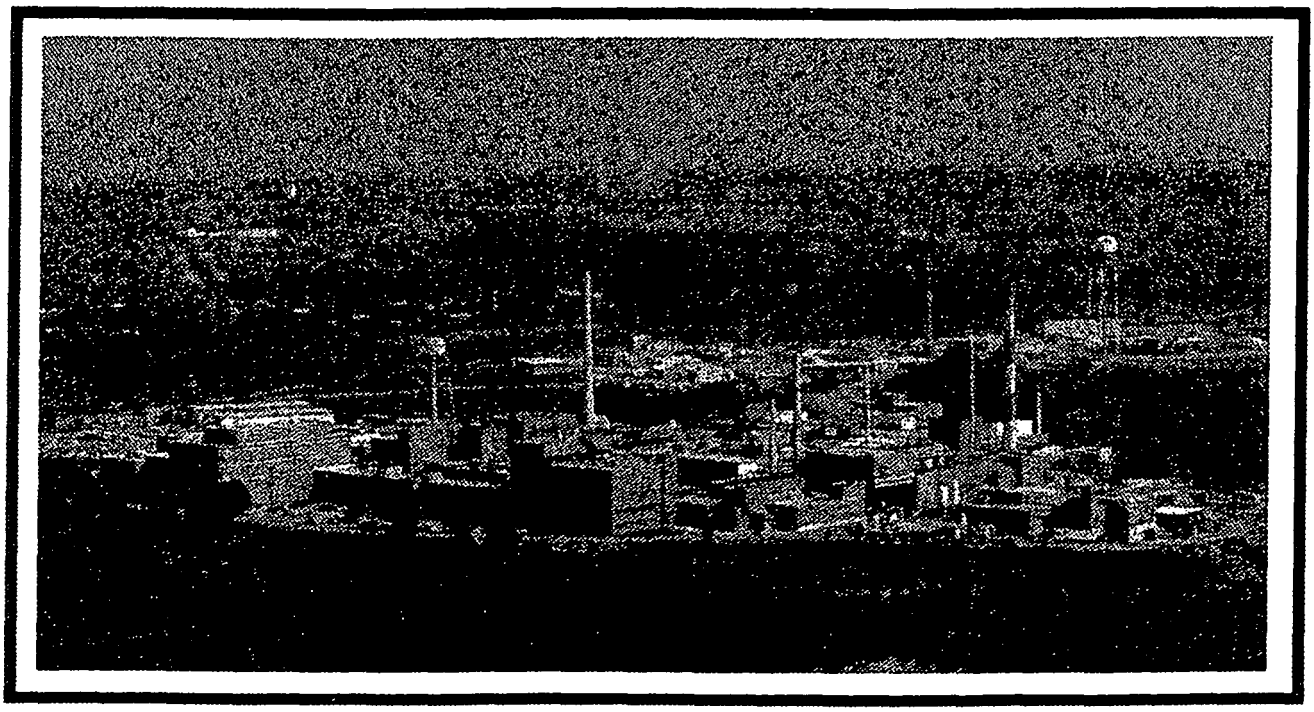
EG&G MOUND-30-03-04-02--9607080109

MOUND

Environmental
Restoration
Program

# MOUND PLANT
## Potential Release Site Package
## PRS # 1/2/3/4/5/6

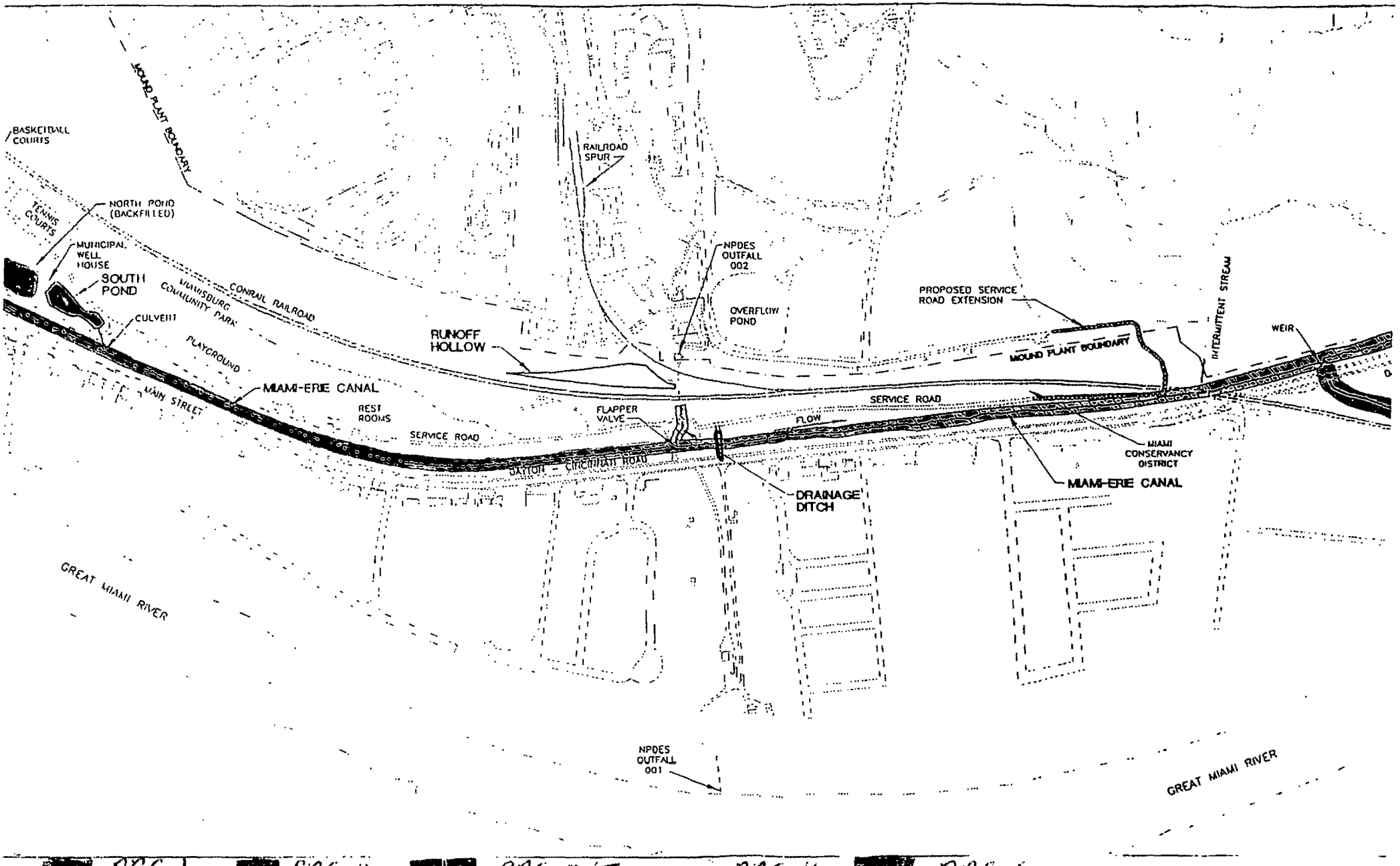



# MOUND PLANT

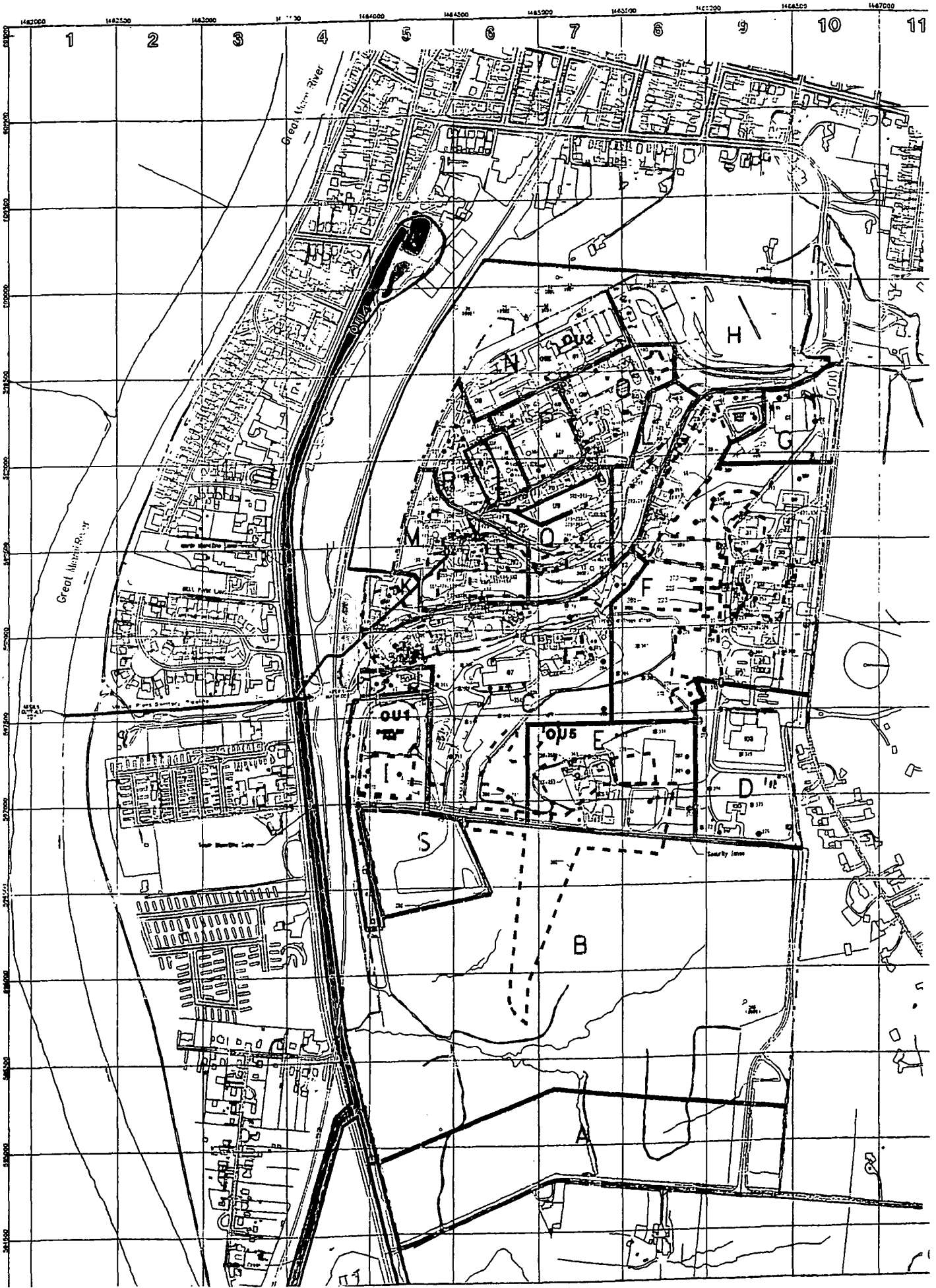
# OPERABLE UNIT 4

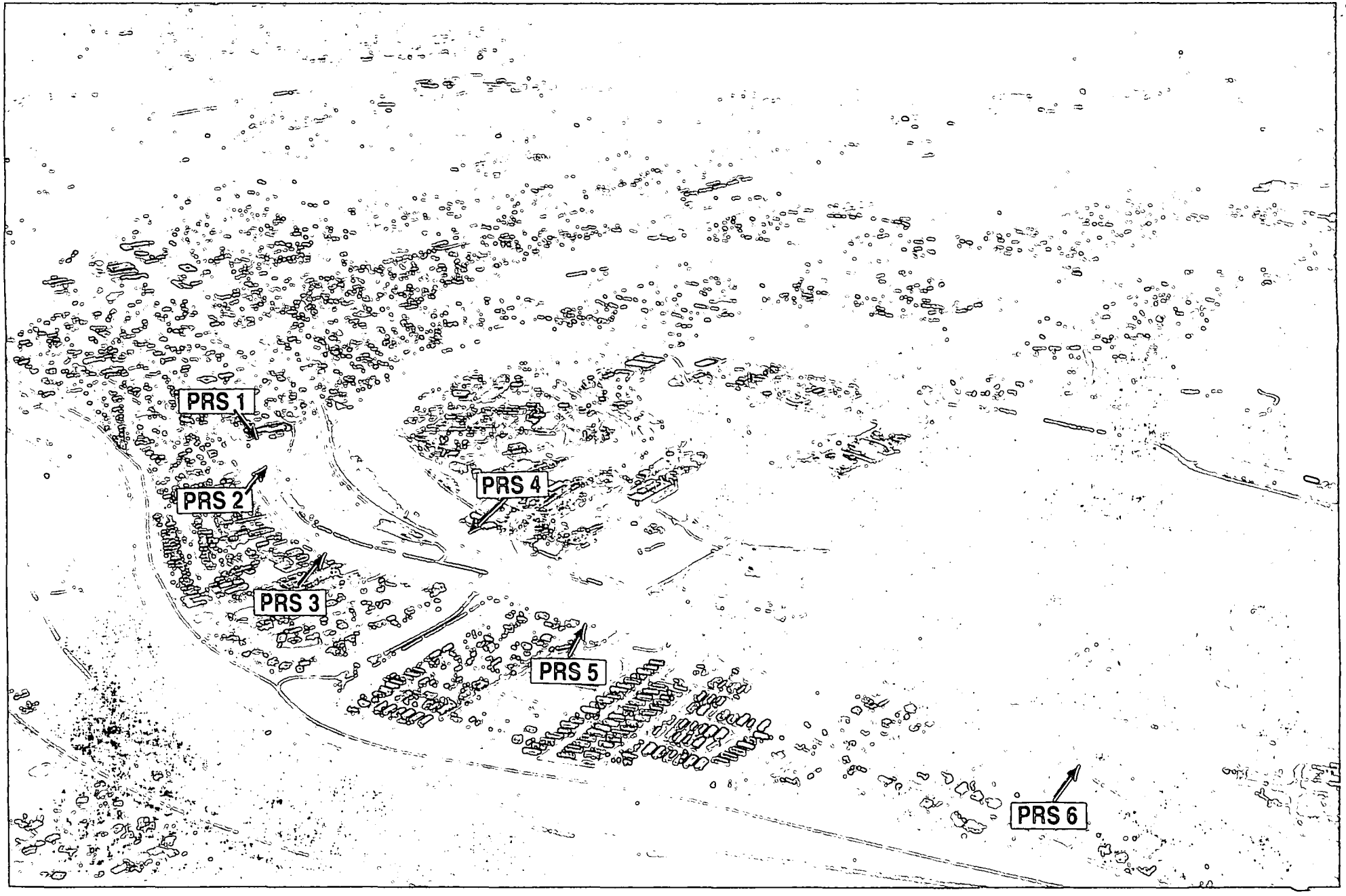
# Potential Release Site

# PRS 1/2/3/4/5/6




PRS 1 PRS 2 NS PRS 3/5 PRS 4 PRS 6


1
2
3
4
5
6
7
8
9
10
11
Great Miami River
Great Miami River
OU4
OU2
OU1
OU5
H
N
G
M
Q
F
K
C
E
D
S
B
A


PRS 1
PRS 2
PRS 3
PRS 4
PRS 5
PRS 6

# PRS 1/2/3/4/5/6

## PRS HISTORY:

PRS's 1 through 6 refers to the Miami-Erie Canal area within the City of Miamisburg and west of the Mound Plant boundary. The respective PRS's include: 1-North Pond, 2-South Pond, 3-North Canal, 4-runoff hollow, 5-South Canal, and 6-overflow creek. In January 1969, an underground pipeline leading from the plutonium processing building to the waste disposal building ruptured, releasing plutonium nitrate solution to the surrounding soils. The waste transfer system was shutdown and removal of the contaminated soil commenced; however, three days of intense rainfall occurred during the excavation efforts. Erosion from the excavated areas carried plutonium-238 (Pu-238) contaminated soil particles down the plant drainage ditch and off Mound Plant property. Contaminated soil particles and surface water runoff were discharged directly to the Miami-Erie Canal.[2]

## PROCESS DESCRIPTION:

No Mound radioactive or hazardous waste generating processes are located in the area of these PRS's. The area is outside the boundary of the Mound Plant.

## CONTAMINATION:

The primary contaminant of concern is Pu-238 with a maximum recorded concentration of 4,560 pCi/g. The OU4, Miami-Erie Canal Removal initiated in 1996 will include excavation of plutonium-238 contaminated soil from the North and South Canal.[2, 3, 8] Verification sampling will include the North(PRS 3) and South(PRS 5) Canal, the South Pond(PRS 2), the overflow creek(PRS 6) from the Canal to the Great Miami River, and the runoff hollow(PRS 4).[3, 8] A reference list of documents associated with the OU 4, Miami-Erie Canal Removal is attached.[4] A secondary isotope of concern was tritium; however a sampling program in 1992 indicated a maximum tritium level of 180 pCi/g which is well below the "Recreational" Cleanup Guideline value in soil of 450,000 pCi/g.[6]

Based upon sampling performed in 1974, PRS 1, North Pond, had a maximum contamination value of 22.3 pCi/g of Pu-238 which is well below the "stakeholder" agreed upon cleanup standard of 75 pCi/g. From 1977 through 1978, the City of Miamisburg converted the North Pond into a solar energy absorber to provide heat for the adjacent swimming pool. During this construction period, air monitoring was performed and the resulting dose equivalent estimates for workers were significantly less than DOE and proposed USEPA Guidance.[7] The North Pond was removed from service as a solar absorber in 1990, backfilled with soil from the area, and is no longer in existence today.[3] Although no direct information concerning chemical contaminants exists for the North Pond, extensive sampling data from 1990 is available concerning the South Pond which indicated the chemical sampling results were within regulatory limits.[5] The North Pond received it's water from the South Pond which would result in similar chemical characteristics of both the North Pond and South Pond sediments.

**READING ROOM REFERENCES:**

1) OU9, Site Scoping Report: Volume 12 - Site Summary Report, Final December 1994. (pages 6-8)
2) Rogers 1975 "Mound Laboratory Environmental Plutonium Study, 1974". (pages 9-17)
3) Removal Action Memorandum, OU4, Miami-Erie Canal, Final, May 1995. (pages 18-22)
4) Removal Action Work Plan, OU4, Miami-Erie Canal, Draft, (Revision 1), August 1995. (pages 23-24)
5) Halford 1990 "Results of South Pond Sampling". (pages 25-29)
6) Special Canal Sampling Report, OU4, Miami-Erie Canal, Final, July 1993. (pages 30-36)

**OTHER REFERENCES:**

7) Environmental Monitoring During Construction of the Miamisburg Solar & Fishing Ponds, Farmer and Carfagno, June 1979. (pages 37-41)
