

EXPLORING EARTH'S MYSTERIES
...PROTECTING ITS FUTURE

Waste Management Facility

Facility Environmental Monitoring Report

Calendar Year 2003



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Brookhaven National Laboratory Waste Management Facility

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Summary of Results

Environmental monitoring conducted at the Waste Management Facility during 2003 continues to indicate that waste management operations are not impacting environmental quality. No contaminants related to Waste Management Facility operations were identified in groundwater samples, or in water samples collected from SPDES Outfall 003. Although low levels of tritium were detected in several facility monitoring wells, it is believed that the tritium originated from a currently undefined upgradient source. Environmental TLD ambient measurements indicate that the dose in the vicinity of the WMF is equivalent to background values.

Background

The Waste Management Facility (WMF) is designed to safely handle, repackage, and temporarily store BNL-derived wastes prior to shipment to an off-site disposal or treatment facility. The WMF has been designed with engineering controls that meet all applicable federal, state, and local environmental protection requirements. Moreover, institutional controls such as spill prevention plans, operations management plans, maintenance, and personnel training ensure that the facility operates in a manner that protects the environment and human health.

The WMF is adjacent to BNL Potable Supply Wells 11 and 12, which are located south of East Fifth Avenue and just north of the WMF site (Figure 1). Because of the close proximity of the WMF to Potable Wells 11 and 12, it is imperative that the engineered and institutional controls are effective in ensuring that waste handling operations do not degrade the quality of the soils and groundwater in this area. The monitoring program for the WMF is designed to supplement the engineered and institutional controls by providing additional means of detecting potential contaminant releases.

Environmental Monitoring Program

As required by DOE Order 450.1 and the facility's RCRA Part B Permit, BNL has established an environmental monitoring program for this facility to evaluate potential impacts to environmental quality resulting from its operation. The environmental monitoring program for the WMF is described in the *BNL Environmental Monitoring Plan* (BNL, 2003a). Monitoring results for CY 2003 are summarized below. As required by the September 2003 update to the RCRA Part B Permit, BNL summarized the CY

2003 groundwater monitoring results in the annual Hazardous Waste Report (BNL, 2003b)

Monitoring Results

Groundwater

The WMF's groundwater monitoring program is designed to provide a secondary means of detecting groundwater contamination in the event that a spill or leak from the WMF goes undetected using the (primary) engineered and institutional controls. Eight wells are used to monitor for potential contaminant releases from the three main waste handling and storage buildings, and to assess background water quality (Figure 1). Groundwater flow directions in the WMF area were monitored on a quarterly basis during 2003 (Figures 1 through 4).

Groundwater monitoring results for CY 2003 are consistent with previous years monitoring, and continue to show that WMF operations are not affecting groundwater quality. There were no outdoor or indoor spills at the facility that could have impacted soil or groundwater quality. During 2003, the Waste Management Facility groundwater monitoring wells were sampled three times, with samples collected in February, May, and August. Except for low-levels of sodium detected in several upgradient wells and one downgradient well, all chemical and radionuclide concentrations were below New York State Drinking Water or Ambient Water Quality Standards. Low levels of the radionuclide tritium were detected in one upgradient and one downgradient well, with a maximum concentration of approximately 1/20th of the drinking water standard. In response, to this detection BNL collected additional samples from several monitoring wells and nearby water supply wells 11 and 12. Although a definitive source for the tritium has not been identified to date, a thorough review of waste management operations suggests that the tritium was not released from the WMF. Rather, the periodic detection of tritium in the upgradient well suggests that the tritium was released from another facility or system.

Radiological Analyses: Gross alpha and beta concentrations in samples from both upgradient and downgradient monitoring wells are consistent with background concentrations, and no Laboratory related gamma-emitting radionuclides were identified (Tables 1A and 1B). During the year, tritium levels in Reclamation Building area monitoring well 056-23 increased from 407 pCi/L in February to 1,120 pCi/L in August (Figure 5). This well is screened in the upper 20 feet of the Upper Glacial aquifer, and its depth suggests that it originates from a nearby source. Although these tritium concentrations were well below the 20,000 pCi/L drinking water standard, BNL implemented its *Groundwater Protection Contingency Plan* in an attempt to identify the source of the tritium and verify that the tritium was not impacting the quality of water obtained from supply wells 11 and 12. As part of this response, the monitoring frequency was increased for well 056-23, nearby monitoring wells 056-22 and 066-84, and supply wells 11 and 12. BNL also formed a technical team to help identify a possible source of

the tritium. Tritium concentrations in well 056-23 increased to 2,430 pCi/L in November 2003.¹ Although a definitive source for the tritium has not been identified, a thorough review of waste management operations and the detection of low levels of tritium in an upgradient well suggest that the tritium was not released from the WMF, rather a nearby upgradient source. During 2003, low levels of tritium (up to 485 pCi/L) were detected in shallow upgradient well 066-07 (Figure 6). Tritium was also detected one sample from upgradient well 055-10 (412 pCi/L). This well is screened in the deep Upper Glacial aquifer, and tritium detected at this depth would be have originated from a source considerably further upgradient (such as the AGS area).

