipment malfunction(s)?	Y
—Possible sample contamination?	Y
—Sampling rate?	Y
D. Chain-of-Custody Record 1. Is a chain-of-custody record included with each sample?	Y
2. Does it document the following: a. Sample number?	Y
b. Signature of collector?	Y
c. Date and time of collection?	Y
d. Sample type?	Y
e. Station location?	Y
f. Number of containers?	Y
g. Parameters requested?	Y
h. Signatures of persons involved in chain-of-custody?	Y
i. Inclusive dates of custody?	Y
E. Sample Analysis Request Sheet 1. Does a sample analysis request sheet accompany each sample?	Y
2. Does the request sheet document the following: a. Name of person receiving the sample?	Y
b. Date of sample receipt?	Y
c. Duplicates?	Y
d. Analysis to be performed?	Y
VI. Review of Quality Assurance/Quality Control A. Is the validity and reliability of the laboratory and field generated data ensured by a QA/QC program?	Y
B. Does the QA/QC program include: 1. Documentation of any deviation from approved procedures?	Y

	Y/N
2. Documentation of analytical results for:	
a. Blanks?	Y
b. Standards?	Y
c. Duplicates?	Y
d. Spiked samples?	Y
e. Detectable limits for each parameter being analyzed?	Y
C. Are approved statistical methods used?	Y
D. Are QC samples used to correct data?	Y
E. Is all data critically examined to ensure it has been properly calculated and reported?	Y
VII. Surficial Well Inspection and Field Observation	
A. Are the wells adequately maintained?	Y
B. Are the monitoring wells protected and secure?	Y
C. Do the wells have surveyed casing elevations?	Y
D. Are the ground-water samples turbid?	N
E. Have all physical characteristics of the site been noted in the inspector's field notes (i.e., surface waters, topography, surface features)?	Y
F. Has a site sketch been prepared by the field inspector with scale, north arrow, location(s) of buildings, location(s) of regulated units, locations of monitoring wells, and a rough depiction of the site drainage pattern?	N

	Y/N
VIII. Conclusions	
A. Is the facility currently operating under the correct monitoring program according to the statistical analyses performed by the current operator?	Y*
B. Does the ground-water monitoring system, as designed and operated, allow for detection or assessment of any possible ground-water contamination caused by the facility?	Y
C. Does the sampling and analysis procedure permit the owner/operator to detect and, where possible, assess the nature and extent of a release of hazardous constituents to ground water from the monitored hazardous waste management facility?	Y

0065

APPENDIX A COMMENTS

IB8d. Under the Alternate Monitoring Plan (AMP) the facility is the waste management area. The routine RCRA groundwater monitoring system addresses releases from the perimeter of the facility.

IF4a. U.S. DOE is continuing its evaluation of the perched zones in the glacial till, the hydraulic connection between the perched water zones and the Great Miami Aquifer.

IJ2a. The horizontal and vertical components of groundwater flow are being established in the CERCLA RI/FS for Operable Unit 5 and the AMP. The current groundwater investigations in the CERCLA RI/FS are part of the RCRA groundwater monitoring system.

IJ2f. Hydraulic conductivity tests are currently being conducted and the results will be presented in the CERCLA RI/FS and the RCRA annual report.

IJ3a. The U.S. DOE is continuing to define the uppermost aquifer by further investigating the relationship of the perched groundwater and the Great Miami Aquifer.

IVA5a. The sample containers are pre-preserved in the laboratory for the sampling teams use. The sampling team checks the containers to assure the containers are properly prepared.

IVA6a. The sample containers are pre-preserved in the laboratory for the sampling teams use. The sampling team checks the containers to assure the containers are properly prepared.

VIIIA. The facility is operating under an approved Alternate Monitoring Program as specified in the September 10, 1993, OEPA Directors Findings and Orders.

