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R-009-208.54

SOUTH PLUME DISCHARGE LINE LEAK DETECTION SYSTEM

11/06/95

DOE-0126-96
DOE-FN EPAS
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REPORT

E-5252



Department of Energy
Fernald Environmental Management Project
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NOV 06 1995

DOE-0126-96

Mr. James A. Saric, Remedial Project Director
U.S. Environmental Protection Agency
Region V - 5HSF-5J
77 W. Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Tom Schneider, Project Manager
Ohio Environmental Protection Agency
401 East 5th Street
Dayton, Ohio 45402-2911

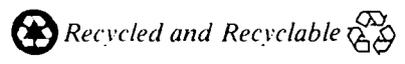
Dear Mr. Saric and Mr. Schneider:

SOUTH PLUME DISCHARGE LINE LEAK DETECTION SYSTEM

This letter presents a summary of the results obtained from sampling Leak Detection Monitoring Points (LDMP) installed along the South Plume recovery well field discharge piping. Evaluation of the monitoring data collected over three sampling rounds indicated that the LDMPs are ineffective for determining leaks from the South Plume discharge line. As explained below, the origin of uranium detected in the LDMPs cannot be definitively identified. Potential (but unconfirmed) origins include the South Plume pipeline, or perched groundwater that persists in the area of the LDMPs. The U.S. Department of Energy (DOE) is reevaluating the need for a leak detection monitoring system along the South Plume discharge line, as well as simultaneously screening potential alternative monitoring methods.

Twenty LDMPs were installed along the South Plume pipeline at locations of below-grade mechanical connections such as flanges and valves (see Enclosure 1 for LDMP locations). The LDMPs were designed to monitor shallow groundwater beneath the mechanical connections to provide an early warning of leakage from the discharge piping (see Enclosure 2 for LDMP schematic). The monitoring program included water elevations and analysis of samples for total uranium. Uranium concentrations were compared to those in the South Plume discharge piping. It was anticipated that uranium concentrations in shallow perched groundwater near the discharge line would be significantly lower than uranium concentrations in the discharge line, therefore, comparison of uranium concentrations would provide an adequate mechanism for determining leakage from the line. Subsequent to the installation, two factors were realized that have called into

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question the usefulness of the LDMPs:

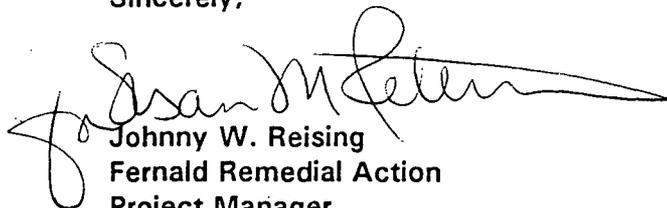
- 1) The uranium concentration in the discharge line is significantly lower than estimated 180 $\mu\text{g/L}$ used during the design of the system. The average uranium concentration in the discharge line through 2 years of operation is less than 20 $\mu\text{g/L}$.
- 2) The LDMP network is located within the area affected by air deposition of uranium from past site operations, as discussed in the Operable Unit 5 (OU5) Remedial Investigation (RI) Report. Uranium concentrations in surface soil samples collected in the vicinity of the off-property portion of the South Plume discharge line range from 6.9 to approximately 12 mg/kg (see Enclosure 3 for soil uranium concentrations). Using these surface soil concentrations and applying a conservative, i.e., low leaching coefficient (K , of 325), based on site-specific uranium leaching properties, it is calculated that leachate concentrations in the porewater surrounding this soil could range from 9.9 to 25.5 $\mu\text{g/L}$ (this assumes a soil background uranium concentration of 3.7 mg/kg that is not leachable). These calculated results are generally consistent with the uranium data collected from the LDMP network through three quarterly sampling rounds (see Enclosure 4 for LDMP uranium data). These leachate concentrations are also consistent with OU5 RI data obtained from on-property lysimeters installed in areas outside the former production area and within the area affected by air deposition of uranium.

As a result of these two factors, the LDMPs cannot be used to distinguish leakage from the pipeline based solely on a comparison of uranium concentrations. A review of perched and aquifer background water quality data was conducted to determine if a discrete water quality signature could be identified in either the perched or aquifer water. Such a signature could be used to identify the origin of LDMP water. No such signature was found due to very similar ranges for all background water quality constituents (see Enclosure 5 for a comparison of background water quality).