Non-radiological Analyses: All anions (chlorides, sulfates, and nitrates) and most metals concentrations were below applicable NYS AWQS (see Tables 2 and 3). As in past years, sodium was detected at concentrations slightly above the NYS AWQS of 20 mg/L in several wells. Sodium was detected in upgradient wells 055-03 and 066-07 at concentrations of 27.9 mg/L and 22.9 mg/L, respectively, and in RCRA Building area well 056-21 at a concentration of 21.3 mg/L. No VOCs were detected at concentrations above NYS AWQS during 2003. Trace levels (<1 ug/L) of chloroform were occasionally detected in upgradient wells 055-03, 055-10, 066-03, and downgradient well 066-84. Trace levels (up to 1.3 ug/L) of TCA were also detected in upgradient well 066-06.

Potable Water Supply Wells

During 2003, trace levels of chloroform (up to 1.4 ug/L) were routinely detected in pre-treated water supply samples. No radiological contaminants were detected in any of the water samples. Following the receipt of August 2003 analytical data indicating a slight increase in tritium levels in monitoring well 056-23, BNL increased the sampling frequency for tritium in supply wells 11 and 12. Samples were collected weekly from late September through October, biweekly in November and monthly in December. Tritium was not detected in any of the samples. Potable water system analytical results are provided to the Suffolk County Department of Health Services on a monthly basis and are summarized in the annual *BNL Site Environmental Report*.

Stormwater Discharges

State Pollutant Discharge Elimination System (SPDES): Storm water runoff from the WMF roofs and pavement is conveyed to SPDES-permitted outfall 003 (HO). In late 2001, the Laboratory petitioned NYSDEC to remove the monitoring requirement for outfall 003 from the Laboratory's SPDES discharge permit. These changes were approved by NYSDEC and a revised SPDES permit was received in February 2002. This discharge was not monitored under the SPDES program in 2003. Although NYSDEC is not requiring monitoring at this outfall, BNL still monitors the flow and pH on a weekly basis, and the discharges are also monitored quarterly under the Environmental Surveillance program described below.

¹ Note: As of February 2004, tritium concentrations in well 056-23 have dropped to 350 pCi/L.

Environmental Surveillance: Under the BNL Environmental Surveillance program, the discharge is sampled quarterly for volatile organics, metals, water chemistry parameters (chlorides, nitrates, and sulfates), radionuclides, and field-measured parameters (pH, conductivity).

During 2003, no radionuclides related to Laboratory operations were detected in the discharges to Outfall 003. All gross alpha and beta concentrations were below the MDL, tritium was not detected in any of the samples, and there were no gamma-emitting radionuclides observed outside of natural products.

Analyses for metals and water chemistry parameters did not find any parameters above the NYS effluent standards, with most being at non-detectable levels. Low levels of trihalomethanes were sporadically detected in the discharges to Outfall 003. However, these compounds are common potable water disinfection by-products, and are not attributable to WMF operations. Acetone and methylene chloride are sporadically detected in many basin discharges, however, these compounds are usually associated with cross-contamination in the analytical lab.

Environmental TLDs

Ambient environmental background radiation monitoring is conducted through a network of on-site and off-site environmental TLDs placed in the 16 wind sectors. These TLDs measure radiation from cosmic and terrestrial sources of radiation, as well as contribution from Laboratory operations, if any. One of the TLDs (066-TLD1) is located between the WMF and Recharge Basin HO, and is used to measure any contribution from the Waste Management Facility (Figure 7). The environmental TLDs are collected and read on a quarterly frequency. The ambient dose rates for the first, second, third, and fourth quarters were 14.7, 11.0, 13.3, and 17.3 mrem, respectively. The annual external dose at this location was estimated to be 56 ± 21 mrem, and was similar to normal background radiation found in the area. Therefore, it can be concluded that there was no external dose contribution from waste handling activities.

Evaporator Facility

Some of the liquid wastes generated at BNL contained residual radioactivity, and they were sent for treatment to the Waste Concentration Facility (Bldg. 811). Many of the radionuclides present in the liquid waste were removed by using a reverse osmosis process. However, because the chemical properties of tritium are similar to hydrogen, it cannot be removed from the aqueous phase using this process. The tritiated water was transferred to the Evaporator Facility (Bldg. 802B), where it was converted to steam and released to the atmosphere as an emission. Due to difficulties in system maintenance and prohibitive operating costs, the evaporator facility has not been in use since 2001. Therefore, there have been no air emissions from this facility since that time.

Future Monitoring Actions

The 2004 monitoring program will consist of the following:

- In September 2003, the NYSDEC (2003) approved BNL's request to modify the RCRA Part B Permit groundwater monitoring requirements. These changes were immediately implemented. The approved monitoring program allows for a reduction in monitoring frequency from quarterly to semiannually. Samples will be analyzed semiannually for gross alpha, gross beta, gamma, and VOCs, and annually for metals and anions.
- Continue the TLD monitoring program on its current schedule.
- Surveillance monitoring will continue the collection of samples from the HO outfall quarterly for radiological and non-radiological parameters, and pH and flow readings will continue to be collected weekly.