-5018

APPENDIX A-1

FACILITY INSPECTION FORM FOR COMPLIANCE WITH INTERIM STATUS STANDARDS COVERING GROUND-WATER

Company U.S. DOE - FMPC EPA I.D. Number OHD 890 008 976

Company Address: 7600 WILLEY RD FERNALD, OH

Company Contact/Official: JACK CRAIG Title: PROJECT MANAGER

Date of Inspection: 9/14 - 15/93

Inspector's Name: JAMES SARIC MIKE PROFFITT Branch/Organization: U.S. EPA/OEPA

Type of Facility: (check appropriately)	Y/N
a) surface impoundment	Y
b) landfill	Y
c) land treatment facility	N
Ground Water Monitoring Program	
1. Has a ground water monitoring plan been submitted to the Director for facilities containing a surface impoundment, landfill, land treatment facility?	Y
2. Was the ground water monitoring plan reviewed prior to the site visit? If "No," explain.	Y
A. Was the ground water plan reviewed at the facility prior to the actual site inspection? If "No," explain.	Y
3. Has a ground water monitoring program (capable of determining the facility's impact on the quality of ground water in the uppermost aquifer underlying the facility) been implemented? 3745-65-90(A)	Y
4. Has at least one monitoring well been installed in the uppermost aquifer hydraulically upgradient from the limit of the waste management area? 3745-65-91(A)(1)	Y
A. Are sufficient ground water samples from the uppermost aquifer, representative of background ground water quality and not affected by the facility, ensured by proper well	
1) Number(s)?	Y
2) Location?	Y
3) Depth?	Y

Y=YES, N=NO, NA=NOT APPLICABLE
NS=NOT SPECIFIED, *=COMMENT

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APPENDIX A-1	Y/N
5. Have at least three monitoring wells been installed hydraulically downgradient at the limit of the waste handling or management area? 3745-65-91(A)(2)	N*
6. Have the locations of the waste handling, storage, or disposal areas been verified to conform with information in the ground water monitoring plan?	Y
7. Do the numbers, locations, and depths of the ground water monitoring wells agree with the data in the ground water monitoring system program? If "No," explain discrepancies.	Y
8. Have all monitoring wells been cased in a manner that:	
A. Maintains the integrity of the bore hole?	Y
B. Is screened and packed to enable sample collection at depths where appropriate aquifer flow exists?	Y
C. Prevents contamination of samples and ground water by sealing the annular space above the sampling depth with a suitable material? 3745-65-91(C)	Y
9. Has a ground water sampling and analysis plan been developed? 3745-65-92(A)	Y
A. Has it been followed?	Y*
B. Is the plan kept at the facility?	Y
C. Does the plan include procedures and techniques for:	
1) Measuring ground water elevations? 3745-65-92(A)(1)	Y
2) Detection of immiscible layers, where applicable? 3745-65-92(A)(2)	Y
3) Collecting ground water samples including? 3745-65-92(A)(3)	
a) Well evacuation? 3745-65-92(A)(3)(a)	Y
b) Sample withdrawal? 3745-65-92(A)(3)(b)	Y
c) Sample equipment? 3745-65-92(A)(3)(c)	Y
d) Sample containers and handling? 3745-65-92(A)(3)(d)	Y
e) Sample preservation? 3745-65-92(A)(3)(e)	Y
4) Performing field analysis, including:	
a) Procedures and forms for recording raw data and the exact location, time, and facility specific considerations associated with the data acquisitions? 3745-65-92(A)(4)(a)	Y
b) Calibration of field instruments? 3745-65-92(A)(4)(b)	Y
c) Procedures for sample filtration? 3745-65-92(A)(4)(c)	Y
5) Decontamination of equipment? 3745-65-92(A)(5)	Y
6) Disposal of purge water? 3745-65-92(A)(6)	Y

