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REMOVAL SITE EVALUATION CONTAMINATED GROUND WATER SOUTH OF PLANT SITE (SOUTH PLUME)

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DOE-FMPC/WMCO
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REMOVAL SITE EVALUATION

CONTAMINATED GROUND WATER SOUTH OF PLANT SITE (SOUTH PLUME)

FEED MATERIALS PRODUCTION CENTER
U.S. DEPARTMENT OF ENERGY
FERNALD, OHIO

Source Term

Ground water in the regional aquifer beneath the FMPC and to the south of the plant boundary is contaminated with uranium. The extent and concentration of the uranium contamination is being defined under the RI/FS ground water monitoring program and the development of a ground water flow model.

The source of the contamination is still under investigation. Based on the current understanding of plant operations and records, site hydrology, and results of the ground water modeling study, the principal source of the off-site plume is believed to be historical releases of uranium contaminated water into Paddy's Run and the storm sewer outfall ditch. Because the sediments of these water sources are highly permeable in the reaches north and west of the south plume, the uranium contaminated water directly entered the regional aquifer in these areas. The ground water flow component from the FMPC is toward the south plume area. The probable source of uranium in the storm sewer outfall ditch and Paddy's Run is storm water run-off and the historic pumping of ground water from the Waste Storage Area to Paddy's Run.

The on-site portion of the plume may be caused by a slower and more recent infiltration of uranium into the underlying aquifer from the Southfield Area and possibly the fly ash piles. Infiltration along Paddy's Run also continues, but the associated uranium levels have been reduced. Another possible explanation of the dual concentration distribution is that the current recharge of water containing much lower levels of uranium along the storm water outfall ditch dilutes the more recent, southerly migrating ground water plume. Uranium concentrations in the ground water plume (both on and off-site) range from 1 microgram per liter (ug/l) to approximately 850 ug/l. A data package documenting these results is provided as an attachment to this assessment. The highest uranium concentrations are located in the upper layer of the aquifer (2000 - series wells located approximately 60-90 feet in depth), with a substantial reduction in concentrations with depth (3000 and 4000 - series wells located approximately 125-150 feet and 220-225 feet in depth, respectively). The 4000 - series wells (lower aquifer layer) have had uranium concentrations consistently less than 1 ug/l.

Evaluation of the Magnitude of the Potential Threat

Approximately 100 acres of off-site property is underlain by ground water exceeding a concentration of 33 ug/l for natural uranium. The DOE has specified that this limit shall apply to releases to all off-site areas where water could be used as a drinking water source (DOE 5400.XX). This is based on the 50-year committed effective dose equivalent (CEDE) limit of 4 mrem from an annual intake of radioactive materials in drinking water and is consistent with the drinking water criteria in 40 CFR Part 141, "National

Interim Primary Drinking Water Regulations (Safe Drinking Water Act)."

In the case of the south plume, exposure to the contaminants can occur only if the ground water reaches the ground surface. The primary mechanisms are ground water discharge to a surface water source and pumping. The south plume is not expected to migrate to the Great Miami River or any other surface water course within the projected life of the removal action, therefore, ground water discharge to surface waters is not considered as an important exposure pathway.

Potential ground water users are located in the south plume area. Pumping is presently occurring and will continue to occur from the south plume. The potential exposure pathways associated with pumping include direct ingestion of ground water used as drinking water, ingestion of plants after use of the ground water for irrigation, and ingestion of meat or milk from livestock exposed to the ground water through direct intake or from irrigated crops.

Assessment of the Need for Removal Action

The potential contamination of drinking water supplies and the associated potential for exposure are factors supporting the need for a removal action.

The impacted aquifer is within the buried valley aquifer of the Great Miami River Basin, which has been designated as a Sole-Source Aquifer by the U.S. EPA under Section 1424(e) of the Safe Drinking Water Act (Federal Register, Vol. 53, No. 131, Friday, July 8, 1988). Under this designation, the Administrator of U.S. EPA Region V determined that this aquifer is the sole or principal source of drinking water for this area and that if contaminated would create a significant hazard to public health.

If left unattended, the plume of elevated uranium concentrations in ground water south of the FMPC would be expected to continue to migrate south-southeast along the regional ground water flow path in the buried channel aquifer. This would obviously extend the area of contamination to new potential users.

Appropriateness of a Response

It has been determined that a response is appropriate, due to the current potential for user access to ground water contaminated with elevated levels of uranium. A removal action to eliminate the access to contaminated ground water and possibly to mitigate the plume migration should be undertaken.

If a planning period of less than six months exists prior to initiation of a response, DOE will prepare an Action Memorandum.

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The Action Memorandum will describe the selected response and supporting documentation for the decision.