References

BNL. 2003a. *Brookhaven National Laboratory Environmental Monitoring Plan CY2003 Triennial Update*. BNL-52676 (January 2003).

BNL. 2003b. *Brookhaven National Laboratory 2003 Groundwater Monitoring Report for the Waste Management Facility: Attachment A of the 2003 Hazardous Waste Report*. Upton, NY. February 16, 2004.

NYS DEC, 2003. Letter dated September 22, 2003 from M.C. Carrara (NYS DEC) to G. Todzia (BNL). Permit Modification. Part 373 Permit #1-477-00032/00102.

Table 1A. WMF Upgradient Wells: Gross Alpha, Gross Beta, Tritium and Gamma Spectroscopy Results for CY 2003.

Waste Management Facility - Upgradient Wells

Site ID	Sample Date	Gross Alpha			Gross Beta			Gamma Spec.	Tritium		
		Conc. (pCi/l)	Err. (pCi/l)	MDA (pCi/l)	Conc. (pCi/l)	Err. (pCi/l)	MDA (pCi/l)		Conc. (pCi/l)	Err. (pCi/l)	MDA (pCi/l)
055-03	2/6/2003	0.371	± 0.316	0.479	0.225	± 0.956	1.62	NOR	125	± 237	364
	5/8/2003	0.115	± 0.243	0.463	1.64	± 0.857	1.31	NOR	179	± 218	317
	8/28/2003	1.09	± 0.494	0.673	3.23	± 0.992	1.41	NOR	-150	± 153	383
055-10	2/6/2003	0.426	± 0.324	0.479	-0.0482	± 0.942	1.62	ND	412	± 253	364
	5/8/2003	0.0872	± 0.244	0.463	0.249	± 0.771	1.31	NOR	203	± 220	317
	8/28/2003	1.03	± 0.506	0.673	0.363	± 0.834	1.41	NOR	62.3	± 166	385
066-07	2/6/2003	0.122	± 0.26	0.479	1.62	± 1.02	1.62	NOR	320	± 236	364
	5/8/2003	0.15	± 0.255	0.463	1.4	± 0.843	1.31	NOR	485	± 196	273
	8/28/2003	0.293	± 0.393	0.673	1.7	± 0.911	1.41	ND	142	± 175	276
066-83	2/6/2003	0.127	± 0.26	0.479	1.41	± 1.01	1.62	NOR	128	± 235	364
	5/8/2003	0.193	± 0.267	0.463	1.39	± 0.842	1.31	NOR	33.2	± 171	273
	8/28/2003	2.92	± 0.694	0.673	3.51	± 1.01	1.41	NOR	-123	± 158	391
DWS		15			50				20000		

MDA = Minimum Detectable Activity

DWS = Drinking Water Standard

NOR = Only naturally occurring radionuclides were detected (e.g., K-40, Bi-214, Pb-212, and Pb-214).

ND = No gamma emitting radionuclides detected.

Table 1B. WMF Downgradient Wells: Gross Alpha, Gross Beta, Tritium and Gamma Spectroscopy Results for CY 2003.

Waste Management Facility - Downgradient Wells

Site ID	Sample Date	Gross Alpha			Gross Beta			Gamma Spec.	Tritium		
		Conc. (pCi/l)	Err. (pCi/l)	MDA (pCi/l)	Conc. (pCi/l)	Err. (pCi/l)	MDA (pCi/l)		Tritium	Err. (pCi/l)	MDA (pCi/l)
056-21	2/11/2003	4.29*	± 0.719	0.351	7.51*	± 1.2	1.42	NOR	150	± 224	377
	5/8/2003	0.259	± 0.278	0.463	3.98	± 0.985	1.31	ND	-11.4	± 169	273
	8/22/2003	0.999	± 0.476	0.663	2.74	± 1.09	1.65	ND	-160	± 192	311
056-22	2/11/2003	4.06*	± 0.708	0.351	5.19*	± 1.1	1.42	NOR	-39.5	± 213	377
	5/8/2003	0.0952	± 0.243	0.463	1.96	± 0.876	1.31	ND	151	± 178	273
	8/22/2003	-0.164	± 0.315	0.663	1.99	± 1.06	1.65	NOR	280	± 214	308
	9/29/2003	--	--	--	--	--	--	--	-5.05	± 247	356
056-23	2/11/2003	7.94*	± 0.968	0.351	11*	± 1.34	1.42	NOR	407	± 243	377
	5/8/2003	-0.146	± 0.172	0.463	2.94	± 0.931	1.31	NOR	411	± 232	317
	8/22/2003	-0.15	± 0.324	0.663	1.36	± 1.03	1.65	NOR	1120	± 253	311
	9/4/2003	--	--	--	--	--	--	--	1100	± 276	346
	9/29/2003	--	--	--	--	--	--	--	1530	± 332	360
	9/29/2003	--	--	--	--	--	--	--	1300	± 246	289
	11/5/2003	--	--	--	--	--	--	--	2430	± 339	356
066-84	2/11/2003	0.359*	± 0.331	0.513	-3.8	± 1.22	2.31	NOR	15.5	± 223	377
	5/8/2003	0.0909	± 0.243	0.463	1.61	± 0.856	1.31	NOR	209	± 222	317
	8/22/2003	-0.216	± 0.298	0.663	0.7	± 0.995	1.65	NOR	-148	± 193	312
	9/29/2003	--	--	--	--	--	--	--	-35.2	± 244	355
DWS		15			50				20000		

MDA = Minimum Detectable Activity

DWS = Drinking Water Standard

NOR = Only naturally occurring radionuclides were detected (e.g., K-40, Bi-214, Ra-226, Pb-212, and Pb-214).