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-1	Y/N
7) Ground water sample analysis of all applicable constituents associated with the facility including: 3745-65-92(A)(7) a) Constituents? 3745-65-92(A)(7)(a)	Y
b) Analytical method and detection limit? 3745-65-92(A)(7)(b)	Y
c) Sample holding time? 3745-65-92(A)(7)(c)	Y
8) Quality assurance/quality control: a) Samples for field/lab/equipment blanks? 3745-65-92(A)(8)(a)	Y
b) Duplicate samples? 3745-65-92(A)(8)(b)	Y
c) Potential interferences? 3745-65-92(A)(8)(c)	Y
9) Chain of custody procedures: a) Standardized field tracking reporting forms to establish sample custody for the field prior to and during shipping? 3745-65-92(A)(9)(a)	Y
b) Sample labels containing all information necessary for effective sample tracking? 3745-65-92(A)(9)(b)	Y
10. Have the required parameters in ground water samples been tested quarterly for the first year? 3745-65-92(B) and (C)(1)	Y
A. Are the ground water samples analyzed for the following: 1) Parameters characterizing the suitability of the ground water as a drinking supply? 3745-65-92 B(1)	Y
2) Parameters establishing ground water quality? 3745-65-92 B(2)	Y
3) Parameters used as indicators of ground water contamination? 3745-65-92 B(3)	Y
a) Are at least four replicate measurements obtained for each sample? 3745-65-92(C)(2)	N*
b) Are provisions made to calculate the initial background arithmetic mean and variance of the respective parameter concentrations or values obtained from well(s) during the first year? 3745-65-92(C)(2)	N*
B. For facilities which have complied with first year ground water sampling and analysis requirements: 1) Have samples been obtained and analyzed for the indicators of ground water quality at least annually? 3745-65-92(D)(1)	Y
2) Have samples been obtained and analyzed for the indicators of ground water contamination at least semi-annually? 3745-65-92(D)(2)	Y
C. Were ground water surface elevations determined at each monitoring well each time a sample was taken? 3745-65-92(E)	Y

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-1	Y/N
D. Were the ground water surface elevations evaluated to determine whether the monitoring wells are properly placed? 3745-65-93(F)	NA
E. If it was determined that modification of the number, location or depth of monitoring wells was necessary, was the system brought into compliance with 3745-65-91(A)? 3745-65-93(F)	Y
11. Has an outline of a ground water quality assessment program been prepared? 3745-65-93(A)	Y
A. Does it describe a program capable of determining:	
1) Whether hazardous waste or hazardous waste constituents have entered the ground water? 3745-65-93(A)(1)	Y
2) The rate and extent of migration of hazardous waste or hazardous waste constituents? 3745-65-93(A)(2)	Y
3) Concentrations of hazardous waste or hazardous waste constituents in ground water? 3745-65-93(A)(3)	Y
B. Have at least four replicate measurements of each indicator parameter been obtained for samples taken for each well? 3745-65-93(B)	NA *
1) Were the results compared with the initial background mean?	NA
a) Was each well considered individually?	NA
b) Was the Student's t-test used (at the 0.01 level of significance)?	NA
2) Was a significant increase (or pH decrease) found in the:	
a) Upgradient wells?	NA
b) Downgradient wells?	NA
If "Yes," Compliance Checklist A-2 must also be completed.	
12. Have records been kept of analyses for parameters establishing ground water quality and indicators of ground water contamination? 3745-65-94(A)(1)	Y
13. Have records been kept of ground water surface elevations taken at the time of sampling for each well? 3745-65-94(A)(1)	Y
14. Have the following been submitted to the Director: 3745-65-94(A)(2)	
A. Initial background concentrations of parameters listed in 3745-65-92(B)(1) within 15 days after completing each quarterly analysis required during the first year? 3745-65-94(A)(2)(a)	N*
B. For each well, any parameters whose concentrations or values have exceeded the maximum contaminant levels allowed in drinking water supplies? 3745-65-94(A)(2)(a)	NA
C. Annual reports including: 3745-65-94(A)(2)(b)	
1) Concentrations or values of parameters used as indicators of ground water contamination for each well?	N*

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-1	Y/N
2) Separate identification of any significant differences from initial background found in upgradient wells? 3745-65-94(A)(2)(b)	NA
3) Results of the evaluation of ground water surface elevations?	Y
4) Was the Annual Report submitted by March 1 of the following year? 3745-65-75(F)	N*

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-1 COMMENTS

4A5. Not required as part of the Alternate Monitoring Plan (AMP).

4A9a. The sampling and anaylsis plan is currently being updated.

10A3a. The system is in assessment monitoring and the four replicates are not required as part of the AMP.

10A4b. The groundwater monitoring system has been in place for over a year and the AMP does not require calculation of the arithmetic mean and variance. However, there is an approved set of background monitoring wells.

11B. Replicate measurements are not part of the AMP.

14A. This was a previously idendified deficiency, which was resolved in the September 10, 1993, OEPA Directors Findings and Orders and with installation and operation of the AMP.

14C1. U.S. DOE will submit the annual report under the AMP.

14C4. U.S. DOE will submit the annual report under the AMP.