8) Design Memorandum, OU4, Miami-Erie Canal, 30% Phase, Working Draft, December 1995. (pages 42-43)

**PREPARED BY:**

Gerald F. Maul, Member of EG&G Technical Staff

# MOUND PLANT
# PRS 1/2/3/4/5/6
# MIAMI-ERIE CANAL AREA

## RECOMMENDATION:

The contaminant of concern for these Potential Release Sites (PRSs) is Plutonium-238. The North Pond had a maximum Pu-238 concentration level of 22 pCi/g which is below the As Low As Reasonably Achievable (ALARA) goal of 25 pCi/g and the 75 pCi/g stakeholder agreed upon canal cleanup standard. The North Pond received its water from the South Pond, therefore other contamination would have come from the South Pond. Extensive sampling of the South Pond indicated that there was no other chemical contamination that could have migrated to the North Pond, therefore PRS 1, North Pond, requires NO FURTHER ASSESSMENT. PRSs 2/3/4/5/6 are being addressed under the OU4, Miami-Erie Canal Removal Action which includes the removal of contaminated soil and complete verification for radiological and chemical contaminants to the stakeholder agreed upon clean-up standard; therefore PRSs 2/3/4/5/6 require NO FURTHER ASSESSMENT.

## CONCURRENCE:

DOE/MB: _____
Arthur W. Kleinrath, Remedial Project Manager (date)

USEPA: _____ 5/8/96
Timothy J. Fischer, Remedial Project Manager (date)

OHIO EPA: _____ 5/8/96
Brian K. Nickel, Project Manager (date)

## SUMMARY OF COMMENTS AND RESPONSES:

Comment period from _____ to _____.

- ☐ No comments were received during the comment period.
- ☐ Comment responses can be found on page_____ of this package.

# REFERENCE MATERIAL
# PRS 1/2/3/4/5/6

Document Control No. _____

Environmental Restoration Program

# OPERABLE UNIT 9 SITE SCOPING REPORT: VOLUME 12 – SITE SUMMARY REPORT

## MOUND PLANT
## MIAMISBURG, OHIO

December 1994

**Final**

**U.S. Department of Energy**
**Ohio Field Office**


EG&G Mound Applied Technologies

## Table A.1. Comprehensive Tabulation of Potential Release Sites

| Description of History and Nature of Waste Handling | | | | | | Hazardous Conditions and Incidents | | | Environmental Data | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | Site Name | Location | Status | Potential Hazardous Substances | Ref. | Releases | Media | Ref | Analytes* | Results | Ref |
| 1 | Miami-Erie canal (north pond) | C-5 | Historical | Plutonium-238, tritium | 1, 8, 5 | Plutonium-238<br>Tritium | S, SW | 10<br>19 | 13 | Table B.9 | 18, 19 |
| 2 | Miami-Erie canal (south pond) | C-5 | Waters of the U.S. | | | | | | 3, 13 | Tables B.6, B.7, B.8, B.9, and B.11 | 15<br>19 |
| 3 | Miami-Erie canal (north canal) | D-4 E-4 F-4 G-4 | Waters of the U.S. | | | | | | 2, 3, 4, 5, 6, 13, 16 | Tables B.6, B.7, B.8, B.9, and B.10 | 16 |
| 4 | Miami-Erie canal (runoff hollow) | G-4 | Tributary Drainage | | | | | | 13 | Table B.9 | 18, 19 |
| 5 | Miami-Erie canal (south canal) | I-4 J-4 K-4 L-4 | Waters of the U.S. | | | | | | 2, 3, 4, 5, 6, 13, 16 | Tables B.9 and B.10 | 16 |
| 6 | Miami-Erie canal (overflow creek) | M-4 N-4 | Waters of the U.S. | | | | | | 13 | Table B.9 | 16 |
| 7 | Plant Sanitary Pipeline | H-5 I-3 I-4 | In service | Plutonium-238 | | Suspected | S | 4 | 16 | see item 88 | 20 |
| 8 | Site Sanitary Landfill | I-5 | Historical | Contaminants listed under Historic Landfill | 4, 5, 18 | None Suspected | | | No Data | | |
| 9 | Area 18, Site Sanitary Landfill Cover | I-5 | In service | Plutonium-238<br>Thorium | 1, 18 | | | | 2, 3, 4, 5, 6, 10, 11, 14, 16 | Table B.1 (Table IV.7 in Ref. 6) Tables B.6, B.7, B.8 and B.9 | 6, 24 |
| 10 | Historic Landfill | I-4 I-5 | Historical | Administrative and laboratory trash<br>Beryllium, Mercury, Nickel carbonyl, Trichloroethene, carbon tetrachloride, Lithium hydride, Benzene, Alcohol, Acetone, Polychlorinated biphenyl oils, Waste antifreeze, Waste oil, Paints, Solvents, Photo-processing solutions, Plating solutions<br>Sediment from plant drainage ditch<br>Bioassay samples<br>Scintillation "cocktails" | 1, 4, 5, 18 | Suspected VOCs | GW, S | 4, 18 | 14<br>2, 3, 4, 5, 6<br>3 | Table B.9 (Table IV.7 in Ref. 6)<br>Tables B.6, B.7, B.8 and B.9 | 6<br>24 |