The continued monitoring of the LDMP network will not provide useful data in evaluating the integrity of the South Plume discharge line; therefore, the DOE requests U.S. EPA and OEPA concurrence with discontinuing sampling the LDMPs. The DOE recommends meeting with the U.S. Environmental Protection Agency (U.S. EPA) and the Ohio Environmental Protection Agency (OEPA) to discuss the continued need for a leak detection monitoring system based on the discharge concentrations, and the associated potential environmental impact of a leak(s) from the discharge line.

If you have questions or comments regarding this issue, please contact Robert Janke at (513) 548-3124, or Kathleen Nickel at (513) 648-3166.

Sincerely,



Johnny W. Reising
Fernald Remedial Action
Project Manager

FN:RJ Janke

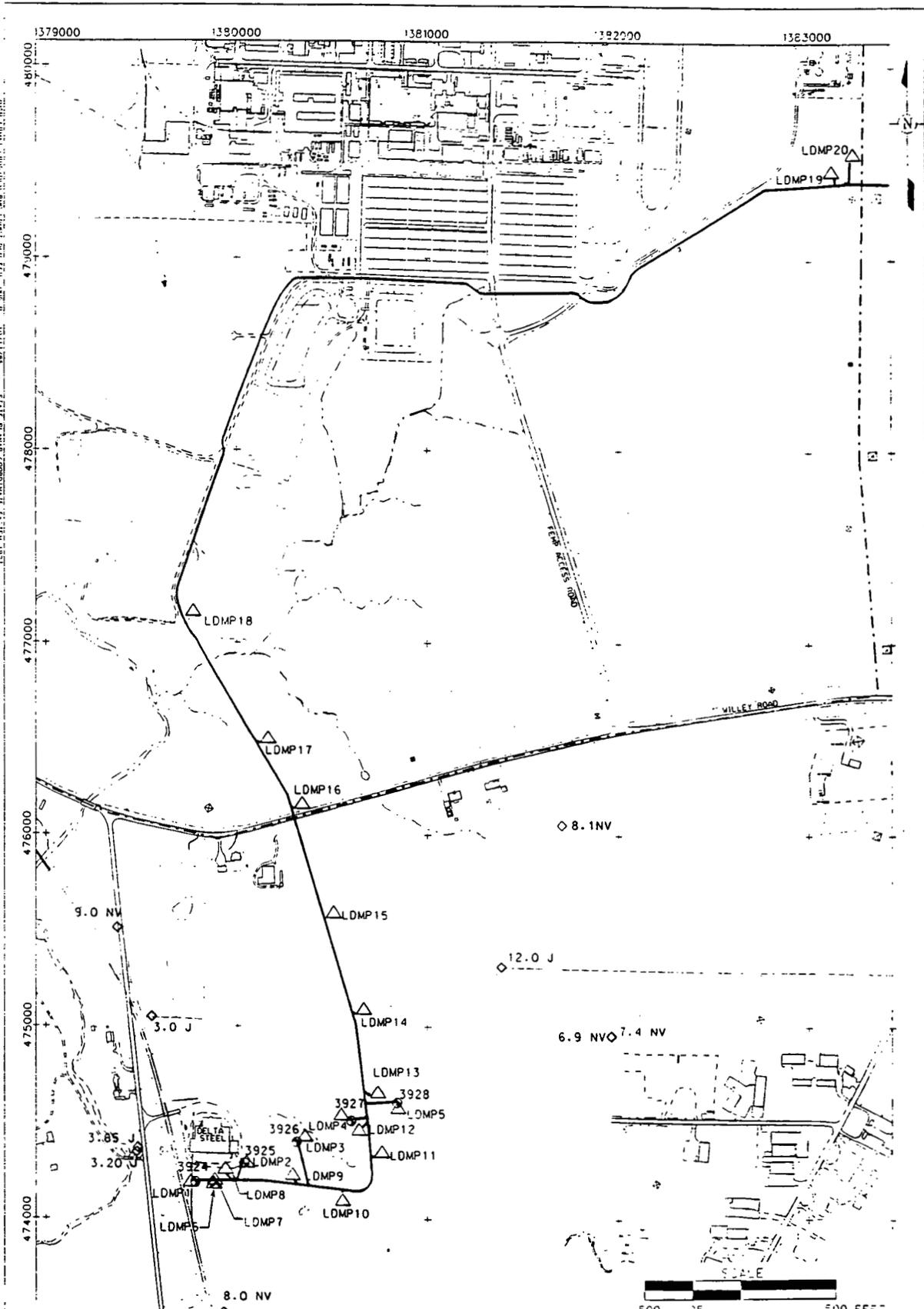
Enclosure: As Stated

cc w/enc:

