INVESTIGATION DERIVED WASTE DISPOSITION RECOMMENDATIONS FOR THE FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

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List of Acronyms

Dames & Moore	Dames & Moore, Inc.
DERP-FUDS	Defense Environmental Restoration Program - Formerly Used Defense Sites
EPA	U.S. Environmental Protection Agency
HI	hazard index
HTW	Hazardous and Toxic Waste
IDW	investigation-derived waste
MCL	maximum contaminant levels
PBOW	Plum Brook Ordnance Works
PPE	personal protective equipment
PRRWP	Pentolite Road Red Water Pond
PRSA	Pentolite Road Storage Area
RBC	risk-based concentrations
TNTA	TNT Manufacturing Area A
TNTB	TNT Manufacturing Area B
TNTC	TNT Manufacturing Area C
WARWP	West Area Red Water Ponds

1.0 Introduction

Under the provisions of the Defense Environmental Restoration Program - Formerly Used Defense Sites (DERP-FUDS), the U.S. Army Engineer District, Nashville, has conducted Hazardous and Toxic Waste (HTW) Investigations of selected areas of concern at the former Plum Brook Ordnance Works (PBOW) in Sandusky, Ohio. This document summarizes the description of investigation derived waste (IDW) generated during the investigations and presents recommendations for the disposition of waste based on the evaluation of analytical data from the investigations.

The investigations were conducted by Dames & Moore, Inc. (Dames & Moore) beginning in October 1994 and concluding in January 1995. During the investigations, IDW, including purge water, well development water, drill water, decontamination water, soil cuttings, rock cores, used sampling equipment, disposable personal protective equipment (PPE), and other miscellaneous wastes were accumulated and are currently stored at the PBOW site.

At present, 241 drums containing IDW generated from the investigation are stored at the site, including 177 drums stored at the Pentolite Road drum storage area, located north of Pentolite Road and west of the Reactor Facility, and 64 drums staged at the NASA Igloo, Building 9155. In addition, there are eleven (11) wooden core boxes containing rock core samples which were too large to be placed into 55-gallon drums; these core boxes are stored at the Pentolite Road drum storage area.

The document is comprised of four sections:

- Section 1.0 - Introduction
- Section 2.0 - IDW Description and Disposition Options
- Section 3.0 - Analytical Results
- Section 4.0 - IDW Evaluation and Disposition Recommendations.

Section 2.0, IDW Description and Disposition Options, provides a summary of the IDW accumulated at the PBOW and options for IDW disposal. Section 3.0, Analytical Results, presents the analytical results that are applicable to the various waste categories and sources. Section 4.0, IDW Evaluation and Disposition Recommendations summarizes the evaluation of the analytical results and presents recommendations for the disposition of the IDW.

2.0 IDW Description and Disposition Options

The IDW accumulated during the previous investigation includes the following:

- Soil cuttings generated from the installation of soil borings and monitoring wells, including drill cuttings, waste soil from the installation of protective posts surrounding monitoring wells, and soil cuttings from hand augered soil borings.
- Rock cores from the installation of groundwater monitoring wells in bedrock.
- Used PPE and sampling equipment, including disposable sample collection equipment and aluminum foil.
- Potable water used during monitoring well drilling.
- Groundwater removed from monitoring wells during well development and sample collection activities.
- Decontamination water used for steam cleaning drilling and sampling equipment.

In general, all IDW was placed in 55-gallon drums when accumulated during the investigation activities. However, some of the rock cores generated during installation of monitoring wells into bedrock were placed in wooden core boxes that were too large to be stored in 55-gallon drums. A total of eleven wooden core boxes are stored at the Pentolite Road drum storage area; none are stored at the NASA Igloo. Rock cores not placed in the wooden core boxes were placed in cardboard boxes that are now stored in 55-gallon drums.

The following sections present a summary of the IDW stored at the PBOW by waste type, and includes possible disposition options considered during this IDW evaluation.