ND = No gamma emitting radionuclides detected.

(*) = Sample from well 066-84 was re-analyzed after initial results indicated gross alpha levels of 15.4 pCi/L and gross beta levels of 14 pCi/L. Other samples collected and analyzed at this time (from wells 056-21, 056-22, and 056-23) had slightly elevated gross alpha and beta concentrations, but were not reanalyzed.

Table 2. Water Quality Results for CY 2003

Waste Management Facility - Upgradient Wells

Well	Sample Date	Chloride		Nitrate (as N)		Sulfate	
		Conc. (mg/L)	Qual.	Conc. (mg/L)	Qual.	Conc. (mg/L)	Qual.
055-003	2/6/2003	17.3		1	U	6.6	
	5/8/2003	76.9		1	UJ	7.5	J
	8/28/2003	18.5		1	UJ	8.6	J
055-10	2/6/2003	9		1	U	16.2	
	5/8/2003	10.7		1	UJ	16.8	J
	8/28/2003	8.5		1	UJ	15.7	J
066-07	2/6/2003	19		1.5		15.2	
	5/8/2003	32.2		2.1	J	26	J
	8/28/2003	25.2		1.7	J	18.3	J
066-83	2/6/2003	14.1		1	U	12.3	
	5/8/2003	19.3		1	UJ	15.7	J
	8/28/2003	15.7		1	UJ	14.7	J
Typical MDL		4		1		4	
NYSAWQS		250		10		250	

Waste Management Facility - Downgradient Wells

Well	Sample Date	Chloride		Nitrate (as N)		Sulfate	
		Conc. (mg/L)	Qual.	Conc. (mg/L)	Qual.	Conc. (mg/L)	Qual.
056-21	2/11/2003	34.9	J	1.1	J	16.2	J
	5/8/2003	46		1.4	J	14.5	J
	8/22/2003	28.8		1.1	J	19	J
056-22	2/11/2003	12.7	J	2.3	J	19.8	J
	5/8/2003	14.1		2.3	J	16.7	J
	8/22/2003	11.6		1.9	J	18.3	J
056-23	2/11/2003	15.1	J	2.6	J	18.2	J
	5/8/2003	7.4		2.5	J	21.3	J
	8/22/2003	11.9		3.1	J	20.6	J
066-84	2/11/2003	6.1	J	1	UJ	7.9	J
	5/8/2003	17.3		1	UJ	8.6	J
	8/22/2003	5.4		<1.0	UJ	4.4	
Typical MDL		4		1		4	
NYSAWQS		250		10		250	

J: Estimated Result

U: Non Detect

Table 3 A. Waste Management Facility Metals Analytical Results for CY 2003.

Waste Management Facility - Upgradient Wells

Well	Sample Date	Al	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Au	Na	Zn
		Conc. (mg/L)										
055-03	2/6/2003	0.0022 U	0.0011 U	0.001 U	0.002 U	0.015 U	0.0013 U	0.002 U	0.0001 U	0.001 U	12.9	0.0069
	5/8/2003	0.0022 U	0.0011 U	0.0014	0.0025	0.1 U	0.0013 U	0.002 U	0.0001 U	0.001 U	27.9	0.0092
	8/28/2003	0.0105 B	0.0003 U	0.00072 B	0.0032 B	0.0269 B	0.0011 U	0.00096 BE	0.0001 U	0.0004 U	12.6	0.209
055-10	2/6/2003	0.0022 U	0.0011 U	0.001 U	0.002 U	0.012 U	0.0013 U	0.002 U	0.0001 U	0.001 U	13.5	0.0055
	5/8/2003	0.0022 U	0.0011 U	0.0015	0.002 U	0.1 U	0.0013 U	0.002 U	0.0001 U	0.001 U	13.9	0.0121
	8/28/2003	0.0097 U	0.0003 U	0.00088 B	0.0023 B	0.0241 B	0.0011 U	0.0024 BE	0.0001 U	0.0004 U	12.9	0.178
066-07	2/6/2003	0.0022 U	0.0011 U	0.001 U	0.002 U	0.014 U	0.0013 U	0.002 U	0.0001 U	0.001 U	13.8	0.0064
	5/8/2003	0.0022 U	0.0011 U	0.0015	0.0025	0.1 U	0.0013 U	0.002 U	0.00037	0.001 U	22.9	0.0115
	8/28/2003	0.0097 U	0.0003 U	0.00073 B	0.0019 B	0.0286 B	0.0011 U	0.0011 BE	0.0001 U	0.0004 U	17.2	0.135
066-83	2/6/2003	0.0022 U	0.0011 U	0.001 U	0.002 U	0.016 U	0.0013 U	0.0028	0.0001 U	0.001 U	10.3	0.0074
	5/8/2003	0.0022 U	0.0011 U	0.0012	0.002 U	0.1 U	0.0013 U	0.002 U	0.0004	0.001 U	13.8	0.01
	8/28/2003	0.0104 B	0.0003 U	0.00092 B	0.0024 B	0.0257 B	0.0011 U	0.0024 BE	0.0001 U	0.0004 U	13.2	0.234
Typical MDL		0.0022	0.0011	0.001	0.002	0.075	0.00132	0.002	0.0001	0.001	1	0.004
NYSAWQS		0.1	0.01	0.05	0.2	0.3	0.025	0.3	0.0007	0.05	20	0.3

Note 1: Mercury analyses not performed on 8/22/2003 samples because holding times were exceeded resulting from instrumentation problems.