- K. H. Chaney, EM-423/GTN
- L. Griffin, EM-423/GTN
- B. Skokan, EM-423/GTN
- B. Barwick, USEPA-V, 5HRE-8J
- G. Jablonowski, USEPA-V, 5HRE-8J
Manager, TSPP/DERR, OEPA-Columbus
- F. Bell, ATSDR
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- R. D. George, FERMCO/52-2
- D. Carr, FERMCO/52-5
- M. J. Cherry, FERMCO/52-2
- R. D. George, FERMCO/52-2
- T. Hagen, FERMCO/65-2
- M. A. Jewett, FERMCO/52-5
AR Coordinator, FERMCO

cc w/o enc:

- C. Little, FERMCO
- M. Yates, FERMCO



- LEGEND:**
- 3926 SOUTH PLUME RECOVERY WELL
 - LDMP7 SOUTH PLUME LEAK DETECTION MONITORING POINT
 - SOUTH PLUME FORCE MAIN
 - FEMP BOUNDARY
 - 8.0 NV SURFACE SOIL SAMPLING LOCATION URANIUM CONCENTRATION (mg/kg) AND VALIDATION QUALIFIERS:
NV = NONVALIDATED VALUE
J = ESTIMATED VALUE

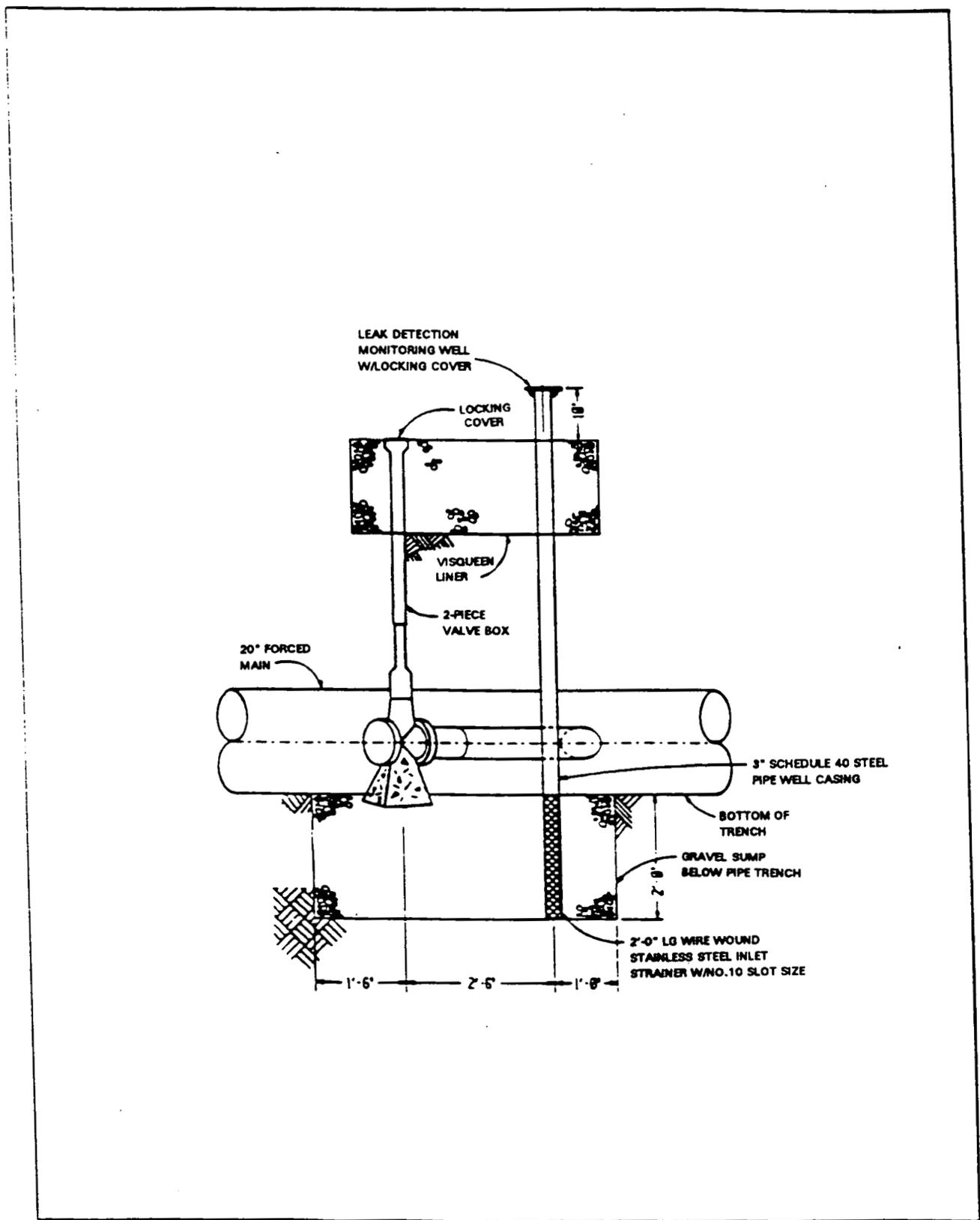
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ATTACHMENT 1. LEAK DETECTION MONITORING POINTS AND OFF-PROPERTY SURFACE SOIL URANIUM CONCENTRATIONS (mg/kg)