2.1 Aqueous IDW

As presented in Table 2-1, a total of 136 drums of aqueous IDW were generated during the PBOW investigations. Of these, 72 drums are stored at the Pentolite Road Storage Area (PRSA) and 64 are stored at the NASA Igloo storage area. Specific IDW contained in these drums include purge water from monitoring well development and sampling (33 drums at the PRSA), drill water recovered from the borehole during installation of monitoring wells (37 drums at the PRSA and 7 drums at the NASA Igloo), core water from the installation of bedrock wells (2 drums at the PRSA), decontamination water from the decontamination area and decontamination of hand augers (55 drums at the NASA Igloo), and excavation water

Table 2-1a

Wastewaster IDW Drum Inventory, Pentolite Road Drum Storage Area

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
E	106	PB-TNTA-MW10	Purge Water	12/7/94
	107	PB-TNTA-MW10	Purge Water	11/7/94
	108	PB-TNTA-MW11	Purge Water	11/7/94
	109	MK-MW24	Purge Water	11/11/94
	110	MK-MW22	Purge Water	11/10/94
	111	MK-MW23	Purge Water	11/10/94
	112	MK-MW17	Purge Water	11/10/94
	113	MK-MW16	Purge Water	11/10/94
	114	PB-TNTC-MW6	Purge Water	11/8/94
	115	PB-TNTC-MW5	Purge Water	12/7/94
	116	PB-TNTC-MW5	Purge Water	11/7/94
	117	PB-WA-MW2	Purge Water	11/10/94
	118	IT-MW02	Purge Water	11/10/94
	119	IT-MW05	Purge Water	11/15/94
	120	PB-PR-MW7	Purge Water	12/6/94
	121	PB-PR-MW8	Purge Water	12/10/94
	122	PB-PR-MW9	Purge Water	11/10/94
	123	PB-BED-MW13	Purge Water	12/10/94
	124	PB-BED-MW13	Purge Water	12/11/94
	125	PB-BED-MW13	Drill Water	11/14/94
	126	PB-BED-MW13	Drill Water	10/14/94
	127	PB-BED-MW13	Drill Water	10/14/94
	128	PB-BED-MW13	Drill Water	11/14/94
	129	PB-BED-MW13	Drill Water	10/14/94
	130	PB-BED-MW13	Drill Water	11/14/94
F	131	PB-BED-MW14	Purge Water	11/14/94
	132	PB-BED-MW14	Drill Water	10/18/94
	133	PB-BED-MW14	Drill Water	11/12/94
	134	PB-BED-MW14	Drill Water	10/18/94
	135	PB-BED-MW14	Purge Water	12/11/94
	136	PB-BED-MW15	Drill Water	11/11/94
	137	PB-BED-MW15	Drill Water	10/19/94
	138	PB-BED-MW15	Purge Water	12/11/94
	139	PB-BED-MW15	Drill Water	11/11/94
	140	PB-BED-MW15	Drill Water	11/11/94
	141	PB-BED-MW15	Drill Water	10/19/94

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
F (continued)	142	PB-BED-MW15	Purge Water	12/11/94
	143	PB-BED-MW16	Core Water	10/30/94
	144	PB-BED-MW16	Core Water	10/30/94
	145	PB-BED-MW16	Drill Water	10/15/94
	146	PB-BED-MW16	Drill Water	10/16/94
	147	PB-BED-MW16	Drill Water	10/16/94
	148	PB-BED-MW16	Purge Water	12/7/94
	149	PB-BED-MW17	Purge Water	12/11/94
	150	PB-BED-MW17	Drill Water	11/12/94
	151	PB-BED-MW17	Drill Water	11/12/94
	152	PB-BED-MW18	Purge Water	11/11/94
	153	PB-BED-MW18	Drill Water	10/25/94
	154	PB-BED-MW18	Drill Water	11/2/94
	155	PB-BED-MW18	Drill Water	11/2/94
	156	PB-BED-MW18	Drill Water	11/2/94
	157	PB-BED-MW18	Drill Water	10/25/94
	158	PB-BED-MW18	Drill Water	11/2/94
	159	PB-BED-MW18	Purge Water	12/10/94
	160	PB-BED-MW18	Drill Water	10/25/94
G	161	PB-BED-MW19	Purge Water	12/10/94
	162	PB-BED-MW19	Purge Water	12/10/94
	163	PB-BED-MW19	Drill Water	11/13/94
	164	PB-BED-MW19	Drill Water	11/13/94
	165	PB-BED-MW19	Drill Water	11/13/94
	166	PB-BED-MW19	Drill Water	11/10/94
	167	PB-BED-MW19	Drill Water	11/10/94
	168	PB-BED-MW19	Drill Water	11/10/94
	169	PB-BED-MW20	Drill Water	10/29/94
	170	PB-BED-MW20	Purge Water	11/15/94
	171	PB-BED-MW20	Purge Water	11/15/94
	172	PB-BED-MW20	Drill Water	11/13/94
	173	PB-BED-MW20	Drill Water	11/13/94
	174	PB-BED-MW20	Drill Water	10/29/94
	175	PB-BED-MW20	Drill Water	10/29/94
	176	Reactor-2	Purge Water	12/7/94
	177	Reactor-2	Purge Water	12/7/94