1 - Soil Gas Survey - Freon 11, Freon 113, Trans-1,2-Dichloroethylene, Cis-1,2-Dichloroethylene, 1,1,1-Trichloroethane, Perchloroethylene, Trichloroethylene, Toluene
2 - Gamma Spectroscopy - Thorium-228, -230, Cobalt-60, Cesium-137, Radium-224, -226, -228, Americium-241, Actinium-227, Bismuth-207, Bismuth-210m, Potassium-40
3 - Target Analyte List
4 - Target Compound List (VOC)
5 - Target Compound List (SVOC)
6 - Target Compound List (Pesticides/Polychlorinated Biphenyl)
7 - Dioxins/Furans
8 - Extractable Petroleum Hydrocarbons (EPH)/Total Petroleum Hydrocarbons (TPH)
9 - Lithium
10 - Nitrate/Nitrite
11 - Chloride
12 - Explosives
13 - Plutonium-238
14 - Plutonium-238, Thorium-232
15 - Cobalt-60, Cesium-137, Radium-226, Americium-241
16 - Tritium

Reference List


1. DOE 1986 "Phase I: Installation Assessment Mound (DRAFT)."
2. DOE 1992a "Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan (Final)."
3. DOE 1992c "Mound Plant Underground Storage Tank Program Plan & Regulatory Status Review (Final)."
4. DOE 1993a "Site Scoping Report: Vol. 7 - Waste Management (FINAL)."
5. EPA 1988a "Preliminary Review/Visual Site Inspection for RCRA Facility Assessment of Mound Plant"
6. DOE 1993d "Operable Unit 9, Site Scping Report: Vol. 3 - Radiological Site Survey (FINAL)."
7. DOE 1993c "Operable Unit 3, Misc. Sites Limited Field Investigation Report."
8. DOE 1992d "Reconnaissance Sampling Report Decontamination & Decommissioning Areas, OU6, (FINAL)."
9. Fentiman 1990 "Characterization of Mound's Hazardous, Radioactive and Mixed Wastes."
10. DOE 1992f "Operable Unit 9, Site Scpoing Report: Vol. 9 - Spills and Response Actions (FINAL)."
11. Styron and Meyer 1981"Potable Water Standards Project: Final Report."
12. DOE 1993b "Reconnaissance Sampling Report - Soil Gas Survey & Geophysical Investigations, Mound Plant Main Hill and SM/PP Hill (FINAL)."
13. DOE 1993d "Operable Unit 9, Site Scoping Report: Vol. 3 - Radiological Site Survey (FINAL)."
14. DOE 1991b "Main Hill Seeps, Operable Unit 2, On-Scene Coordinator Report for CERCLA Section 104 Remedial Action, West Powerhouse PCB Site."
15. Halford 1990 "Results of South Pond Sampling."
16. DOE 1993e "Operable Unit 4, Special Canal Sampling Report, Miami Erie Canal."
17. DOE 1990 "Preliminary Results of Reconnaissance Magnetic Survey of Mound Plant Areas 2, 6, 7, and C."
18. DOE 1992a "Remedial Investigation/Feasibility Study, Operable Unit 9, Site-Wide Work Plan (FINAL)."
19. Rogers 1975 "Mound Laboratory Environmental Plutonium Study, 1974."
20. DOE 1992h "Ground Water and Seep Water Quality Data Report Through First Quarter, FY92."
21. Dames and Moore 1976a, b "Potable Water Standards Project Mound Laboratory" and "Evaluation of the Buried Valley Aquifer Adjacent to Mound Laboratory."
22. DOE 1992i "Closure Report, Building 34 - Aviation Fuel Storage Tank."
23. DOE 1992j "Closure Report, Building 51 - Waste Storage Tank."
24. DOE 1994 "Operable Unit 1, Remedial Investigation Report."
25. EG&G 1994 "Active Underground Storage Tank Plan."

MLM-2249

# Mound Laboratory

# Environmental Plutonium Study

# 1974

*D. R. Rogers*

September 15, 1975

MOUND
Miamisburg, Ohio 45342
operated by
MONSANTO RESEARCH CORPORATION
a subsidiary of Monsanto Company
for the
U. S. DEPARTMENT OF ENERGY
Contract No. DE-AC04-76-DP00053

Monsanto

## SUMMARY

In 1974, Mound Laboratory found that the sediment in certain waterways near the laboratory site appeared to exhibit plutonium-238 concentrations higher than the expected baseline levels. As a result, Mound Laboratory initiated a comprehensive environmental plutonium-238 study to determine the full extent of the contamination, the cause and mechanisms of the release, and the health and safety impact of these deposits on the public.

During the plutonium-238 environmental survey program, over 1750 soil, sediment, biota, water, and air samples were collected in the off-site areas and analyzed for plutonium-238. From these data, it was determined that about 5.2 curies of plutonium-238 are deposited in these waterways, mostly buried under up to 3 ft of sediment.

The plutonium-238 was found to be strongly sorbed and fixed onto the sediment. Autoradiographic analysis indicated very little, if any, particulate forms of plutonium. The solubility of the plutonium/sediment in the natural surface water is very low; only about one part per one hundred thousand parts of the plutonium is soluble in canal water. The maximum concentration in the water sampled from the waterways is about 0.00001 nCi/g. The highest subsurface sediment concentration is 4.56 nCi/g at a 3 or 4 ft depth in a localized area. The plutonium-238 concentration in samples of the biota was found to be very low.

The plutonium-238 concentrations in land areas contiguous to the waterways are at or below baseline levels (<0.0004 nCi/g).

An intensive investigation identified the cause of the plutonium-238 deposits and the mechanisms of the release, transport and deposition into these off-site waterways. Experimental laboratory studies and field observations were used to verify these mechanisms.

In January, 1969, an underground pipeline carrying plutonium-238 waste solution from the Plutonium Processing (PP) Building to the Waste Disposal Facility (WD) ruptured. Acidic waste solution containing plutonium-238 was released to the soil adjacent to the pipe. The plutonium was quickly and strongly sorbed by the soil where it was immobilized. During the excavation and repair operations, when the contaminated soil was most susceptible to erosion, the weather warmed, and intense rain was experienced for two days. This heavy rain eroded the exposed surface of the contaminated soil causing the soil particles to be carried off-site. These erosion products, suspended in the moving water, settled according to normal sedimentation processes in the waterways adjacent to Mound Laboratory. Water sampling performed during this occurrence failed to detect this movement because the plutonium was in the sediment.

The health and safety aspects of the plutonium-238 sediment deposits were evaluated under the prevailing conditions and under credible worst-case future conditions.

The evaluation under prevailing conditions was performed considering the measured concentrations of plutonium-238 in air, water, vegetation, fish, soil and sediment and the physical conditions and circumstances prevalent in this specific area. The air and water data were compared with existing Radioactivity Concentration Guides (RCG) for plutonium-238. The biota was evaluated by determining the amount of each of the materials which would have to be ingested to receive 1/70 of a permissible body burden per year. It was concluded that the air and water concentrations are at safe levels (substantially below RCG). Due to the physical and chemical properties of the area and the sediment, the present air and water concentrations are not likely to be significantly higher in the future under prevalent conditions. The amount of the other materials which would have to be ingested to lead to a potential uptake of 1/70 of a permissable body burden per year is too large to be of concern. Overall, these plutonium-238 deposits, therefore, were evaluated and found to present no hazard to the public under the prevalent conditions which presently existed in this area.

Anticipating that future conditions may change, comprehensive pathway analyses were performed, assuming credible worst-case conditions associated with each of the several ingestion, absorption, and inhalation pathways considered. From these pathway analyses, *Sediment Concentration Decision Guides* were estimated using methods and philosophies similar to those used for RCG deviations. The maximum available, potentially available, and worst-case credible plutonium-238 sediment/soil concentrations found in and around these waterways were compared with these decision guides.

On the basis of this analysis, the concentrations of plutonium in the sediment are not expected to present a hazard to the public in the future.

## II. TOPOGRAPHY, HYDROLOGY AND DESCRIPTION OF THE AREA

Mound Laboratory is situated on a topographically high area overlooking Miamisburg, the Great Miami River, and the river plain area to the west. Figure 4 shows the topography in the general area.

The 180-acre laboratory site is basically located on two hills of about 880 ft elevation and a valley between with an elevation of about 705 ft. The site topography and facilities are shown in Figure 5. The Plutonium Processing Facility (SM-PP) is on the southeast hill while the Plutonium Research Facility (R Building) and the Waste Disposal (WD) and Sewage Disposal (SD) facilities are on the northwest hill.

A drainage ditch flows continuously through the on-site valley generally from east to west and is the major surface hydrological artery for carrying surface run-off water from the site (Figure 6). This drainage ditch flows off the site on the western side through a culvert under a raised railroad grade which runs generally north-south along the western boundary of the laboratory. Since 1971, Mound Laboratory has had an automatic flow measurement weir and an environmental sampling station on the drainage ditch just before it flows off-site (Figure 7). After the drainage ditch passes under the railroad grade, it flows to an abandoned section of the old Miami-Erie Canal. Part of the water is diverted north through pipes under an earthen dam into the North Canal while the remainder of the water flows around a make-shift dam into the South Canal (Figures 8, 9, and 10). These two sections of the old Miami-Erie Canal extend north and south (2500 ft north and 2700 ft south) of the drainage ditch/canal confluence as shown in Figure 11. The canal bed is approximately 40 ft wide and 5 to 10 ft deep relative to the bank height. It was constructed in the 19th Century as a commercial transportation barge canal and abandoned in 1913.

The North Canal, immediately north of the earthen dam, is a high sedimentation area and contains 5 ft or more of sediment. Turbulent water, heavily laden with erosion products from the drainage ditch, passes through the pipes in the earthen dam and encounters calm water and a heavy growth of cattail reeds which tends to cause laminar flow (Figure 12). Under the less turbulent flow condition, a large percentage of the erosion products settle out and deposit. In a short distance, ~100 to 200 ft, the canal gets wider and deeper. At the northern end of the North Canal (Figure 13), the water is again diverted by an earthen dam and an underground pipe into the South Pond (Figure 14). The water flows north from the South Pond (which consists of a north and south basin) and into the North Pond (Figure 15) where the excess is carried off through a standpipe drain into the underground Mound Street storm sewer which carries the water directly to the river.

Under very high flow conditions, water in the North Canal flows through a notch in the earthen weir and can be released to the Mound Street storm sewer directly by opening a sewer gate at the north end of the canal (Figure 13). The North Canal and ponds remain under water at all times.

The maximum sediment "very surface" values found in each of the waterways is presented in Table 2. As can be seen, the values vary from 0.02 to 0.45 nCi/g depending on the location. This range of values was found to be in agreement with shallow surface scoop samples taken by Mound Laboratory, U. S. EPA, and HASL in sediment areas not covered with water.

Table 2

MAXIMUM "VERY SURFACE" $^{238}$PU CONCENTRATION OF SEDIMENT IN WATERWAYS NEAR MOUND LABORATORY

| Waterway | Maximum "Very Surface" Concentration (nCi/g ± 2σ) |
|---|---|
| Runoff Hollow | 0.0286 ± 0.0061 |
| North Pond | 0.0223 ± 0.0051 |
| South Pond | |
| North Basin | 0.0653 ± 0.0114 |
| South Basin | 0.208 ± 0.028 |
| North Canal | 0.267 ± 0.033 |
| Drainage Ditch | 0.450 ± 0.050 |
| South Canal | 0.395 ± 0.045 |
| Overflow Creek | 0.270 ± 0.034 |

The maximum "very surface" concentrations along the immediate banks of the waterways which are subject to occasional flooding are presented in Table 3 for each of the waterways. The values were taken from shallow surface soil samples and tended to range from 0.002 to 0.06 nCi/g.