APPENDIX A-2
INSPECTION COMPLIANCE FORM FOR A FACILITY THAT HAS DETERMINED IT MAY BE AFFECTING GROUND WATER QUALITY

Company Name: U.S. DOE - FMPC EPA I.D. Number: OHD 890 008 976

Company Address: 7600 WILLEY RD FERNALD, OHIO

Company Contact/Official: JACK CRAIG Title: PROJECT MANAGER

Date of Inspection: 9/14 - 15/93

Inspector's Name: JAMES SARIC/MIKE PROFFITT Branch/Organization USEPA/OEPA

Type of facility: (check appropriately)	Y/N
a) surface impoundment	Y
b) landfill	Y
c) land treatment facility	N
Ground Water Monitoring Program	
1. Has (Have) comparison(s) of ground water contamination indicator parameters for the upgradient well(s) 3745-65-93(B) shown a significant increase (or pH decrease) over initial background?	Y
A. If "Yes," has(have) the increase(s) been submitted to the Director as part of the annual report? 3745-65-94(A)(2)	Y
2. Have comparisons of indicator parameters for the downgradient wells 3745-65-93(B) shown a significant increase (or decrease) over initial background?	Y
A. If "Yes," were additional ground water samples taken for those downgradient wells where the significant difference was determined? 3745-65-93 (C)(2)	Y
1) Were samples split in two?	N
2) Was the significant difference due to laboratory error? (If "Yes," do not continue.)	N
3. If significant differences were not due to laboratory error, was a written notice sent to the Director within 7 days of (laboratory) confirmation? 3745-65-93(D)(1)	Y
4. Within 15 days of notification of the Director was a ground water quality assessment plan (GWQAP) submitted? 3745-65-93(D)(2)	Y
A. Does the GWQAP specify the following: 1) Hydrogeologic conditions at the facility? 3745-65-93(D)(3)(a)	Y
2) The detection monitoring program implemented by the facility, including, but not limited to:	NA

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-2	Y/N
a) The number, location, depth, and construction of detection monitoring wells with written documentation? 3745-65-93(D)(3)(b)(i)	NA
b) A summary of detection monitoring analytical data with written documentation of the results? 3745-65-93(D)(3)(b)(ii)	NA
c) A summary of statistical analyses applied to the data? 3745-65-93(D)(3)(b)(iii)	NA
3) The investigative approach to be followed during the assessment, including, but not limited to:	
a) The proposed number, location, depth, installation method, and construction of monitoring wells? 3745-65-93(D)(3)(c)(i)	Y
b) The proposed methods for gathering additional hydrogeologic information? 3745-65-93(D)(3)(c)(ii)	Y
c) The proposed use of supporting methodology (e.g., soil gas analysis, geophysics)? 3745-65-93(D)(3)(c)(iii)	Y
d) The proposed methodology for determining contaminant migration rates? 3745-65-93(D)(3)(c)(iv)	Y
4) Sampling and analysis procedures as specified under paragraph (A) of Rule 3745-65-92 of the Ohio Administrative Code? 3745-65-93(D)(3)(d)	Y
5) Proposed data evaluation procedures, including, but not limited to:	
a) Utilization of statistical data evaluation? 3745-65-93(D)(3)(e)(i)	Y
b) Utilization of computer models? 3745-65-93(D)(3)(e)(ii)	Y
c) Criteria that will be utilized to determine if additional assessment activities are warranted? 3745-65-93(D)(3)(e)(iii)	Y
6) A schedule of implementation? 3745-65-93(D)(3)(f)	Y
B. Does the plan allow for determination of:	
1) Rate and extent of migration of hazardous waste constituents? 3745-65-93(D)(4)(a)	Y
2) Concentrations of the hazardous waste or hazardous waste constituents? 3745-65-93(D)(4)(b)	Y
C. Is it indicated that the 1st determination was made as soon as technically feasible? 3745-65-93(D)(5)	Y
1) Within 15 days after determination, was a written report containing the assessment of ground water quality submitted to the Director?	NA
D. Has it been determined that hazardous waste or hazardous waste constituents from the facility have entered the ground water?	Y