If it is determined that there is a planning period greater than six months before a response is initiated, DOE will prepare an Engineering Evaluation/Cost Analysis (EE/CA) Approval Memorandum. This memorandum is to be used to document the threat to public health and environment. It will also serve as a decision document for the Administrative Record File.

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DATA PACKAGE ATTACHMENT

Table A-1

FERNALD RI/FS SAMPLING ROUNDS

SOUTH PLUME TOTAL URANIUM CONCENTRATIONS
2000-SERIES WELLS

(micrograms per liter)

WELL NO.	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	ROUND 6
2002	a	a	a	a	2	<1
2014	32	33	35	17	b	33
2015	168	169	185	186	b	b
2016	21	18	17	22	b	d
2017	3	4	3	4	b	b
2018	2	<1	3	4	b	b
2020	3	<1	<1	<1	b	b
2044	2	1	33	1	b	b
2045	a	a	a	283	265 291[c]	341
2046	a	a	a	309	850	232
2047	a	a	a	15	10	9
2048	a	a	a	<1	<1	<1
2049	130	8	3 2[c]	6	175	147
2060	242 203[c]	225	171	250	b	b
2061	247	260	260	292	b	b
2065	10	9	7	9 8[c]	b	12 11[c]
2068	<1 3[c]	2	<1	<1	b	b
2069	6	13	12	12	b	b
2070	<1	1	<1	<1	b	b
2091	a	<1	<1	1	1.2	b
2092	a	7	<1	1	1.5	b
2093	a	<1 1[c]	<1	1.0	0.5	b

See footnotes at end of table.

TABLE A-2
(Continued)

WELL NO.	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	ROUND 6
2094	a	2	<1	4.5	<0.1	b
2095	a	169	177	146	208 195[c]	b
2096	a	1	<1	0.4	1.4	b
2104	<1	0.3	0.4	0.4	b	b
2106	a	a	a	61	16	b
2107	a	a	a	14	9	b
2127	a	a	a	37	6	14

[a]Well installation not completed.

[b]Well not sampled.

[c]Duplicate sample.

[d]Data not available.

Notes: Data validation is not complete for Rounds 5 and 6.

Uranium values reported with a decimal fraction reflect laboratory detection limits of 0.1 μg/ℓ. All other values reflect laboratory detection limits of 1 μg/ℓ.

TABLE A-3

FERNALD RI/FS
SOUTH PLUME TOTAL URANIUM CONCENTRATIONS
3000-SERIES WELLS

(micrograms per liter)

WELL NO.	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	ROUND 6
3014	23	29	28	30	b	b
3015	4	<1	<1	<1	b	b
3016	11	9	8	7	b	b
3017	<1	<1	<1	<1	b	b
3018	2	2	1	2	b	b
3020	<1	<1	<1	<1	b	b
3044	2	<1	<1	<1	b	b
3049	a	a	a	<1	<1	b
3062	62	37	41	44	b	b
3065	a	a	a	<1	<1	b
3068	2	<1 <1[c]	<1	<1	b	b
3069	3	1	11	<1	b	b
3070	2	2	<1	<1	b	b
3091	a	<1	<1	<1	0.1	b
3092	a	<1	<1	<1	0.2	b
3093	a	<1	<1	<1	0.5	b
3094	a	<1	<1	0.6	<0.1	b
3095	a	13	5	6	4	b
3096	a	<1	1	0.7	0.8	b
3106	a	a	a	2	<1	b
3107	a	a	a	2	1	b
3127	a	a	a	<1	<1	<1

[a]Well installation not completed.

[b]Well not sampled.

[c]Duplicate sample.

Notes: Data validation is not complete for Rounds 5 and 6.

Uranium values reported with a decimal fraction reflect laboratory detection limits of 0.1 µg/ℓ. All other values reflect laboratory detection limits of 1 µg/ℓ.

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TABLE A-4

FERNALD RI/FS
SOUTH PLUME TOTAL URANIUM CONCENTRATIONS
4000-SERIES WELLS

(migrograms per liter)

WELL NO.	ROUND 1	ROUND 2	ROUND 3	ROUND 4	ROUND 5	ROUND 6
4014	a	a	a	<1	<1	b
4015	<1 <1[c]	<1	<1	<1	b	b
4016	a	a	a	<1	<1	b
4091	a	2	<1 <1[c]	<1	<0.1	b
4096	a	2	0.5 0.7[c]	0.5	0.8	b

[a]Well installation not completed.

[b]Well not sampled.

[c]Duplicate sample.

Notes: Data validation is not complete for Round 5 and 6.

Uranium values reported with a decimal fraction reflect laboratory detection limits of 0.1 μg/ℓ. All other values reflect laboratory detection limits of 1 μg/ℓ.

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