## Radiochemical Analysis

Table 7

MAXIMUM FIRST-FOOT $^{238}Pu$ CONCENTRATIONS
OF SEDIMENT IN WATERWAYS

| Waterway | Maximum First-Foot Concentration (nCi/g ± 2σ) |
|---|---|
| Runoff Hollow | 0.0314 ± 0.0066 |
| North Pond | 0.0062 ± 0.0019 |
| South Pond | |
| North Basin | 0.0309 ± 0.0065 |
| South Basin | 0.0096 ± 0.0027 |
| North Canal | 1.14 ± 0.10 |
| Drainage Ditch | 0.749 ± 0.013 |
| South Canal | 3.80 ± 0.25 |
| Overflow Creek | 0.0744 ± 0.0126 |
| River | |
| East Bank Near Canal Outfall | 0.0367 ± 0.0074 |
| East Bank Downstream | 0.0016 ± 0.0007 |
| Away from East Bank | 0.0003 ± 0.0002 |

## Radiochemical Analysis

Table 8

MAXIMUM ANY-DEPTH $^{238}Pu$ CONCENTRATIONS
OF SEDIMENT IN WATERWAYS

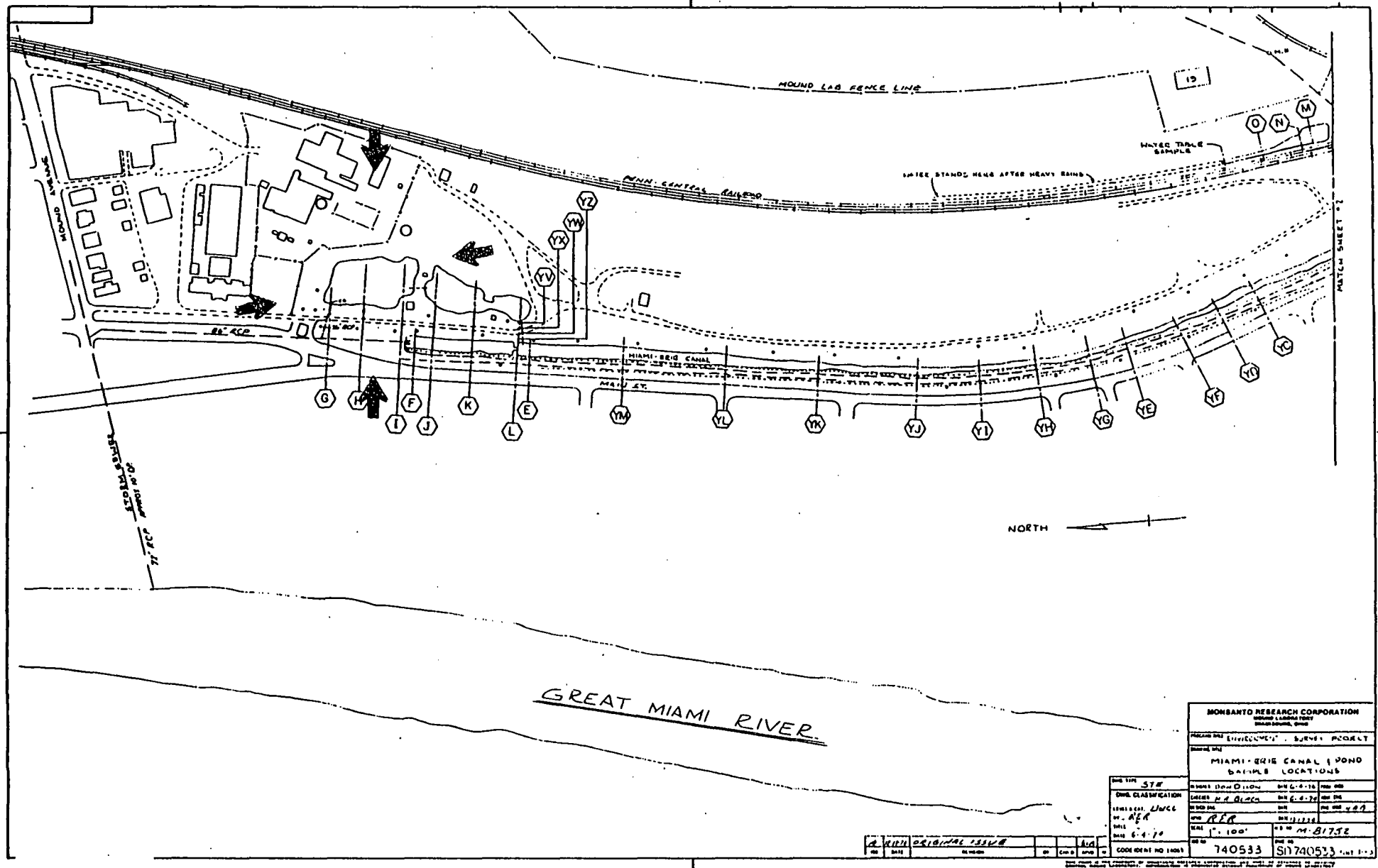
| Waterway | Depth (ft) | Maximum Any-Depth Concentration (nCi/g ± 2σ) |
|---|---|---|
| Runoff Hollow | 1 | 0.0314 ± 0.0066 |
| North Pond | 0 | 0.0223 ± 0.0051 |
| South Pond | | |
| North Basin | 0 | 0.0653 ± 0.0114 |
| South Basin | 0 | 0.208 ± 0.028 |
| North Canal | 3 | 4.56 ± 0.20 |
| Drainage Ditch | 1 | 0.749 ± 0.013 |
| South Canal | 1 | 3.80 ± 0.025 |
| Overflow Creek | 0 | 0.270 ±0.034 |
| River | | |
| East Bank Near Canal Outfall | 2 | 0.0415 ± 0.0081 |
| East Bank Downstream | 7 | 0.0037 ± 0.0013 |
| Away from East Bank | 4 | 0.0006 ± 0.0002 |

Unlike "very surface" concentrations that tended to be reasonably uniform within a given area, the plutonium deposited below the surface tends to be much more localized. These localized deposition patterns result from the nature of the transport and deposition mechanisms, which will be discussed in more detail later in this report.

The first-foot concentrations found in the North and South Canals, which vary greatly as a function of length and width, are shown in Figure 32. The concentration profiles across the canal that are presented are typical of many others measured. The highest concentrations are very localized near the middle of the South Canal.

Figure 33 shows the maximum concentrations (worst case) at any depth along or across the North and South Canals. The maximum levels occur just north of the earthen dam and midway down the South Canal.

## Radiochemical Analysis


MOUND LAB FENCE LINE
MINN. CENTRAL RAILROAD
WATER TABLE SAMPLE
WATER STANDS HERE AFTER HEAVY RAINS
MATCH SHEET #2
MIAMI-ERIE CANAL
MAIN ST.
MOUND AVENUE
NORTH
GREAT MIAMI RIVER
MONSANTO RESEARCH CORPORATION
MIAMI-ERIE CANAL & POND SAMPLE LOCATIONS
740533
SD 740533

# CORE SAMPLE RESULTS

| | |
|---|---|
| WATER | 0.00000004 (LFE) |
| SILT | 0.0116 (LFE) |
| GA1 | 0.0004 ± 0.0002 |
| GA2 | <0.0001 |
| GA3 | <0.0001 |
| GA4 | NOT DETECTABLE (LFE) |

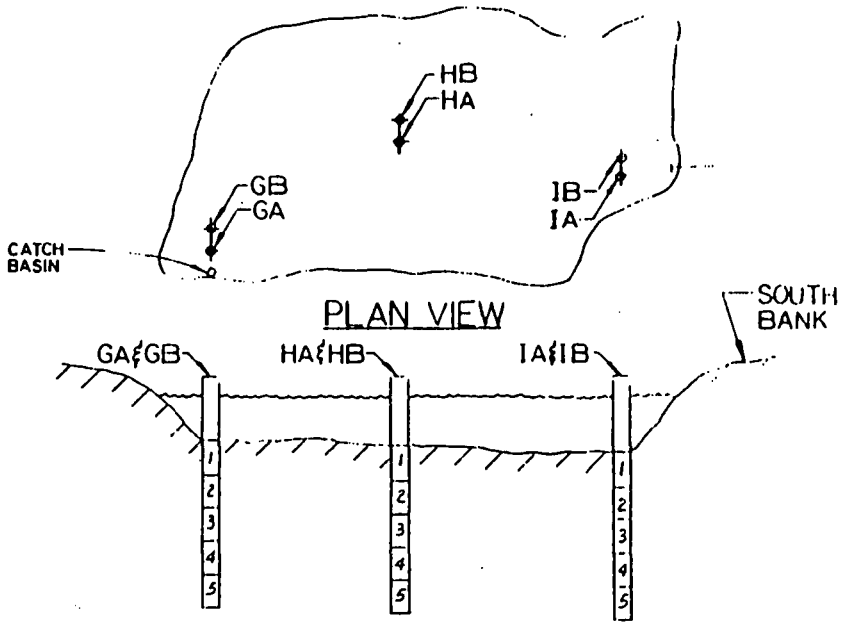
| | |
|---|---|
| WATER* | 0.0000004 (LFE) |
| SILT | 0.0188 (LFE) |
| IB1 | 0.0021 ± 0.0008 |
| IB2 | <0.0001 |
| IB3 | <0.0001 |
| IB4 | <0.0001 |
| IB5 | 0.0001 ± 0.0001 |

| | |
|---|---|
| WATER* | 0.0000001 (LFE) |
| SILT | 0.0178 (LFE) |
| GB1 | 0.0005 ± 0.0003 |
| GB2 | <0.0001 |
| GB3 | 0.0002 ± 0.0001 |
| GB4 | 0.0003 ± 0.0002 |
| CMPST | 0.0002 ± 0.0002 |

| | |
|---|---|
| WATER* | 0.000000(1 (LFE) |
| SILT | 0.0206 (LFE) |
| HA1 | 0.0047 ± 0.0016 |
| HA2 | <0.0001 |
| HA3 | <0.0001 |
| HA4 | <0.0001 |
| HA5 | 0.0006 ± 0.0003 |
| CMPST | 0.000366 (LFE) |

| | |
|---|---|
| WATER* | 0.0000002 (LFE) |
| SILT | 0.0222 (LFE) |
| HB1 | 0.0062 ± 0.0019 |
| HB2 | 0.0001 ± 0.0001 |
| HB3 | <0.0001 |
| HB4 | 0.0003 ± 0.0002 |
| HB5 | <0.0001 |
| CMPST | 0.000626 (LFE) |

| | |
|---|---|
| WATER* | 0.0188 29 (LFE) |
| SILT | 0.0223 (LFE) |
| IA1 | 0.0020 ± 0.0008 |
| IA2 | <0.0001 |
| IA3 | <0.0001 |
| IA4 | 0.0013 ± 0.0006 |
| IA5 | <0.0001 |
| CMPST | 0.0005 ± 0.0003 |




## CORE SECTIONS

NOTES:

1. FIRST LETTER INDICATES THE SAMPLE LOCATION REFER TO MRC DRAWING NO 50740533.
2. SECOND LETTER INDICATES WHERE SAMPLE CORE WAS OBTAINED AT THAT STATION
3. EACH NUMBER REPRESENTS A ONE (1) FOOT SECTION OF THE CORE AT THE INDICATED DEPTH.
4. ALL VALUES ARE IN NANOCURIES/GRAMS (nCi/g). NANOCURIES = $10^{-9}$ CURIES = 2220 DISINTEGRATIONS/MIN.
5. CMPST = COMPOSITE
6. * RESULTS ARE IN NANOCURIES/MILLILITER
7. LFE - ANALYSES PERFORMED BY LFE ENVIRONMENTAL ANALYSIS LABORATORY, RICHMOND, CALIFORNIA

MONSANTO RESEARCH CORPORATION
MOUND LABORATORY
MIAMISBURG, OHIO

PROGRAM TITLE: ENVIRONMENTAL SURVEY PROJECT

DRAWING TITLE: NORTH POND SAMPLE LOCATIONS "G-H&I"

DWG TYPE: STE

DWG CLASSIFICATION

LEVEL & CAT.

BY RLR

TITLE

DATE 6-19-74

CODE IDENT. NO 14065

DESIGNER [illegible] DATE 6-13-74

CHECKER H. A. H[illegible] DATE 6-19-74

DESIGN ENG DATE

APVD DATE

SCALE AS SCALED

WO NO AT-81752

JOB NO 740533

DWG NO SC740534 (1/2)

| NO | DATE | REVISIONS | BY | CHK'D | APVD |
|---|---|---|---|---|---|
| 1 | 7-3-74 | ORIGINAL ISSUE | | | MLH |

Environmental Restoration Program

# REMOVAL ACTION
# ACTION MEMORANDUM
# OPERABLE UNIT 4, MIAMI-ERIE CANAL

## MOUND PLANT
## MIAMISBURG, OHIO

**Final**

**May 1995**

**U.S. Department of Energy**
**Ohio Field Office**

EG&G Mound Applied Technologies

"NORTH POND EXCLUDED"

OU4 is defined as: 1) the abandoned Miami-Erie Canal west of Mound Plant; 2) the Overflow Creek, which connects the canal to the river; 3) the Drainage Ditch from the site boundary to the canal; 4) the Runoff Hollow between the Conrail tracks and Mound Plant; and 5) the South Pond in the Miamisburg City Park. The primary feature of OU4, and the main region of concern in this study, is a portion of the abandoned Miami-Erie Canal. The north-south trending canal area lies between the Conrail Railroad right-of-way to the east and the Dayton-Cincinnati Road to the west (see Figures 2.2 and 2.3).