U: Analyte not detected.

B: Estimated Result. Result is less than the RL

E: Estimated Result due to matrix interference.

Table 3 B. Waste Management Facility Metals Analytical Results for CY 2003.

Waste Management Facility - Downgradient Wells

Well	Sample Date	Al	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Au	Na	Zn
		Conc. (mg/L)										
056-21	2/11/2003	0.0022 U	0.0011 U	0.001 U	0.0022	0.015 U	0.0013 U	0.0055	0.0001 U	0.001 U	21.3	0.0066
	5/8/2003	0.0022 U	0.0011 U	0.0013	0.0023	0.1 U	0.0013 U	0.0031	0.0001 U	0.0013	26.4	0.01
	8/22/2003	0.036 B	0.0004 B	0.0006 U	0.0026 B	0.029 B	0.0011 U	0.0307 E	Note 1	0.0004 U	18.4 E	0.0382
056-22	2/11/2003	0.0022 U	0.0011 U	0.001 U	0.002 U	0.028 U	0.0013 U	0.002 U	0.0001 U	0.001 U	9.51	0.0063
	5/8/2003	0.0022 U	0.0011 U	0.0012	0.002 U	0.1 U	0.0013 U	0.002 U	0.0001 U	0.001 U	9.8	0.0104
	8/22/2003	0.0111 B	0.0003 U	0.0006 U	0.0023 B	0.034 B	0.0011 U	0.0039 BE	Note 1	0.0004 U	8.6 E	0.102
056-23	2/11/2003	0.0022 U	0.0011 U	0.001 U	0.002 U	0.031 U	0.0013 U	0.0026	0.0001 U	0.001 U	11.1	0.0063
	5/8/2003	0.0022 U	0.0011 U	0.0014	0.002 U	0.1 U	0.0013 U	0.002 U	0.0001 U	0.001 U	6.9	0.0107
	8/22/2003	0.017 B	0.0003 U	0.0006 U	0.0021 B	0.03 B	0.0011 U	0.0045 BE	Note 1	0.0004 U	10.1 E	0.056
066-84	2/11/2003	0.0022 U	0.0011 U	0.001 U	0.002 U	0.02 U	0.0013 U	0.002 U	0.0001 U	0.001 U	9.11	0.0059
	5/8/2003	0.0022 U	0.0011 U	0.0026	0.0021	0.1 U	0.0013 U	0.002 U	0.0001 U	0.001 U	17	0.01
	8/22/2003	0.0097 U	0.0003 U	0.0006 B	0.0025 B	0.024 B	0.0011 U	0.002 BE	Note 1	0.0004 U	10.6 E	0.0389
Typical MDL		0.0022	0.0011	0.001	0.002	0.075	0.00132	0.002	0.0001	0.001	1	0.004
NYSAWQS		0.1	0.01	0.05	0.2	0.3	0.025	0.3	0.0007	0.05	20	0.3

Note 1: Mercury analyses not performed on 8/22/2003 samples because holding times were exceeded resulting from instrumentation problems.

U: Analyte not detected.

B: Estimated Result. Result is less than the RL

E: Estimated Result due to matrix interference.