Table 2-1b

Wastewaster IDW Drum Inventory, NASA Igloo 9155 Drum Storage Area

Drum Number	Source of IDW	Drum Contents	Date
178	Decon Area/Hand Auger Decon	Decon Water	10/18/94
179	Decon Area/Hand Auger Decon	Decon Water	10/17/94
180	PB-BED-MW20	Drill Water	11/13/94
181	PB-BED-MW20	Drill Water	11/13/94
182	PB-BED-MW14	Drill Water	11/12/94
183	PB-BED-MW14	Drill Water	11/12/94
184	PB-BED-MW17	Drill Water	11/12/94
185	Decon Area/Hand Auger Decon	Decon Water	11/10/94
186	Decon Area/Hand Auger Decon	Decon Water	11/2/94
187	Decon Area/Hand Auger Decon	Decon Water	11/2/94
188	Decon Area/Hand Auger Decon	Decon Water	10/27/94
189	Decon Area/Hand Auger Decon	Decon Water	10/17/94
190	Decon Area/Hand Auger Decon	Decon Water	10/94
191	Decon Area/Hand Auger Decon	Decon Water	10/31/94
192	Decon Area/Hand Auger Decon	Decon Water	11/1/94
193	Decon Area/Hand Auger Decon	Decon Water	10/18/94
194	Decon Area/Hand Auger Decon	Decon Water	10/27/94
195	Decon Area/Hand Auger Decon	Decon Water	10/94
196	Decon Area/Hand Auger Decon	Decon Water	11/2/94
197	Decon Area/Hand Auger Decon	Decon Water	10/14/94
198	Decon Area/Hand Auger Decon	Decon Water	10/14/94
199	Decon Area/Hand Auger Decon	Decon Water	10/14/94
200	Decon Area/Hand Auger Decon	Decon Water	10/26/94
201	Decon Area/Hand Auger Decon	Decon Water	11/4/94
202	Decon Area/Hand Auger Decon	Decon Water	10/16/94
203	Decon Area/Hand Auger Decon	Decon Water	11/1/94
204	Decon Area/Hand Auger Decon	Decon Water	10/14/94
205	Decon Area/Hand Auger Decon	Decon Water	10/14/94
206	Decon Area/Hand Auger Decon	Decon Water	10/19/94
207	Decon Area/Hand Auger Decon	Decon Water	10/19/94
208	Decon Area/Hand Auger Decon	Decon Water	10/31/94
209	Decon Area/Hand Auger Decon	Decon Water	10/14/94