ATTACHMENT 2

LEAK DETECTION MONITORING POINT CONSTRUCTION DIAGRAM



ATTACHMENT 3

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TOTAL URANIUM ANALYSES

Sampling Location	Pre-/Postpurge Filtered/Unfiltered Duplicate/Reanalysis	Date	Result (µg/L)	South Plume Discharge Line Uranium Concentration
Uranium Analyses				
3926	Post/Filtered	02/03/95	4.9	NA
3926	Post/Unfiltered	02/03/95	4.9	NA
3927	Post/Filtered	02/03/95	1.7	NA
3927	Post/Unfiltered	02/03/95	1.6	NA
LDMP 3	Post/Unfiltered	11/22/94	19	3.2
LDMP 3	Reanalysis	11/22/94	22	3.2
LDMP 3	Reanalysis	11/22/94	21	3.2
LDMP 3	Post/Filtered	01/31/95	8.7	6.5
LDMP 3	Post/Unfiltered	01/31/95	9.2	6.5
LDMP 3	Post/Filtered	02/01/95	12	4.9
LDMP 3	Post/Unfiltered	02/01/95	14	4.9
LDMP 3	Pre	02/01/95	9.2	4.9
LDMP 3	Pre/Filtered	02/01/95	9.2	4.9
LDMP 3	Post/Unfiltered	03/29/95	6.3	5.1
LDMP 3	Post/Unfiltered	06/20/95	41	5.9
LDMP 3	Reanalysis	06/20/95	42	5.9
LDMP 3	Post/Unfiltered	06/30/95	5.6	5.9
LDMP 3	Reanalysis	06/30/95	5.6	5.9
LDMP 3	Post/Filtered	06/30/95	6.0	5.9
LDMP 3	Reanalysis	06/30/95	6.1	5.9
LDMP 4	Post/Unfiltered	11/22/94	6.2	1.5 ^a
LDMP 4	Post/Filtered	02/02/95	24	1.6
LDMP 4	Post/Unfiltered	02/02/95	14	1.6
LDMP 4	Pre/Filtered	02/02/95	2.8	1.6
LDMP 4	Pre/Unfiltered	02/02/95	2.9	1.6
LDMP 4	Post/Unfiltered	03/29/95	2.5	1.2
LDMP 4	Post/Unfiltered/Duplicate	03/29/95	2.5	1.2
LDMP 4	Post/Unfiltered	06/20/95	1.8	1.2
LDMP 5	Post/Unfiltered	12/01/94	2.7	0.0
LDMP 5	Post/Unfiltered	03/30/95	3.5	0.0
LDMP 5	Post/Unfiltered	06/21/95	1.2	0.0
LDMP 9	Post/Unfiltered	11/22/94	2.7	12.6
LDMP 9	Post/Unfiltered	03/29/95	2.3	14.1
LDMP 9	Post/Unfiltered	06/20/95	10	16.2

ATTACHMENT 3
(Continued)