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

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APPENDIX A-2	Y/N
1) If "No," was the original detection evaluation program, required by OAC Rule 3745-65-92 reinstated?	NA
a) Was the Director notified of the reinstatement of the program within 15 days of the determination? 3745-65-93(D)(6)	NA
E. If it was determined that hazardous waste or hazardous waste constituents have entered the ground water: 1) For facilities where the program was implemented prior to final closure, have determinations of hazardous waste or hazardous waste constituents continued on a quarterly basis? 3745-65-93(D)(7)(a)	N*
2) Were(are) records kept of the analyses and evaluations specified in the ground water quality assessment plan throughout the active life of the facility? 3745-65-94(B)(1)	Y
a) If a disposal facility, were (are) records kept throughout the post-closure period as well?	Y
F. Are annual reports submitted to the Director containing the results of the ground water quality assessment program? 3745-65-94(B)(2)	Y*
1) Do the reports include the calculated or measured rate of migration of hazardous waste or hazardous waste constituents?	N
2) Have the annual reports been submitted by March 1 of the following year?(3745-65-75(F))	N*

Y = YES, N = NO, NA = NOT APPLICABLE
NS = NOT SPECIFIED, * = COMMENT

APPENDIX A-2 COMMENTS

4E1. The AMP requires quarterly monitoring of the perimeter wells and annual reporting. The first determination will be submitted with the CERCLA RI Report.

4F. Annual Reports are required in the September 10, 1993 OEPA Directors Findings and Orders.

4F2. Annual Reports are required in the September 10, 1993 OEPA Directors Findings and Orders.

-5018

ATTACHMENT 3

Issue Date: SEP 10 1993

Effective Date: SEP 10 1993

BEFORE THE
OHIO ENVIRONMENTAL PROTECTION AGENCY

In the Matter of:

U.S. Department of Energy Fernald Environmental Management Project P.O. Box 389705 Cincinnati, Ohio 45239	: : :	**Director's Final Findings and Orders**

PREAMBLE

It is hereby agreed by and among the parties hereto as follows:

I. JURISDICTION

These Director's Final Findings and Orders ("Orders") are issued to the U.S. Department of Energy ("Respondent") pursuant to the authority vested in the Director of the Ohio Environmental Protection Agency ("Ohio EPA") in Ohio Revised Code ("ORC") sections 3734.02(G) and 3745.01.

II. PARTIES

These Orders shall apply to and be binding upon the Respondent, its agents, assigns, successors in interest, and its co-operator, Fernald Environmental Restoration Management Corporation ("FERMCO"). No change in ownership or operation of the Facility will in any way alter the Respondent's responsibilities under these Orders.

I certify this to be a true and accurate copy of the official document as filed in the records of the Ohio Environmental Protection Agency.

By: Mary Cavin Date 9-10-93

OHIO E.P.A.
SEP 10 93
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III. DEFINITIONS

Unless otherwise stated, all terms used in these Orders shall have the same meaning as in ORC Chapter 3734. and the regulations promulgated thereunder. The following terms are defined as:

a. "Alternate Program" shall consist of the portions of the Remedial Investigation ("RI") Work Plans and Addenda that pertain to groundwater characterization and the "Routine System", as specified in Orders number 1, 2 and 3 of these Orders.

b. "Site" shall mean the Fernald Environmental Management Project ("FEMP"), including all areas within the property boundary of the FEMP and any other areas that received or potentially received or released hazardous waste or hazardous waste constituents.

c. "Routine System" shall consist of the monitoring wells that will be located along the downgradient property boundary of the Facility. As of the effective date of these Orders, the Routine System consists of thirty-three (33) monitoring wells.

IV. FINDINGS OF FACT

The Director of the Ohio EPA has determined the following findings of fact:

1. Respondent owns and operates a former industrial facility located approximately twenty (20) miles northwest of Cincinnati, Ohio in Hamilton and Butler Counties ("Facility"). The Site is presently listed on U.S. Environmental Protection Agency's ("U.S. EPA") National Priorities List ("NPL") under the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, ("CERCLA"), 42 U.S.C. Sections 9601 et seq. Respondent is investigating and remediating environmental contamination at the site.

I certify this to be a true and accurate copy of the official document as filed in the records of the Ohio Environmental Protection Agency.

By: Mary Cavin Date 9-10-93

OHIO E.P.A.
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2. The Respondent is a "person" as defined in ORC Sections 1.59 and 3734.01 and Ohio Administrative Code ("OAC") rule 3745-51-03.