Drum Number	Source of IDW	Drum Contents	Date
210	Decon Area/Hand Auger Decon	Decon Water	11/2/94
211	Decon Area/Hand Auger Decon	Decon Water	10/16/94
212	PB-BED-MW17	Drill Water	10/27/94
213	PB-BED-MW17	Drill Water	11/12/94
214	Decon Area/Hand Auger Decon	Decon Water	10/27/94
215	Decon Area/Hand Auger Decon	Decon Water	10/28/94
216	Decon Area/Hand Auger Decon	Decon Water	11/1/94
217	Decon Area/Hand Auger Decon	Decon Water	10/14/94
218	Decon Area/Hand Auger Decon	Decon Water	10/14/94
219	Decon Area/Hand Auger Decon	Decon Water	10/14/94
220	Decon Area/Hand Auger Decon	Decon Water	10/14/94
221	Decon Area/Hand Auger Decon	Decon Water	10/13/94
222	Decon Area/Hand Auger Decon	Decon Water	10/26/94
223	Decon Area/Hand Auger Decon	Decon Water	10/17/94
224	Decon Area/Hand Auger Decon	Decon Water	10/14/94
225	Decon Area/Hand Auger Decon	Decon Water	10/14/94
226	Decon Area/Hand Auger Decon	Decon Water	10/14/94
227	Decon Area/Hand Auger Decon	Decon Water	10/14/94
228	Decon Area/Hand Auger Decon	Decon Water	10/17/94
229	Decon Area/Hand Auger Decon	Decon Water	10/18/94
230	Decon Area/Hand Auger Decon	Decon Water	10/27/94
231	Decon Area/Hand Auger Decon	Decon Water	10/94
232	Decon Area/Hand Auger Decon	Decon Water	10/17/94
233	Decon Area/Hand Auger Decon	Decon Water	11/2/94
234	Decon Area/Hand Auger Decon	Decon Water	11/2/94
235	Decon Area/Hand Auger Decon	Decon Water	10/18/94
236	Decon Area/Hand Auger Decon	Decon Water	10/18/94
237	Decon Area/Hand Auger Decon	Decon Water	10/14/94
238	Decon Area/Hand Auger Decon	Decon Water	10/27/94
239	Decon Area/Hand Auger Decon	Decon Water	10/94
240	Flume west of Engineering Bldg	Excavation Water	11/1/94
241	Flume west of Engineering Bldg	Excavation Water	11/1/94

from the flume excavation west of the engineering building (2 drums at the NASA Igloo). The flume excavation water was collected by a NASA contractor from an excavation trench during the installation of a sewer line and reportedly originated from an underground wooden flume associated with the former PBOW. The water is reportedly red in color and may contain explosives residue; however, chemical analyses of this IDW was not performed. Therefore, these two drums of aqueous IDW will not be addressed under the scope of this work.

Possible disposition options for the remaining aqueous IDW include on-site disposal within areas of known contamination (preferred) or off-site disposal.

2.2 Drill Cuttings and Rock Core IDW

Table 2-2 provides an inventory of 78 drums containing soil cuttings generated during background soil sampling and drilling and installation of monitoring wells. In addition, this table lists 11 wooden core boxes containing rock cores that were accumulated during bedrock monitoring well drilling and installation. All of these drums are stored at the PRSA. Disposal options for soil cuttings and rock cores include on-site disposal in areas of known contamination (preferred) or off-site disposal.

2.3 PPE, Used Sampling Equipment, and Miscellaneous IDW

As presented in Table 2-3, a total of 25 drums of PPE, used sampling equipment, and other miscellaneous IDW generated during the PBOW investigations are stored at the PRSA. These wastes will be double bagged and disposed of in an off-site industrial landfill.

Soil Cuttings/Rock Core IDW Drum Inventory, Pentolite Road Drum Storage Area

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
B	26	TNTA-MW10	Soil	10/15/94
	27	TNTA-MW11	Soil	10/15/94
	28	TNT Area A	Soil Cuttings	10/25/94
	29	TNT Area A	Soil Cuttings	10/29/94
	30	TNT Area B	Soil Cuttings	10/15/94
	31	TNT Area B	Soil Cuttings	10/14-15/94
	32	TNTB-MW12	Soil	10/14/94
	33	Background	Soil Cuttings	10/30/94 - 11/02/94
	34	TNT Area C	Soil Cuttings	10/12/94
	35	TNTC-MW4	Soil	10/12-13/94
	36	TNTC-MW5	Soil	10/13-14/94
	37	TNTC-MW5	Soil	10/13-14/94
	38	TNTC-MW6	Soil	10/16/94
	39	TNTC-MW3	Soil	10/12/94
	40	TNTC-MW4	Soil	10/12-13/94
	41	TNTA-MW11	Post Hole Soil	11/16/94
	42	TNTA-MW10	Post Hole Soil	11/15/94
	43	TNTC-MW3	Post Hole Soil	11/16/94
	44	TNTC-MW4	Post Hole Soil	11/16/94
	45	TNTC-MW5	Post Hole Soil	11/16/94
	46	TNTC-MW6	Post Hole Soil	11/16/94
	47	PB-PR-MW7	Post Hole Soil	11/15/94
	48	PB-PR-MW8	Post Hole Soil	11/15/94
	49	PB-PR-MW9	Post Hole Soil	11/15/94
	50	PB-WA-MW1	Post Hole Soil	11/16/94
	51	PB-BED-MW13	Post Hole Soil	11/16/94
	52	PB-BED-MW14	Post Hole Soil	11/16/94
	53	PB-BED-MW17	Post Hole Soil	11/15/94
	54	PB-BED-MW16	Post Hole Soil	11/16/94
	55	PB-BED-MW19	Post Hole Soil	11/16/94
	56	PB-BED-MW20	Post Hole Soil	11/16/94