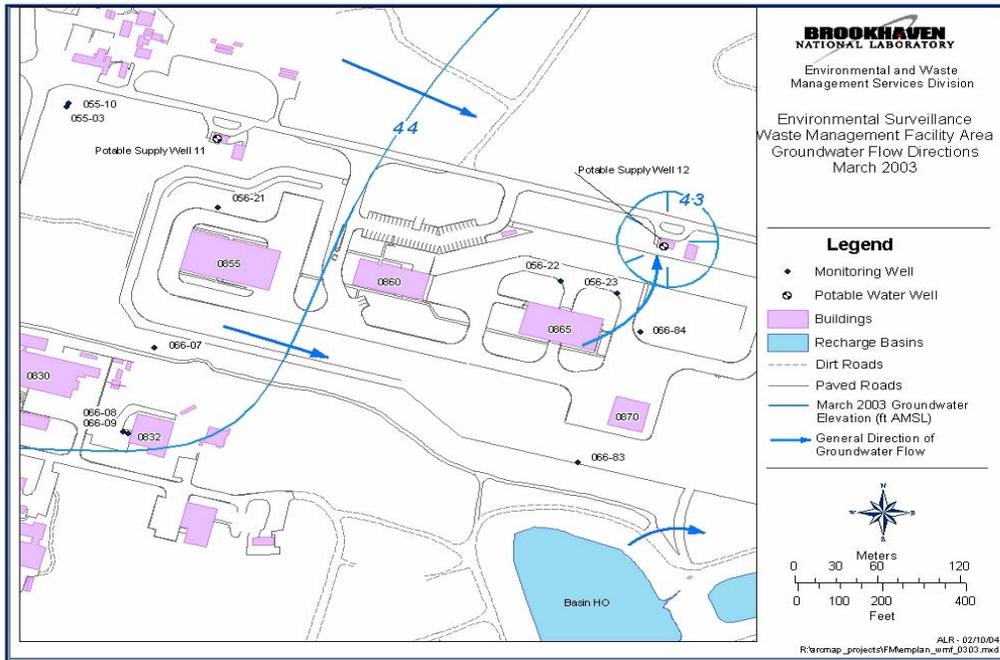


Figure 1. Locations of Monitoring Wells Near the Waste Management Facility. Groundwater flow directions in WMF area during March 24-27, 2003.

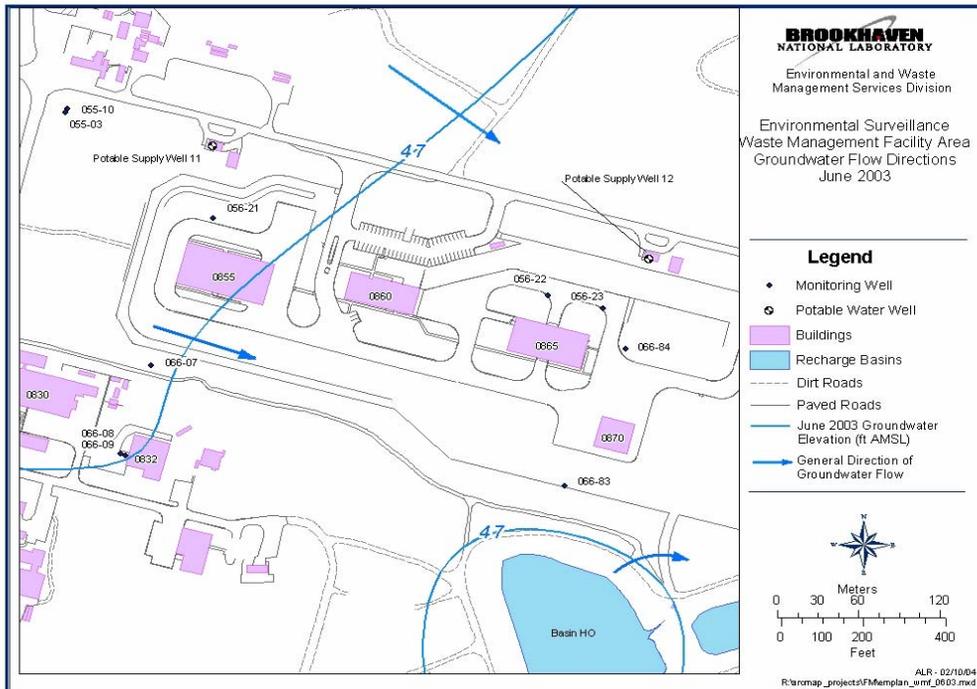


Figure 2: Groundwater flow directions in WMF area during June 16-18, 2003.

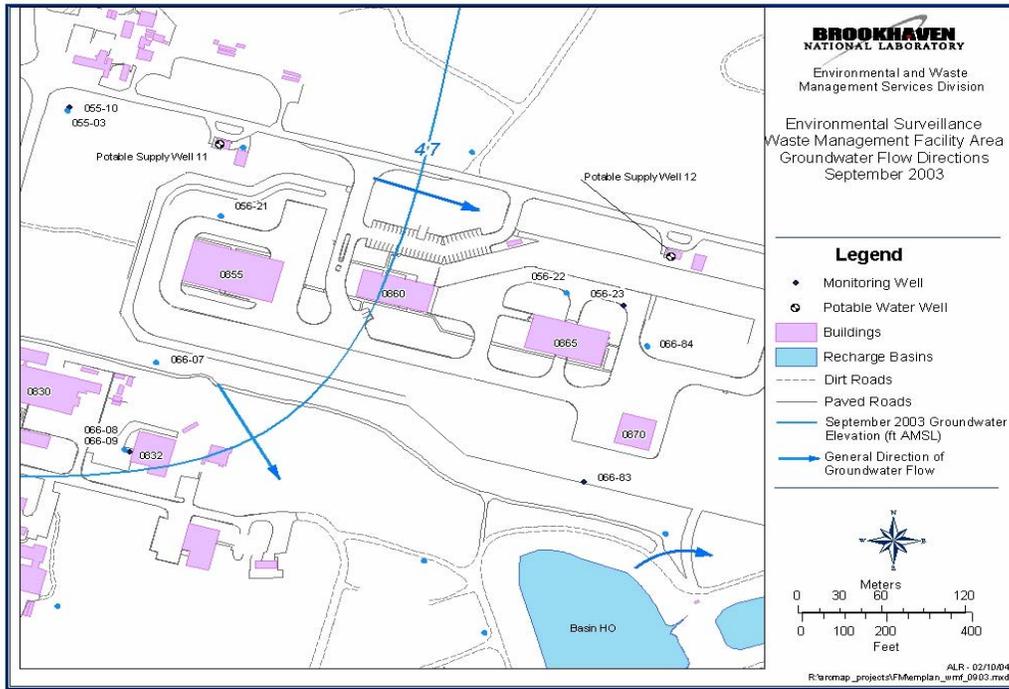


Figure 3: Groundwater flow directions in WMF area during September 23-25, 2003.