3. The Respondent generates "hazardous waste" as that term is defined by ORC Section 3734.01 and OAC rule 3745-51-03.

4. The Respondent notified U.S. EPA on August 8, 1980 of its hazardous waste activity at the Facility and was issued U.S. EPA Identification Number OH6890008976.

5. The Respondent submitted "Part A" and "Part B" of its permit application pursuant to OAC rule 3745-50-41. The most recent revision of Respondent's "Part B" permit application was submitted on March 26, 1993.

6. There are land-based units at the Facility for which Respondent is required to implement a groundwater monitoring program described in OAC rules 3745-65-90 through 3745-65-94. The Respondent implemented a Resource Conservation and Recovery Act ("RCRA") groundwater monitoring program in 1985 pursuant to OAC rule 3745-65-90.

7. The Respondent is also conducting a groundwater monitoring investigation as part of its Remedial Investigation and Feasibility Study ("RI/FS") under CERCLA. The RI/FS schedules contained in the Amended Consent Agreement ("ACA") are based upon discussions between Respondent and U.S. EPA in consultation with the State of Ohio.

8. An objective of the CERCLA process is to characterize the nature, rate and extent of groundwater contaminant migration to the extent necessary to select and implement response action(s). This process will ensure characterization and remediation of groundwater for the entire Site, including the areas potentially affected by the land-based units identified in Finding number 6., above.

I certify this to be a true and accurate copy of the official document as filed in the records of the Ohio Environmental Protection Agency.

By: Mary Cain Date 9-10-93

OHIO EPA
SEP 10 '93
RECORDS DIVISION JOURNAL

9. During a May 7, 1993 meeting and in a May 12, 1993 letter, the Respondent asked the Ohio EPA to approve an alternate RCRA groundwater monitoring program ("Alternate Program") for the Facility to replace the existing groundwater monitoring program at the Facility.

10. Ohio EPA and the Respondent desire to avoid duplication and to integrate the groundwater monitoring activities required by OAC rules 3745-65-90 through 3745-65-94 with the site-wide RI/FS groundwater characterization required by the ACA and described in the Respondent's RI/FS Work Plans and Addenda. In order to facilitate integration and avoid duplication, the Ohio EPA will review and approve portions of CERCLA documents for purposes of demonstrating compliance with OAC rules 3745-65-90 through 3745-65-94 and these Orders.

11. The Routine System is an assessment groundwater monitoring system with documented groundwater contamination in the following four stratigraphic levels: the surficial glacial till, the water table, the upper section of the sand and gravel aquifer, and the deep sand and gravel unit.

12. The Respondent, through a federal assistance award administered under 10 CFR Part 600, has agreed to provide Ohio EPA equipment and other support to electronically access environmental data for the Site through the use of the Intergraph System.

13. Pursuant to ORC Section 3734.02(G), the Director may by order exempt any person generating, storing, treating, or disposing of hazardous wastes in such quantities or under such circumstances that, in the determination of the Director, are unlikely to adversely affect the public health or safety or the environment from any requirement to obtain a permit or license, comply with the manifest system or with the requirements of ORC Chapter 3734.

14. If the Respondent conducts its Alternate Program in accordance with the Orders herein, it is unlikely that the public health or safety or the environment will be adversely affected.

I certify this to be a true and accurate copy of the official document as filed in the records of the Ohio Environmental Protection Agency.

By: Mary Cavin Date 9-10-93

OHIO E.P.A.
SEP 10 '93
MESSENGER DIVISION'S JOURNAL

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V. ORDERS

1. The Respondent shall comply with the groundwater monitoring requirements in OAC rules 3745-65-90(A) through 90(E), 3745-65-91(B)(2) through 92(A), 3745-65-92(E) through 93(D)(2) and 3745-65-93(D)(7) through 94(B)(1) as applicable to an assessment monitoring program.