Site land use is a combination of a city park, conservancy district, and the railroad right-of-way. The City of Miamisburg is immediately north and west of OU4, and includes the northern portion of the canal. The 1990 census of Miamisburg reported 17,834 residents.

The park, located immediately northeast of OU4, is used year-round, with a peak usage in the summer (swimming pool, basketball area, and tennis courts). Houses, a mobile home park, and light commercial businesses are located near the Overflow Creek and the west side of the northern portion of the canal.

Further details are available in the RSE (DOE 1993a) and EE/CA (DOE 1995a) reports.

### 2.1.3. Site Characteristics

The Miami-Erie Canal was constructed during the 1800s as a north-south transportation route, and abandoned in 1915. The segment of the canal within OU4, with the exception of the Miamisburg City Park, appears to have gone unmaintained since its abandonment. All of the South Canal and a portion of the North Canal is considered a floodplain.

Due to the elevated plant site, the Drainage Ditch from the Mound Plant to the canal is utilized for surface water runoff. This Drainage Ditch is the separation point between the North and South Canal. Originally, the runoff flowed both north and south along the canal. In 1976, a flapper valve was installed, eliminating discharges to the North Canal, but allowing flow from the North Canal to the South Canal. Currently, runoff flows from the site via the Drainage Ditch into the South Canal, and flows into the Overflow Creek which empties into the Great Miami River. The Great Miami River is approximately 2,000 feet from the plant's west fenceline.

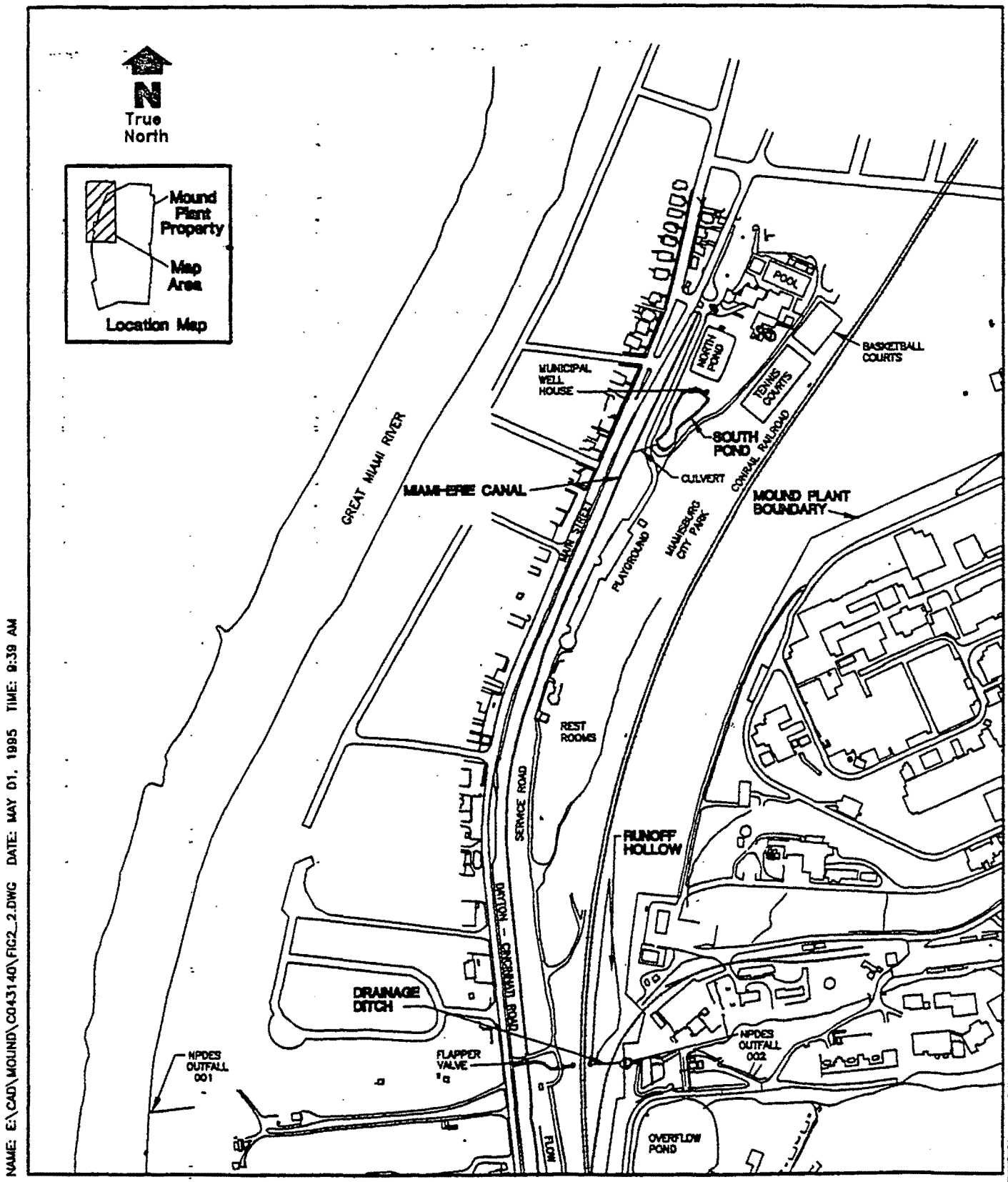



**Figure 2.2. Location of Miami-Erie Canal and Associated Waterways Within OU4 - Northern Half**

In the mid 1970s, an electric power plant was dismantled from a location adjacent to the pool and the rest of the area was converted to a city park. The northern portion of the North Canal is a city park in which two ponds and a municipal swimming pool were originally located. In 1977, the North Pond was converted for use as a solar heating pond for the swimming pool. The South Pond was deepened for use as a fishing pond. Excavated soil from the ponds was used as fill material beneath the nearby city park tennis courts and also stockpiled into two berms: one lying between the North Pond and the tennis courts, and the other between the tennis courts and the railroad tracks. Due to the extensive reconstruction work by the City of Miamisburg from May 1977 to October 1978, the remnant North Canal and the North and South Ponds became part of Miamisburg's City Park. No soil was removed from the park area during this reconstruction (Farmer and Carfagno 1979). From 1990 to 1993, the North Pond was removed from service, drained, and backfilled by the City of Miamisburg. During high water conditions, the South Pond can discharge via a culvert to the North Canal.

The City of Miamisburg has a sanitary sewer line buried within the North Canal. The sanitary sewer line runs approximately the entire length of the North Canal. At the northern end, it connects to a pump station in the City Park. At the south end, it connects to a line running under Cincinnati-Dayton Road, via another pumping station located immediately north of the Canal/Drainage Ditch intersection. Several manhole access risers protrude from the sanitary sewer line several feet above the canal bed.

The South Canal is overgrown and not as easily accessible as the North Canal. The South Canal supports a continual flow of water and is still used to drain surface water runoff from the plant. Water flowing from the Plant into the canal is monitored under an Ohio Environmental Protection Agency (OEPA) National Pollutant Discharge Elimination System (NPDES) permit.

For further detail regarding site characteristics, see the RSE, Section 1 (DOE 1993a) and the EE/CA, Section 2.2. (DOE 1995a).

### 2.1.4. Release or Threatened Release Into the Environment of a Hazardous Substance, or Pollutant or Contaminant

Historic operations and accidental releases from the Mound Plant have resulted in the discharge of contamination into the Miami-Erie Canal. The extent of this contamination consists primarily of plutonium and tritium. Although the potential for releases of non-radiological chemicals into the Drainage

## 9. RECOMMENDATION

This decision document represents the selected removal action for the Mound OU4 Miami-Erie Canal site in Miamisburg, Ohio, developed in accordance with CERCLA as amended by SARA, and consistent with the NCP. This decision is based on the administrative record for the site.

Because conditions at the site meet the NCP 40 CFR 300.415 (b)(2) criteria for a removal action, I recommend approval of the proposed removal action.

Approved:

Arthur Kleinrath 6/1/95

A. Kleinrath, DOE/MB Date

Disapproved:

_____ _____

A. Kleinrath, DOE/MB Date

Environmental Restoration Program

# REMOVAL ACTION WORK PLAN OPERABLE UNIT 4, MIAMI-ERIE CANAL

## MOUND PLANT
## MIAMISBURG, OHIO

**Draft (Revision 1)**

**August 1995**


**U.S. Department of Energy**
**Ohio Field Office**

EG&G Mound Applied Technologies

## 13. REFERENCES


ATSDR. 1993. "Health Consultation, DOE Mound Plant" Miami-Erie Canal and Miamisburg Community Park, Miamisburg, Ohio. Division of Health Assessment and Consultation, Agency for Toxic Substances and Disease Registry, September 29, 1993.

DOE. 1993a. "Special Canal Sampling Report, Miami-Erie Canal, OU4." [Final Revision 1], prepared for EG&G Mound Applied Technologies and the U.S. Department of Energy. July 1993.

DOE. 1993b. "Removal Site Evaluation, Operable Unit 4, Miami-Erie Canal." [Final Revision 3], prepared for the U.S. Department of Energy under Contract No. DE-AC04-88DP43495. May 1993.

DOE. 1993c. Letter from Michael Reker, Chief, ES&H Branch (DOE) to Diana Mally (USEPA) and Martha Hatcher (OEPA), April 12, 1993.

DOE. 1994. "Focused Risk Assessment, Mound Plant, Miami-Erie Canal, Operable Unit 4," MLM-3788, EG&G Mound Applied Technologies for the U.S. Department of Energy, September 1994.

DOE. 1995a. "Removal Action Engineering Evaluation/Cost Analysis, Operable Unit 4, Miami-Erie Canal." [Final Revision 1], prepared for the U.S. Department of Energy and EG&G Mound Applied Technologies. January 1995.

DOE. 1995b. "Removal Action Action Memorandum, Operable Unit 4 Miami-Erie Canal." [Final Revision 1] Prepared for the U.S. Department of Energy by EG&G Mound Applied Technologies. July 1995.

EPA. 1989."Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media," EPA/230/02-89/042 U.S. Environmental Protection Agency, 1989.

EPA. 1993. Letter from Diana Mally (USEPA) to Arthur Kleinrath (DOE/DAO) May 7, 1993.

OEPA. 1993. Letter from Martha Hatcher, Division of E&RR (OEPA) to Arthur Kleinrath (DOE/DAO), May 7, 1993.

Means. 1993. "Heavy Construction Cost Data," 7th Annual Edition, R.S. Means Co., Inc., Kingston, MA 1993.

Rogers, D.R. 1975. "Mound Laboratory Environmental Plutonium Study 1974." Monsanto Research Corporation Report Number MLM-2249. Prepared for the U.S. Energy Research and Development Administration. Miamisburg, Ohio. September 1975.

**OAK RIDGE NATIONAL LABORATORY**
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

GRAND JUNCTION OFFICE
P. O. BOX 2567
GRAND JUNCTION, COLORADO 81502

June 29, 1990

Dwain Farley
Technical Support Office, ER Program
Los Alamos National Laboratory, MS K485
P. O. Box 1663
Los Alamos, NM 87544

OU 4
DATA

Dear Mr. Farley:

Results of South Pond Sampling

The City of Miamisburg informed EG&G Mound in March 1990 that they intended to dredge the South Pond and use the material to fill the North (solar) Pond. Since the Miami-Erie Canal is an NPL site and there is a Memorandum of Understanding between Mound and the City of Miamisburg, the City was asked to delay the dredging until the South Pond could be sampled for hazardous chemicals and radioisotopes (Pu-238).