Sampling Location	Pre-/Postpurge Filtered/Unfiltered Duplicate/Reanalysis	Date	Result (µg/L)	South Plume Discharge Line Uranium Concentration
LDMP 9	Reanalysis	06/20/95	9.8	16.2
LDMP 10	Post/Unfiltered	11/22/94	.2	12.6
LDMP 10	Post/Unfiltered	03/30/95	2.0	14.1
LDMP 10	Post/Unfiltered	06/21/95	1.3	16.2
LDMP 11	Post/Unfiltered	11/22/94	.7	12.6
LDMP 11	Post/Unfiltered	03/30/95	1.5	25.4
LDMP 11	Post/Unfiltered	06/21/95	0.8	25.2
LDMP 12	Post/Unfiltered	11/22/94	.1 U	12.6
LDMP 12	Post/Unfiltered	03/30/95	1.5	25.4
LDMP 12	Post/Unfiltered	06/21/95	0.4	25.2
LDMP 13	Post/Unfiltered	11/22/94	14	9.8
LDMP 13	Reanalysis	11/22/94	23	9.8
LDMP 13	Reanalysis	11/22/94	23	9.8
LDMP 13	Post/Filtered	01/31/95	5.0	18.2
LDMP 13	Post/Unfiltered	01/31/95	7.4	18.2
LDMP 13	Post/Filtered	02/03/95	5.6	10.1
LDMP 13	Post/Unfiltered	02/03/95	5.9	10.1
LDMP 13	Pre/Filtered	02/03/95	5.6	10.1
LDMP 13	Pre/Unfiltered	02/03/95	5.9	10.1
LDMP 13	Post/Unfiltered	03/29/95	20	19.7
LDMP 13	Post/Unfiltered	06/21/95	2.5	6.9
LDMP 14	Post/Unfiltered	11/23/94	2.0	9.8
LDMP 14	Post/Unfiltered	03/31/95	1.3	17.2
LDMP 14	Post/Unfiltered	06/21/95	1.1	6.9
LDMP 15	Post/Unfiltered	11/23/94	4.1	9.8
LDMP 15	Post/Unfiltered	03/31/95	5.6	17.2
LDMP 15	Post/Unfiltered	06/21/95	4.0	6.9
LDMP 16	Post/Unfiltered	03/31/95	6.4	17.2
LDMP 16	Post/Unfiltered	06/23/95	1.8	15.2
LDMP 17	Post/Unfiltered	11/23/94	9.6	9.8
LDMP 17	Post/Filtered	02/06/95	6.4	10.1
LDMP 17	Post/Unfiltered	02/06/95	7.3	10.1
LDMP 17	Pre/Filtered	02/06/95	6.0	10.1
LDMP 17	Pre/Unfiltered	02/06/95	2.4	10.1

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**ATTACHMENT 3
(Continued)**

Sampling Location	Pre-/Postpurge Filtered/Unfiltered Duplicate/Reanalysis	Date	Result (µg/L)	South Plume Discharge Line Uranium Concentration
LDMP 17	Post/Unfiltered	03/31/95	9.9	17.2
LDMP 17	Post/Unfiltered	06/23/95	16	15.2
LDMP 17	Reanalysis	06/23/95	16	15.2
LDMP 19	Post/Unfiltered	11/23/94	1.9	69.8
LDMP 19	Post/Unfiltered/Duplicate	11/23/94	1.8	69.8
LDMP 19	Post/Unfiltered	03/31/95	5.9	12.8
LDMP 19	Post/Unfiltered	06/22/95	0.3	49.2
LDMP 19	Post/Unfiltered/Duplicate	06/22/95	0.7	49.2
LDMP 20	Post/Unfiltered	11/23/94	8.9	69.8
LDMP 20	Reanalysis	11/23/94	8.4	69.8
LDMP 20	Reanalysis	11/23/94	8.6	69.8
LDMP 20	Post/Filtered	01/31/95	7.2	38.9
LDMP 20	Post/Unfiltered	01/31/95	4.3	38.9
LDMP 20	Post/Unfiltered	03/31/95	4.7	12.8
LDMP 20	Post/Unfiltered	06/23/95	4.8	36.0
Manhole	Post/Unfiltered	04/04/95	2.8	NA
Manhole	Post/Unfiltered	04/05/95	3.2	NA
RW 3 Pit	Post/Unfiltered	03/31/95	17	NA
RW 3 Pit	Post/Unfiltered	06/30/95	18	NA
RW 3 Pit	Reanalysis	06/30/95	19	NA
RW 3 Pit	Post/Filtered	06/30/95	15	NA
RW 3 Pit	Reanalysis	06/30/95	15	NA
SWRB	Post/Filtered	02/03/95	14	NA
SWRB	Post/Unfiltered	02/03/95	43	NA