2. The Respondent is exempt from complying with the groundwater monitoring requirements in OAC rules 3745-65-91(A)(1) through 91(B)(1), 3745-65-92(B) through 92(D), 3745-65-93(D)(3) through 93(D)(6), and 3745-65-94(B)(2) provided that Respondent complies with these Orders and within ninety (90) days from the date of issuance of these Orders, modifies its groundwater monitoring program as described below to Ohio EPA's satisfaction:

   a. The Respondent shall establish and maintain a groundwater monitoring system capable of yielding groundwater samples for analysis consisting of a total of thirty-three (33) existing and/or any potentially necessary monitoring wells installed hydraulically downgradient at the property boundary of the FEMP within the upper, middle and lower zones of the Great Miami Aquifer (2000, 3000 and 4000-series wells).

   b. The Respondent shall conduct sampling and analysis of the target parameters including analyte metals, radionuclides, water quality parameters and volatile organic compounds on a quarterly basis. The quarterly sampling period for the wells shall normally extend no longer than one week, but shall not exceed two weeks.

   c. The Respondent shall determine the elevation of the groundwater surface at each monitoring well each time a sample is obtained. The groundwater elevations shall be evaluated annually to determine if the downgradient requirements of Order number 2a., above, continue to be met. If the evaluation shows that the requirements of Order number 2a., above, are no longer met, the Respondent shall modify the number, location or depth of the monitoring wells to meet the

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downgradient requirements of Order number 2a, above.

d. In the event that initial sample results from the Routine System indicate a potential immediate risk to human health or the environment, the Respondent shall verbally notify Ohio EPA's FEMP Site Coordinator within 48 hours of receipt of laboratory data. In the event that confirmatory sample results from the Route System indicate a potential risk to human health or the environment, the Respondent shall, within 48 hours of receipt of laboratory data, verbally notify Ohio EPA's FEMP Site Coordinator and initiate a Removal Site Evaluation ("RSE") to determine if a Removal Action is warranted. The Respondent shall notify the Director in writing within five (5) days of the RSE initiation. Ohio EPA may request an RSE based upon its technical review of routine monitoring data. The necessity of additional work will be determined in consultation with U.S. EPA, Ohio EPA and the Respondent.

e. The Respondent shall conduct other site-wide groundwater monitoring and characterization activities throughout the CERCLA process as necessary to implement appropriate response action(s), including determining background groundwater quality.

f. When the Respondent submits the OU 5 RI Report, it shall be analogous to the groundwater quality first determination assessment report described in OAC rule 3745-65-93(D)(5).

g. The Respondent shall submit by March 1 of each year an annual report of groundwater monitoring activities which includes: groundwater surface level elevations; analytical data from the Routine System; an update of groundwater-related activities for each operable unit from the previous calendar year; graphical representation delineating any changes in target parameter contaminant levels for each boundary well that shows changes in groundwater quality, as specified in the Alternate Program plan required in Order number 3 of these Orders; and changes in plume boundary configurations or concentrations related to the Routine System wells as determined by OU 5 data from

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the previous calendar year.

h. The Respondent shall provide Ohio EPA electronic access to the environmental databases for the site.

3. Within forty-five (45) days from the effective date of these Orders, the Respondent shall submit a plan to Ohio EPA for its Alternate Program. The plan shall incorporate both the Routine Property Boundary Groundwater Monitoring Program and appropriate portions of the OU 5 RI/FS Work Plans. The assessment monitoring portion of the plan shall be analogous to the plan required by OAC rule 3745-65-93(D)(3) and shall contain an identification of the wells included in the Routine System; a well construction diagram for each well; a sampling and analyses plan meeting the requirements of OAC rule 3745-65-92(A); a sampling schedule and parameter list including target analyte metals, radionuclides, water quality parameters and volatile organic compounds; a description of the RSE/Removal Action process for addressing potential immediate risks to human health and the environment that may be identified through reviewing and evaluating groundwater monitoring data; a list of items that will be contained in the annual groundwater monitoring report; and a description of how compliance with the OAC rules required in Order number 1. and the conditions of Order number 2., above will be achieved.

4. If the Ohio EPA provides the Respondent with a written statement of deficiencies in the Alternate Program plan, the Respondent shall modify the plan or submit a new plan for approval that addresses the deficiencies within thirty (30) days of receiving such a written statement.

5. The Respondent shall determine to Ohio EPA's satisfaction the full nature, rate and extent of contaminant migration prior to implementation of any remedial design.