As requested by ER-TSO, EG&G Mound Applied Technologies, USEPA, OEPA, and USDOE, ORNL-GJ conducted sampling at the South Pond to determine the level of contaminants and, based on those results, if any special precautions were necessary when the City of Miamisburg dredges the pond. The results of sampling of the South Pond at Miami-Erie Canal on March 22-24, 1990 have been received and are discussed in Attachment I.

The following Attachments are enclosed:

- Attachment I: Discussion of South Pond Sampling Results
- Attachment II: Sampling Plan for South Pond
- Attachment III: Trip Report for South Pond Sampling and Field Notes
- Attachment IV: Additional Correspondence
- Attachment V: Results of Chemical Analyses
- Attachment VI: Results of Radioisotope Analyses

Please call me at FTS 326-6202 if you have questions or if you require additional information.

Sincerely,

Douglas K. Halford
Program Manager

Enclosures: as stated

cc: G. Laskar, DOE-AL
J. Lyons, DOE-DAO
R. Neff, EG&G MAT

## DISCUSSION OF SOUTH POND SAMPLING RESULTS

### TASK OBJECTIVES

The objectives for this task were to:

- Determine the presence of hazardous chemical and Pu-238 contamination in sediments and water samples collected from the South Pond at the Miami-Erie Canal (see Attachment II).

- Determine if chemical and Pu-238 contamination levels (if detected) are within regulatory guidelines (40 CFR 260-265 for chemicals; DOE Order 5400.XX and "U. S. DOE Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites, Revision 2" (March 1987) for Pu-238).

### SAMPLING

Originally, the Sampling Plan (Attachment II) specified that sediment samples would be taken to 5 foot depths and analyzed in one foot increments. However, due to compaction of the sediment and the depth of water in the South Pond, the field team, with approval from ER-TSO collected sediment samples to refusal (to a maximum of 3 feet) (Attachment III). The samples were then composited before being submitted for analyses. One sampler was left in the pond sediment and will be removed when the pond is drained (Attachment IV).

A total of 10 sediment samples (8 locations and 2 splits for triplicate), 3 surface water samples, 2 equipment rinses, 2 trip blanks and 1 field blank were collected and shipped to International Technology Corporation Analytical Services for analyses by Contract Laboratory Procedures (CLP) as specified by USEPA. Required chain of custody records were maintained and all specified holding times were followed. All samples were analyzed for VOA's (these were taken separately from other samples), pesticides, herbicides, BNA's, PCB's, metals, EP toxicity and Pu-238 (Attachments V and VI). Water samples were not filtered in the field.

### RESULTS OF CHEMICAL ANALYSES

Concentrations of analytes in all but two samples were within regulatory limits (see Attachment V). One sediment sample from location A4 (see Attachment III) contained Osmium at 53 ppm. Since this was the only sample which contained detectable levels of Osmium and there appears to be no use of Osmium at Mound, the same sample was reanalyzed by another laboratory with more sensitive methodology. The results indicated that Osmium levels were less than 4 ppm which is below the detection limit for CLP methods (see Attachment V). Therefore, it was concluded that Osmium was not present above regulatory guidelines or environmental levels in the South Pond.

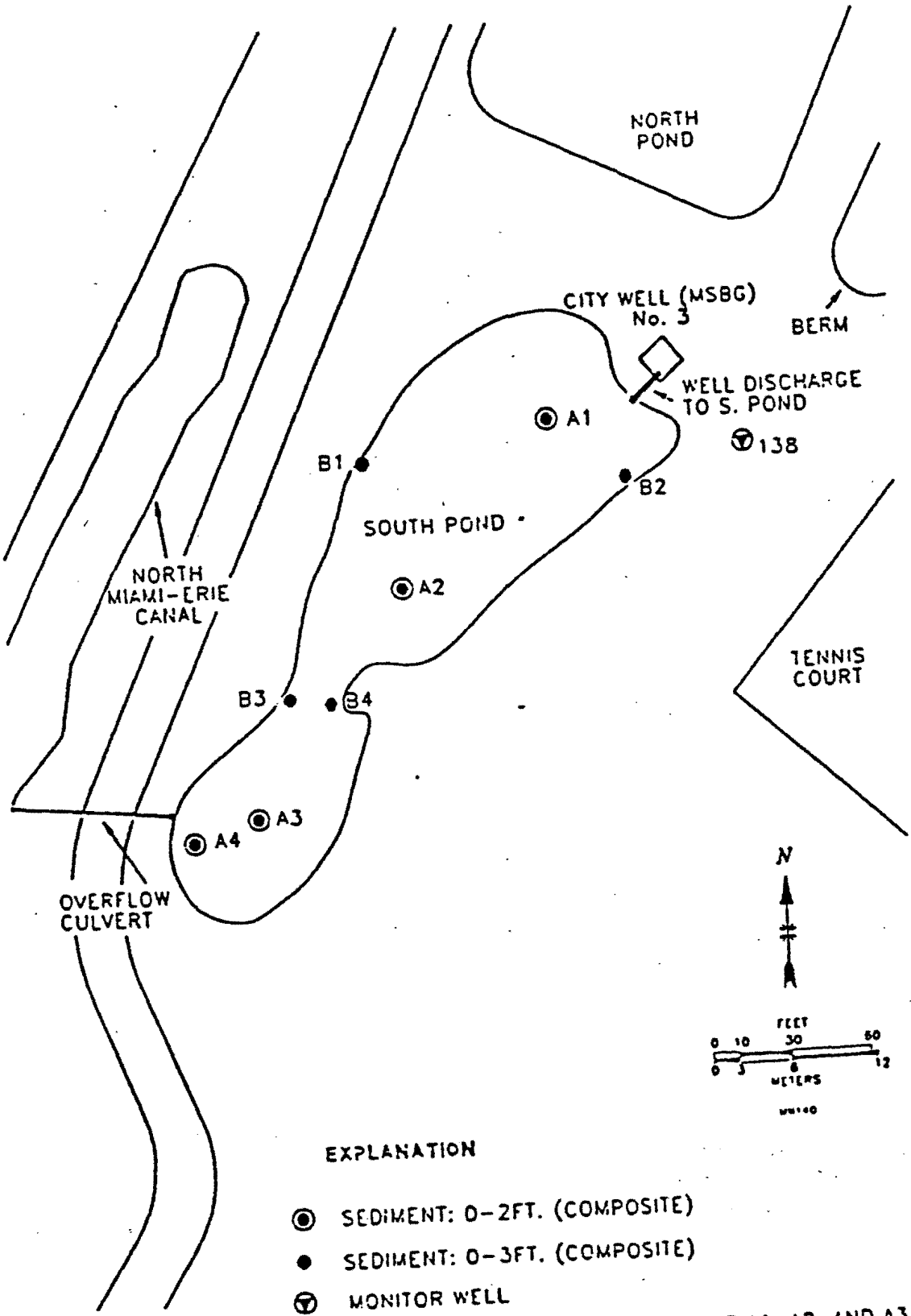
One water sample from location A1 (see Attachment II and III) contained a lead concentration of 27 ppb. However the presence of lead at 31 ppb in the equipment rinse and 19 ppb in the field blank indicates that this level is not unusual for the South Pond environment. To determine if the lead level reported in the water sample resulted from laboratory or sample contamination, additional water samples were collected by Mound personnel and analyzed for lead. Their results indicated <10 ppb in filtered water (2 samples) and <10 and 31 ppb in unfiltered water samples (Attachment V). Therefore it was concluded that lead was not present above environmental levels or regulatory guidelines in the South Pond.

## RESULTS OF RADIOISOTOPE ANALYSES

The results of Pu-238 analyses for sediment and water indicated that levels in these media were below the 100 pCi/g recommended clean up guideline and the 25 Pci/g guideline recommended for off facility areas (see FUSRAP and SFMP Guidelines, Revision 2, March 1987). The maximum concentration of Pu-238 in sediment and water was 2.05 Pci/g and 1.8 E-4 Pci/ml, respectively (see Attachment VI). If we assume ingestion of 36.5 g/year of sediment and 500 L/year of water (see EPA, 1989, "Exposure Factors Handbook", EPA/600/8-89-043) maximum effective dose equivalents would be <0.001 mRem/year and <0.01 Mrem/year, respectively. The inhalation dose would be <0.11 Mrem/year (see Dunning et. al, 1981, "Estimates of Internal Dose Equivalent to 22 Target Organs for Radionuclides Occurring in Routine Releases from Nuclear Fuel-Cycle Facilities, Vol. III", NUREG/CR-0150). All of these doses are based on worse case assumptions and ingestion or inhalation of maximum concentrations detected at the South Pond. Since these levels result in effective dose equivalents well below the 25 mrem/yr performance objectives for the protection of the public (DOE Order 5820.2A, 40 CFR 193), it was concluded that Pu-238 in the South Pond does not represent a hazard to the public.

## CONCLUSIONS

Based on the data analyses of the South Pond sediment, it can be concluded that concentrations of hazardous chemicals and Pu-238 are well below regulatory guidelines. Therefore it is recommended that it is not necessary for the City of Miamisburg to take special precautions during the dredging of the South Pond.




(NOTE: SURFACE WATER SAMPLES COLLECTED AT LOCATIONS A1, A2, AND A3.)

South Pond sediment and surface water sample locations.

ENVIRONMENTAL RESTORATION PROGRAM

# SPECIAL CANAL SAMPLING REPORT
# MIAMI-ERIE CANAL
# OPERABLE UNIT 4

## MOUND PLANT
## MIAMISBURG, OHIO

FINAL, Revision 1

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

PREPARED BY:
SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
1321 RESEARCH PARK DRIVE
DAYTON, OHIO 45432

JULY 1993

## EXECUTIVE SUMMARY

As part of the Mound Plant Environmental Restoration (ER) program, field activities associated with the Special Canal Sampling project were conducted during 1992. The overall objective of the Special Canal Sampling project is to provide qualified data to support the determination of whether mixed waste (radioactive and hazardous waste) contamination is present in the canal. Borehole soil samples in 1 foot intervals down to 3 feet below land surface (bls) were collected and composited (for each 1 foot interval) from the locations shown in Figures ES.1 and ES.2 in the Miami-Erie Canal, listed below from north to south. With the exception of locations XXX and DL1, the sample locations are identical to some of the locations sampled in the previous canal study (Rogers 1975).

The samples were excavated, handled, packaged, labeled, and shipped in accordance with Mound Plant ER Standard Operating Procedures (SOPs) (DOE 1991a). Quality control activities associated with the field sampling include the collecting of co-located and matrix spike samples, maintaining a field log record of samples with their unique identifiers, mixing soil into representative interval samples, labeling and packaging of the samples into bottles, collecting and preparing archive samples, decontaminating equipment after each use, and certifying that approved procedures were followed using qualified personnel. Chain-of-custody forms accompanied each sample. Samples were shipped to the analytical laboratories only after they were screened at the Mound Plant Soil Screening Facility.

The samples were analyzed in accordance with United States Environmental Protection Agency (EPA) Contract Laboratory Program (CLP) procedures to evaluate the potential for organic and inorganic chemical (non-radioactive) contamination as well as for radiological contamination in accordance with EPA and U.S. Department of Energy (DOE) analytical standards. The field samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), inorganics (metals and cyanide) and selected radionuclides, per the project Statement of Work (SOW) (EG&G 1992a).

Results of the chemical and radiological data analyses from the laboratory were validated using EPA (EPA 1988, EPA 1991) and SAIC (SAIC 1991) guidelines. The data are usable, with some qualifications, for the evaluation of the concentration of chemical and radioactive constituents in the canal sediments. Table ES.1 summarizes the maximum contaminant concentrations observed by type and location in the Miami Erie Canal.