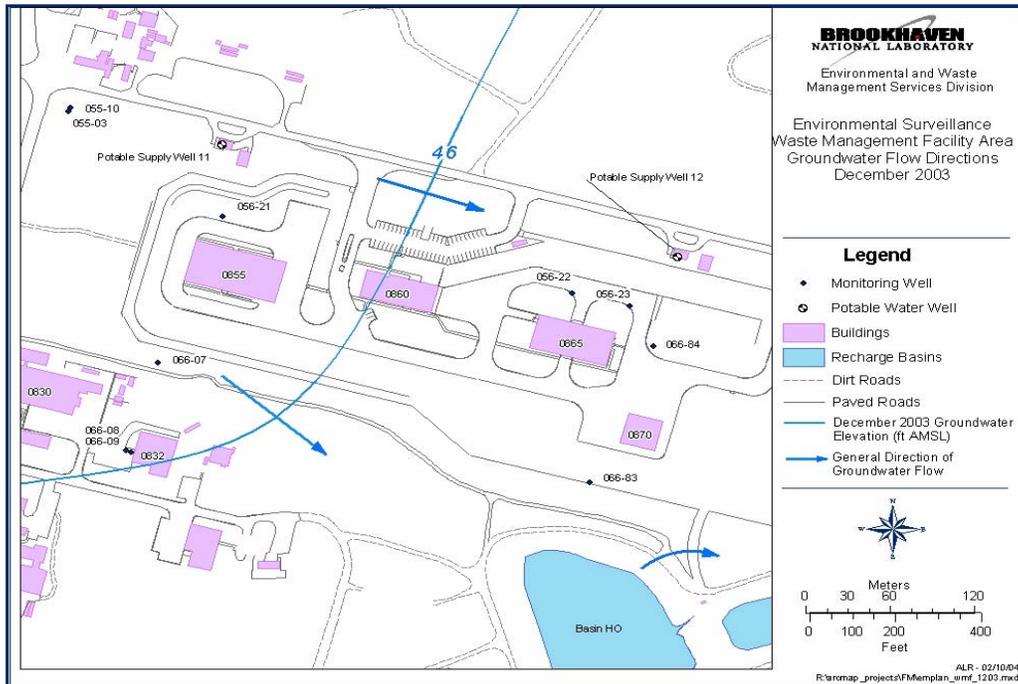


Figure 4: Groundwater flow directions in WMF area during December 16-19, 2003.

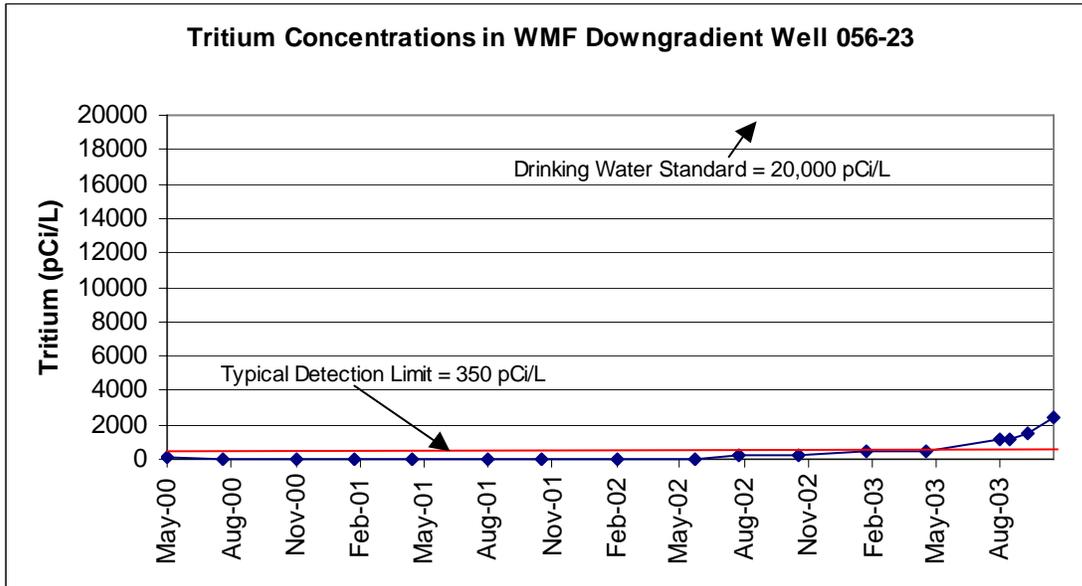


Figure 5. Tritium concentration trends in downgradient well 056-23.