*Estimated value based on historical pumping data
 *Fernald Analytical Computerized Tracking System
 NA = Not applicable

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ATTACHMENT 4

**COMPARISON OF BACKGROUND DATA IN GROUNDWATER
BETWEEN PERCHED GROUNDWATER AND THE GREAT MIAMI AQUIFER
mg/L**

Constituent	Range of Detections for Unfiltered Perched Groundwater ^a	95th Percentile for Unfiltered Perched Groundwater ^a	Range of Detections for Unfiltered Great Miami Aquifer Groundwater ^b	95th Percentile for Unfiltered Great Miami Aquifer Groundwater ^b
Aluminum	0.774-2.29	2.29	0.06-0.225	0.225
Antimony	ND	ND	ND	ND
Arsenic	0.0031-0.0194	0.0194	0.0011-0.0294	0.0294
Barium	0.0486-0.454	0.454	0.0368-0.768	0.768
Beryllium	ND	ND	ND	ND
Cadmium	ND	ND	0.0022-0.0135	0.0135
Calcium	81.1-172	172	78-162	159
Chromium	0.0046	0.0046	0.0067-0.0211	0.0211
Cobalt	ND	ND	0.0086	0.0086
Copper	0.0053-0.0294	0.0294	0.011-0.035	0.0354
Cyanide	ND	ND	ND	ND
Iron	0.249-6.35	5.5	0.312-5.5	5.72
Lead	0.0013-0.0016	0.0016	0.002	0.002
Magnesium	23.1-50.7	50.7	20.1-39	38.5
Manganese	0.0035-0.205	0.205	0.0043-0.904	0.904
Mercury	ND	ND	ND	ND
Molybdenum	ND	ND	ND	ND
Nickel	0.0072	0.0072	0.0514	0.0514
Potassium	.963-17.2	17.2	0.648-1.96	1.96
Selenium	ND	ND	0.00075	0.00075
Silicon	5.6-10.7	10.7	5.81	5.81
Silver	0.0031	0.0031	0.0117	0.0177
Sodium	8.81-50	50	3.08-50.4	47.2
Thallium	ND	ND	ND	ND
Vanadium	0.0051	0.0051	0.0076-0.0117	0.0117
Zinc	0.0192-0.352	0.352	0.0087-0.021	0.021
Alkalinity	313-430	430	210-430	422
Ammonia	0.1-4.5	4.3	0.045-12.6	4.2
Chloride	1.4-50	45	0.02-120	73
Fluoride	0.2-1.3	1.3	0.1-1.9	0.89
Nitrate	0.12-0.3	0.29	0.014-24.9	11.4
Nitrate/Nitrite	0.07	0.07	0.02-4.1	4.1
Phenols	0.007-0.03	0.03	0.00575-0.091	0.03

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**ATTACHMENT 4
(Continued)**

Constituent	Range of Detections for Unfiltered Perched Groundwater ^a	95th Percentile for Unfiltered Perched Groundwater ^a	Range of Detections for Unfiltered Great Miami Aquifer Groundwater ^b	95th Percentile for Unfiltered Great Miami Aquifer Groundwater ^b
Phosphate	0.191	.191	NA	NA
Phosphorous	0.026-0.18	0.18	0.01-3.08	0.954
Sulfate	3-175	136	2.79-321	197
Sulfide	ND	ND	ND	ND
TKN ^c	0.178-4.34	4.34	0.1-4.74	3.3
TOC ^d	1.15-9	9	1-4.25	2.23
TOX ^e	0.011-0.126	0.126	0.012-0.12	0.052
TON ^f	0.1-1.35	0.34	0.075-2.75	0.9
Total Solids	452	452	330-773	711
Total Dissolved Solids	ND	NA	NA	NA
Dissolved Oxygen	1-9.2	9.2	0.1-10.4	7.84
pH (standard units)	6.9-7.7	7.5	6.3-7.9	7.7
Specific Conductivity umhos/cm	470-1170	955	370-1890	928

^aPerched groundwater data taken from table 4-7, OUS RI report.

^bGreat Miami Aquifer groundwater data taken from table 4-8, OUS RI report.

^cTotal Kjeldahl nitrogen

^dTotal organic carbon

^eTotal organic halogen

^fTotal organic nitrogen

ND = Not detected

NA = Not analyzed

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