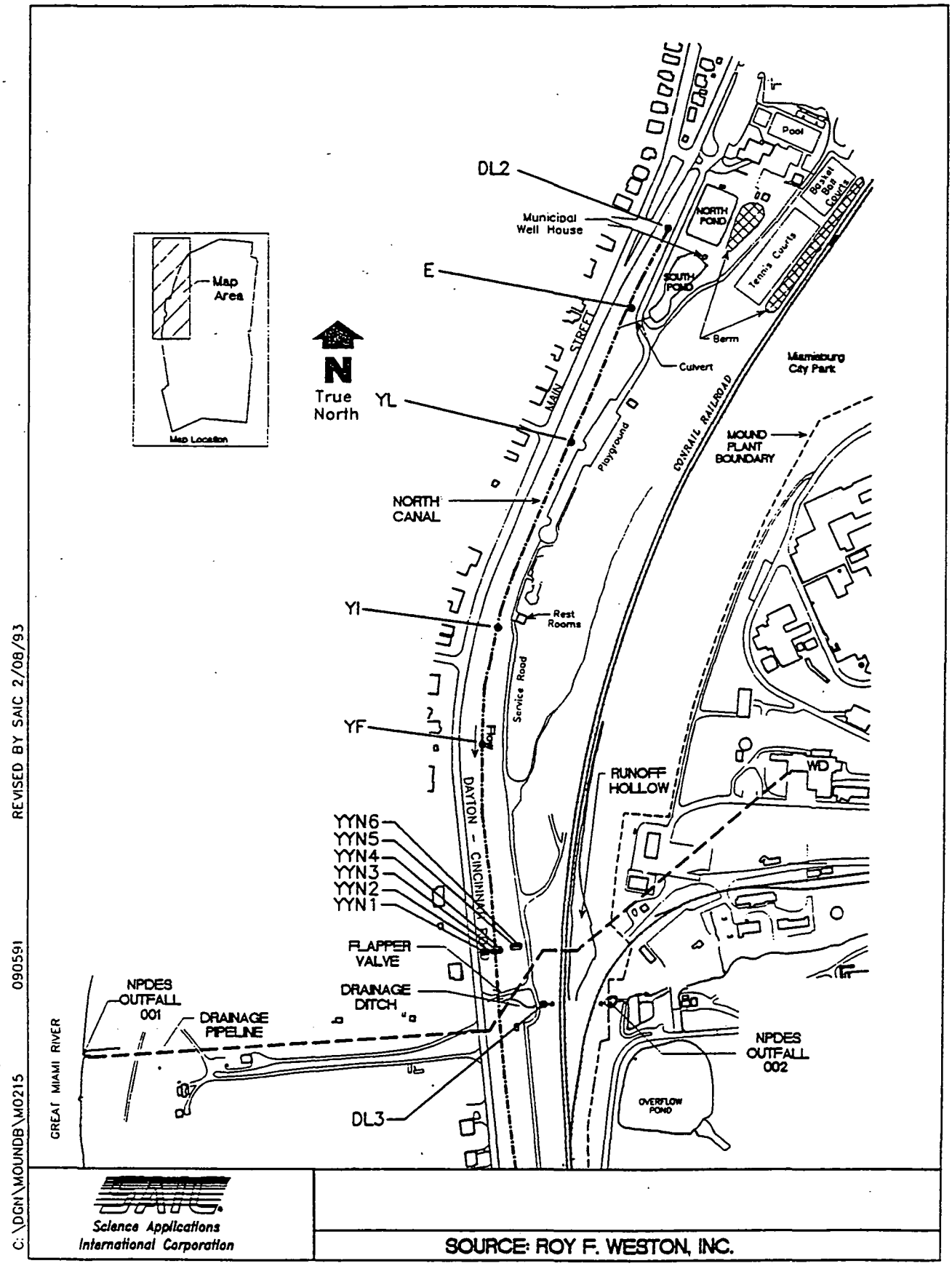



Figure ES.1 Special Sampling Locations at Miami-Erie Canal (northern half)

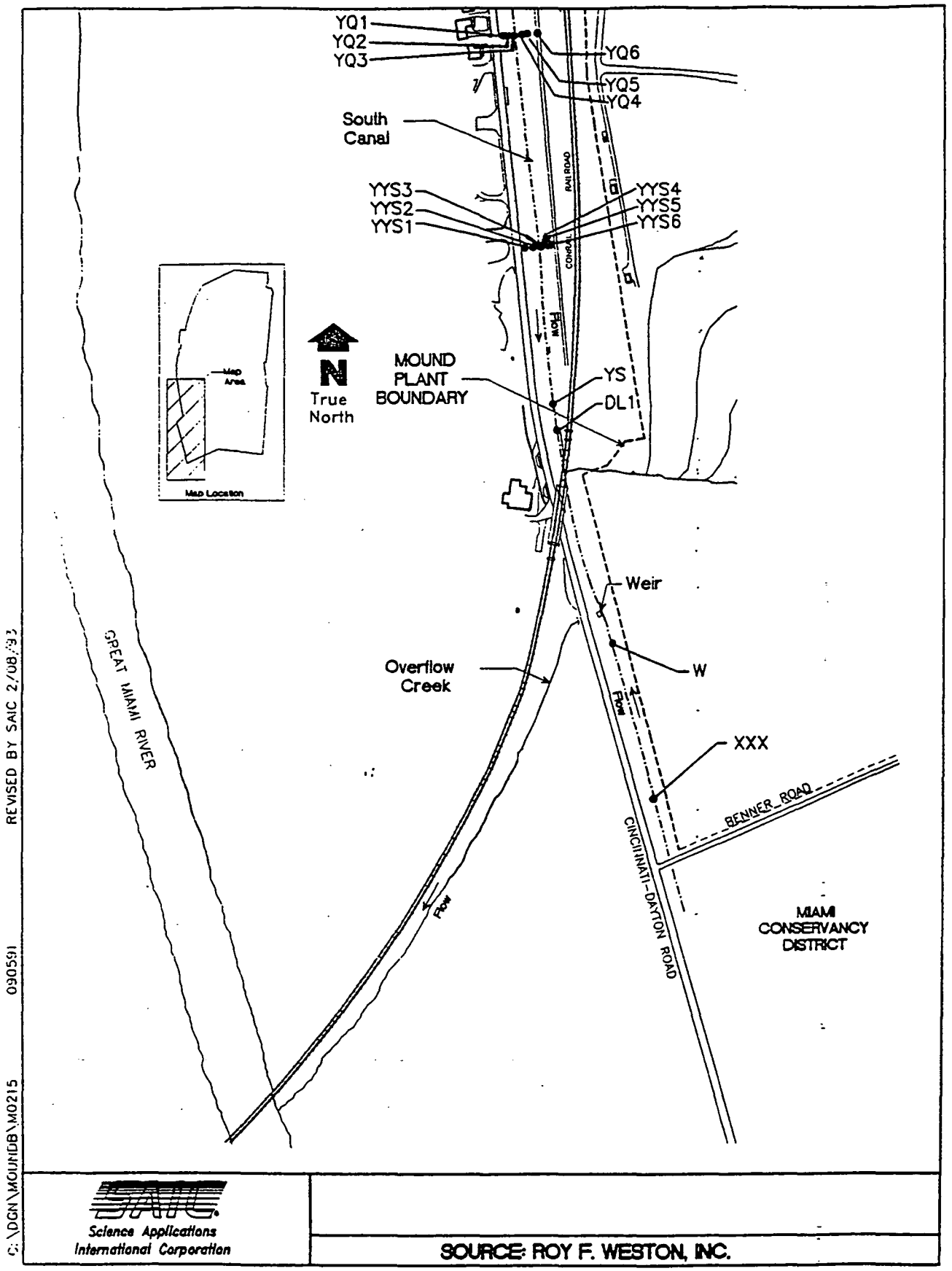



Figure ES.2 Special Sampling Locations at Miami-Erie Canal (southern half)

**Table ES.1. Maximum Radiological and Chemical Concentration by Location, Miami-Erie Canal (1992 Study)**
**Page 1 of 2**

| Location | Maximum Concentration[a] Radiological (pCi/g) | SVOC (ug/kg) | Toxic Inorganic (mg/kg) | Pesticide/PCB (ug/kg) | Remarks |
|---|---|---|---|---|---|
| North Canal | | | | | |
| DL2 | 20 (Pu-238) | 55000 (Pyrene) | 82 (Pb) | 19000 (Aroclor-1248) | Highest PCB, PAH |
| E | 170 (Pu-238) | 1700 (Fluoranthene) | 53 (Cr) | 2400 (Aroclor-1248) | |
| YL | 390 (Pu-238)<br>180 (H-3) | 180 (Pyrene) | 74 (Pb) | 6.5 (DDT) | Highest Tritium |
| YI | 530 (Pu-238)<br>77 (H-3) | 1900 (Fluoranthene) | 116 (Ba) | 170 (Aroclor-1248) | |
| YF | 520 (Pu-238)<br>130 (H-3) | 870 (Fluoranthene) | 122 (Cr) | 150 (Aroclor-1248) | |
| YYN | 530 (Pu-238)<br>38 (Th-230) | 7200 (Fluoroanthene) | 127 (As)<br>0.76 (Hg)<br>248 (Pb) | 840 (Aroclor-1248) | Highest Arsenic, Mercury<br>Highest Thorium[b] |
| Drainage Ditch | | | | | |
| DL3 | 2.6 (Pu-238) | ND | 90 (Ba) | ND | |
| South Canal | | | | | |
| YQ | $1x10^3$ (Pu-238) | 5900 (Fluoranthene) | 579 (Pb) | 360 (Aroclor-1254) | Highest Pu-238<br>Highest Lead[c] |
| YYS | 520 (Pu-238)<br>87 (Th-228) | 6100 (Pyrene) | 406 (Pb)<br>178 (Ba)<br>334 (Cr) | 260 (Aroclor-1248 & 1254) | Highest Chromium, Barium |
| | Maximum Concentration[a] | | | | |

**Radiochemical Analysis**

**GC/MS**

Table ES.1. Maximum Radiological and Chemical Concentration
by Location, Miami-Erie Canal (1992 Study)
Page 2 of 2

| Location | Radiological (pCi/g) | SVOC (ug/kg) | Toxic Inorganic (mg/kg) | Pesticide/PCB (ug/kg) | Remarks |
|---|---|---|---|---|---|
| South Canal (Cont'd) | | | | | |
| YS | 760 (Pu-238)<br>100 (H-3)<br>11 (Th-230) | 6800<br>(Pyrene) | 101 (Ba) | 340<br>(Aroclor-1254) | |
| DL1 | 600 (Pu-238)<br>70 (H-3)<br>5.7 (Th-230) | 7000<br>(Fluoranthene) | 104 (Cr) | 260<br>(Aroclor-1254) | |
| W | 96 (Pu-238)<br>43 (U-234) | 210<br>(Pyrene) | 115 (Ba) | 1.1<br>(Endril) | Highest Uranium |
| XXX | 0.95 (Pu-238) | 180<br>(Fluoranthene) | 90 (Ba) | 3.5<br>(DDT) | |

a No VOCs were detected in the canal

b DOE Order 5400.5 guideline is 5 pCi/g for Thorium

c Proposed Action Level (background) for lead is 53 ppm (Table VII.3)

ND Not Detected

GC/MS

Radiochemical Analysis

The results have been compared whenever possible to known regulatory standards, background concentrations and DOE guidelines. However, there are no Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Resource Recovery and Conservation Act (RCRA) action levels for Mound Plant soils at this time. Further, since the non-radiological hazardous constituents do not appear to be the result of Mound Plant releases, a comparison to a clean-up standard based on site-specific background is required to document the presence of non-naturally occurring substances or contaminants significantly above site-specific background levels.

Based on the available standards, it is concluded that the chemical contamination in the canal soils sampled is limited to trace amounts of PCBs, polynuclear aromatic hydrocarbons (PAHs), and lead. Further, it is not probable that Mound Plant is the source of this contamination. The results of the radiological analyses, in general, are consistent with the results of earlier studies (Robinson et al. 1974; Kershner and Rhinehammer 1978). In addition to plutonium, thorium, and tritium, trace amounts of uranium, cesium, and potassium were detected in the canal. The distribution of plutonium contamination observed in the canal is consistent with the earlier (Rogers 1975) results.

The results of the Special Canal Sampling indicate that hazardous constituents were detected in the canal, but since the sources of these constituents are inconclusive, it is not possible at this time to determine if these constituents are hazardous waste. In addition, the amounts of hazardous constituents are not significant. Additional testing may be needed for removal or remedial actions to support treatment/disposal requirements. Consequently, a specific determination of mixed waste will be made on a case-by-case basis.