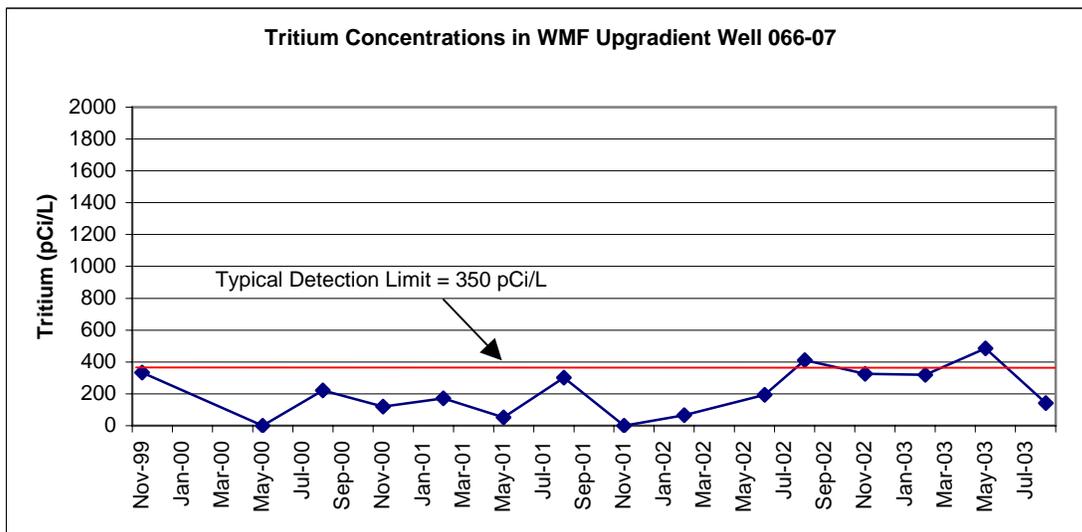


Figure 6. Tritium concentration trends in upgradient well 066-07.

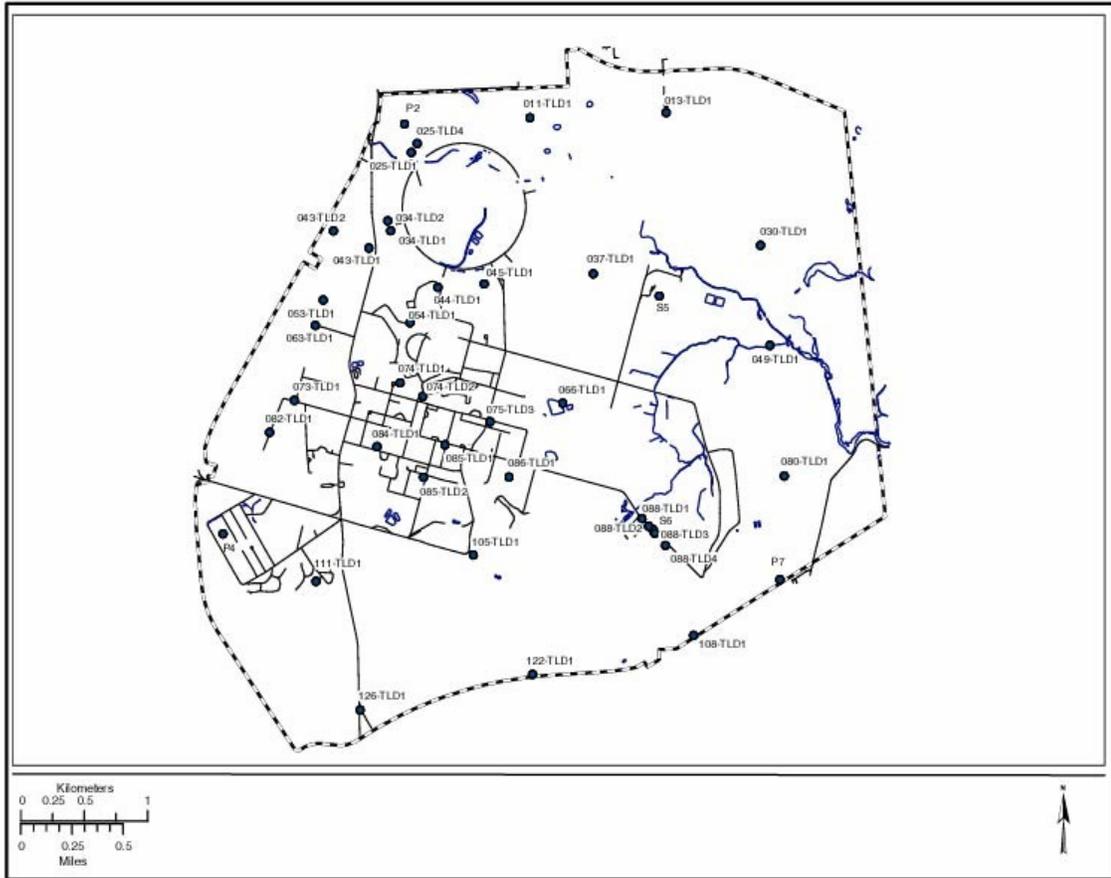


Figure 7: Locations of Environmental TLDs.