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6. Future site activities may necessitate changes to the approved Alternate Program plan including but not limited to activities such as the duration of monitoring, sampling frequency, and sampling parameters and locations. No such changes or modifications shall be made by the Respondent without written notification to and written approval of Ohio EPA. Any notification of proposed changes to the Alternate Program under this section shall set forth the nature and basis for the proposed changes or modifications to the approved Alternate Program plan

7. The Respondent, by its acceptance of this exemption, agrees to comply with all conditions of the exemption and acknowledges that the Respondent's failure to so comply may result in immediate revocation of this exemption and further legal action by Ohio EPA. The Respondent also acknowledges this exemption may be revoked upon finding that such revocation is necessary to protect the public health or safety or the environment.

VI. MODIFICATIONS

These Orders may be modified by the Director upon written notification to the Respondent. The notification shall set forth the nature and basis for any modifications.

VII. RESERVATION OF RIGHTS

Nothing contained herein shall be construed to prevent Ohio EPA from seeking legal or equitable relief to enforce the terms of these Orders or from taking other authorized administrative, legal or equitable action as deemed appropriate and necessary against the Respondent for noncompliance with these Orders. Nothing herein shall be construed as an admission by Respondent or its co-operator or otherwise restrict the right of the Respondent or its co-operator to raise any administrative, legal or equitable claim or defense with respect to such further actions which the Ohio EPA may seek to require of the Respondent. Nothing in these Orders shall be construed to limit the authority of Ohio EPA to seek relief for violations not addressed in these Orders.

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In addition, no provision in this Order shall be interpreted to require obligation or payment of funds in violation of the of the Anti-Deficiency Act, 31 U.S.C. 1341.

VIII. TERMINATION AND SATISFACTION

These Orders shall terminate: (1) when the Respondent demonstrates in writing and certifies to the satisfaction of Ohio EPA that all obligations under these Orders have been performed and the Ohio EPA Division of Hazardous Waste Management acknowledges, in writing, the Ohio EPA's acceptance of this demonstration and certification; or (2) upon notification that the Respondent is no longer required to maintain the groundwater monitoring systems at the FEMP.

The certification required under this Section shall be signed by a responsible official of the Respondent. The certification shall make the following attestation: "I certify that the information contained in or accompanying this certification is true, accurate and complete."

IX. EXPIRATION

These Orders shall expire upon the effective date of any state-issued post-closure permit for the Facility .

IX. SIGNATORIES

Each signatory to these Orders certifies that he or she is fully authorized to enter into these Orders and to legally bind such signatory to this document.

IT IS SO ORDERED:

Donald R. Schregardus
Director

SEP 10 1993
Date

I certify this to be a true and accurate copy of the official document as filed in the records of the Ohio Environmental Protection Agency.

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X. WAIVER

The Respondent agrees that these Orders are lawful and reasonable and that the schedules provided herein are reasonable. The Respondent agrees to comply with these Orders. Compliance with these Orders shall be in full accord and satisfaction for the Respondent's and FERMCO's potential liability for any alleged violations of those specific OAC rules outlined in Order number 2 which may have occurred since December 20, 1991 or which occur at the Facility until the date that these Orders terminate or expire.

Except as provided in Section VII, above, the Respondent hereby waives the right to appeal the issuance, terms and service of these Orders and it hereby waives all rights its might have to seek judicial or administrative review of said Orders either in law or equity. The Respondent expressly waives any and all rights it has to request an adjudication hearing of any proposed revocation of these Orders or to appeal any final action of the Director revoking these Orders.

Notwithstanding the preceding, the Ohio EPA and the Respondent agree that in the event that these Orders are appealed by any other party to the Environmental Board of Review, or any court, the Respondent retains the right to intervene and participate in such appeal. In such event, the Respondent shall continue to comply with these Orders notwithstanding such appeal and intervention unless these Orders are stayed, vacated, or modified.

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IT IS SO AGREED:

U.S. Department of Energy

By Raymond J. Hannon Date September 10, 1993

Title Acting Manager

Fernald Environmental Restoration Management Corporation

By MCR Date 9/10/93

Title President FERMCO

Ohio Environmental Protection Agency

Donald R. Schregardus Date SEP 10 1993

I certify this to be a true and accurate copy of the official document as filed in the records of the Ohio Environmental Protection Agency.

By: Mary Cavin Date 9-10-93

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