MLM-2621
UC-11

# Environmental Monitoring During Construction of the Miamisburg Solar and Fishing Ponds

Billy M. Farmer and Daniel G. Carfagno

Issued: June 8, 1979

MOUND FACILITY
Miamisburg, Ohio 45342

operated by
MONSANTO RESEARCH CORPORATION
a subsidiary of Monsanto Company

for the
U. S. DEPARTMENT OF ENERGY

Contract No. DE-AC04-76-DP00053

were collected in early 1974. Analysis by the Mound Environmental Control Section established that plutonium-238 concentrations in the sediment of some waterways adjacent to the site were above the ~0.4 pCi/g baseline levels expected. As a result, Mound Facility initiated a comprehensive Environmental Plutonium-238 Study to determine the full extent of the contamination, the cause and mechanisms of the release, and the health and safety impact of these deposits on the public sector. The site drainage ditch and adjacent waterways including the abandoned Miami-Erie Canal, ponds in the Miamisburg Community Park, overflow creek, and Great Miami River are shown in Figure 1.

From the data collected during the study, it was determined that about 5.2 Ci of plutonium-238 was deposited in these waterways, buried under 1 ft or more of sediment. The contamination was released by a 1969 underground pipe break and subsequently was carried offsite into the drainage ditch, canal, and ponds by runoff.

Based on worst-case pathway analyses, the overall conclusions of the Environmental Plutonium Study concerning the health and safety aspects of the plutonium deposited in waterways near Mound are:

- The plutonium-238 does not, and will not in the future, present a hazard to people living in this area, or to the public at large.
- There is no apparent reason to restrict the use of the area in or near the waterways because of the plutonium deposits.

A detailed report of the Environmental Plutonium Study has been published (Rogers, 1975).

Additionally, an Ad Hoc Committee was appointed to independently evaluate the health and safety aspects of the plutonium deposited in the sediments adjacent to Mound. The committee essentially agreed with the conclusions of the Environmental Plutonium Study, but did recommend that any future modifications of the areas known to contain contaminated sediments should be reevaluated (Bair, 1976).

In late 1976 the City of Miamisburg announced plans to modify the ponds in Community Park to provide improved and additional facilities. The northernmost of the two ponds was to be converted into a solar energy absorber to provide heat for adjacent swimming facilities. To accomplish this, the pond was deepened to 10 ft, reshaped, fitted with a plastic liner, and filled with a brine solution to control loss of absorbed energy by convection. The energy absorbed by the solar pond is transferred to the swimming pool and bath house facilities by a heat exchanger. A fence provides protection from unwanted visitors. The other pond was deepened, reshaped, and is to be used as a fishing pond. The excavated soil was used as fill beneath the nearby tennis courts and to build the landscaping berm between the tennis courts and adjacent Conrail railroad right of way. In no case was any soil to be removed from the pond or park project area. Figure 2 shows the location of the ponds, buildings, and berm adjacent to the railroad tracks. Figure 3 shows the solar pond during the construction phase.

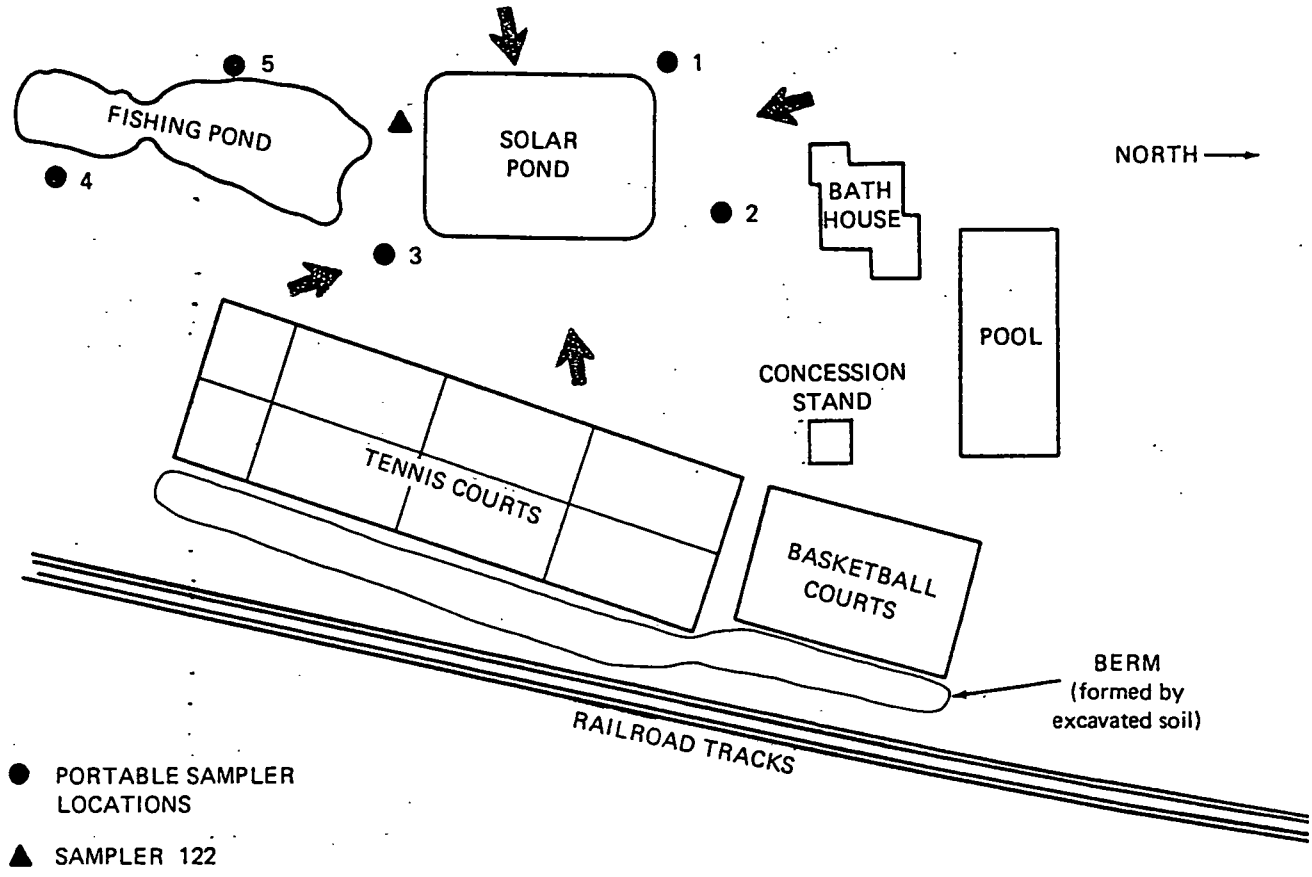



FIGURE 2 - Drawing of Miamisburg Community Park showing sampler locations and berm made from excavated soil.

Since the contaminated sediments and soils were to be disturbed and/or relocated, a re-evaluation of the potential hazards was performed (Farmer, 1977). This re-evaluation covered the health and safety of the public on a long-term basis and the involved workers on a short-term basis. The doses to man, both long and short-term, were calculated for all routes of entry into the body including inhalation, ingestion, and absorption, where applicable.

In all cases, the calculations indicated extremely low lung and bone dose both to the workers on the project, and to the general public utilizing the modified park for 70 yr. The final conclusion of the hazard analysis: None of the planned modifications to the ponds in Community Park adjacent to Mound would result in any hazard to the worker in the short term or to the general public in the long term. The City of Miamisburg was advised of the hazard analysis results and proceeded with their plans for modifying the ponds.

To ensure the validity of these calculations and to protect construction workers and park visitors from potential radiation exposures, the area was monitored continuously during the construction period (May 1977 through Oct. 1978). This study presents data actually obtained during construction activity and an evaluation of potential radiation exposure hazards.

The actual dose equivalents from these calculations are shown below.

Dose equivalent to the lung of construction worker during:

1 yr = 0.057 mrem

50 yr = 0.143 mrem

Dose equivalent to the bone of construction worker during:

1 yr = 0.025 mrem

50 yr = 0.954 mrem

Dose equivalent to the lung of individual in the vicinity of the pond area during:

1 yr = 0.030 mrem

70 yr = 9.245 mrem

Dose equivalent to the bone of individuals in the vicinity of the pond area during:

1 yr = 0.011 mrem

70 yr = 45.42 mrem

The dose equivalent estimates from the hazard analysis of the project, even though different dose models were used, are in same range as those based on actual monitoring data as can be seen below.

The predicted dose equivalent from the hazards analyses from resuspension are:

Construction Worker (short-term)

Dose equivalent to lung (first year) from resuspension = 0.24 mrem

Dose equivalent to bone (first year) from resuspension = 0.07 mrem

Individuals in Public (long-term)

Dose equivalent to lung (during 70 yr) from resuspension = 3.72 mrem

Dose equivalent to bone (during 70 yr) from resuspension = 12.90 mrem

These values, when compared to ERDA/DOE guidelines of 1500 millirem/year to the lung or bone of individuals in the population, are small. Additionally, these values are also less than those recommended by the USEPA of 1 millirad/year to the pulmonary lung and 3 millirad to the bone during the 70th year of exposure assuming a quality factor of 10 for alpha particles and a distribution factor of 5 to account for unequal distribution of plutonium in the bone (USEPA, 1977).

# Conclusion

From the data, it is apparent that plutonium-238 is being resuspended from the solar pond area. It is also apparent that the resuspension increases with construction activity since the average of short-term (8-hr) sampling during construction is a factor of 14 greater than the average of the long-term sampling (168-hr). Correlation analyses comparing both short-term and long-term plutonium-238 concentrations in air with particulate loading verify this. In both cases there was a significant correlation at the 95% confidence level.

Correlation analyses were also performed on plutonium-239 data and no correlation was observed during the construction activity. During the long term, however, a significant correlation was observed indicating resuspension of plutonium-239 is also occurring.

Dose equivalent estimates for both 1 and 50 yr were calculated for the workers exposed during construction activities. Dose equivalent estimates for 1 and 70 yr were also calculated for individuals

who reside near the pond area. Conservative assumptions were used in these calculations and the dose equivalent estimates were significantly less than DOE/ERDA standards and the proposed USEPA Guidance.

In conclusion, the hazard to construction workers and the public presented by resuspension of plutonium-238 during the construction of the solar pond and fishing pond is negligible.

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# References

Bair, W. J., R. Blandhard, L. T. Odland, E. L. Saenger, L. P. Wilding, and M. E. Wrenn, Report of the Ad Hoc Committee to Evaluate the Health and Safety Aspects of $^{238}$Pu in the Environment Adjacent to Mound Laboratory, (February, 1976).

Farmer, B. M., B. Robinson, and W. H. Westendorf, Hazard Analysis of Miamisburg Park Improvement Project, (Mar. 17, 1977).

Healy, J. W., A Proposed Interim Standard for Plutonium in Soils, LA-5483-MS, Los Alamos Scientific Laboratory, Los Alamos, N. M. (1974).

ICRP, "Report of International Commission on Radiological Protection Committee II on Permissible Dose for Internal Radiation (1959)," Health Physics, 3, 15 (1960).

ICRP Task Group on Lung Dynamics, "Deposition and Retention Models for Internal Dosimetry of the Human Respiratory Tract," Health Physics, 12, 1973 (1966).

ICRP, "The Metabolism of Compounds of Plutonium and Other Actinides," Publication 19, International Commission on Radiological Protection, Pergamon Press, New York, N. Y. (1972).

Rogers, D. R., Mound Laboratory Environmental Plutonium Study 1974, MLM-2249, Mound Laboratory (Sept. 15, 1975), 142 pp.

USEPA, "Draft - Guidance on Dose Limits for the Transuranium Elements in the General Environment," May 1977, p. 17.

ENVIRONMENTAL RESTORATION PROGRAM

# DESIGN MEMORANDUM

# OPERABLE UNIT 4
# MIAMI-ERIE CANAL

MOUND PLANT
MIAMISBURG, OHIO

30% PHASE

DECEMBER 1995

WORKING DRAFT

PREPARED BY:

EG&G Mound Applied Technologies
P.O. Box 3000
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