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
C	57	PB-PR-S-?-	Soil	10/28/94
	58	PB-PR-MW8 (S14)	Soil	11/7/94
	59	PB-PR-S6	Soil	10/29/94
	60	PB-PR-MW9 (S19)	Soil	11/1/94
	61	PB-PR-S15	Soil	10/30/94
	62	PB-PR-S16	Soil	11/2/94
	63	PB-PR-S2,S5	Soil	10/28/94
	64	PB-PR-MW9 (S19)	Soil	11/1/94
	65	PB-PR-S12	Soil	10/30/94
	66	PB-PR-S6,S9	Soil	10/29/94
	67	PB-PR-MW7	Soil	10/31/94
	68	PB-PR-S10,S11	Soil	10/29/94
	69	PB-PR-MW8 (S14)	Soil	11/7/94
	70	PB-PR-MW7	Soil	10/31/94
	71	Pentolite Rd RWP	Soil Cuttings	10/30/94
	72	PB-WA-MW2	Soil	10/27/94
	73	PB-WA-S18	Soil	10/18-19/94
	74	PB-WA-MW1	Soil	10/17-18/94
	75	PB-WA-MW1	Soil	10/17-18/94
	76	West Area RWP	Soil Cuttings	10/17/94
	77	West Area RWP	Sediment	10/26/94
	78	PB-WA-MW2	Soil	11/13/94
	79	PB-BED-MW13, 14, 15, 16	Rock Core	10/94-11/94
	80	PB-BED-MW17, 18, 20	Rock Core	10/94-11/94
	WCB	PB-BED-MW14, 15, 17	Rock Core	10/94-11/94

Tal 2-2

Soil Cuttings/Rock Core IDW Drum Inventory, Pentolite Road Drum Storage Area

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
D	81	PB-BED-MW13	Soil	10/14/94
	82	PB-BED-MW13	Soil	10/14/94
	83	PB-BED-MW13	Soil	10/14/94
	84	PB-BED-MW13	Soil	10/14/94
	85	PB-BED-MW14	Soil	10/18/94
	86	PB-BED-MW14	Soil	10/18/94
	87	PB-BED-MW15	Soil	10/19/94
	88	PB-BED-MW15	Soil	10/15/94
	89	PB-BED-MW15	Soil	10/19/94
	90	PB-BED-MW16	Soil	10/15/94
	91	PB-BED-MW16	Soil	10/15/94
	92	PB-BED-MW16	Soil	10/15/94
	93	PB-BED-MW16	Soil	10/16/94

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
D (continued)	94	PB-BED-MW16	Soil	10/16/94
	95	PB-BED-MW17	Soil	10/26/94
	96	PB-BED-MW17	Soil	10/26/94
	97	PB-BED-MW17	Soil	10/26/94
	98	PB-BED-MW17	Soil	10/26/94
	99	PB-BED-MW18	Soil	10/25/94
	100	PB-BED-MW18	Soil	10/25/94
	101	PB-BED-MW18	Soil	11/15/94
	102	PB-BED-MW18	Soil	10/25/94
	103	PB-BED-MW19	Soil	11/10/94
	104	PB-BED-MW20	Soil	10/29/94
	105	PB-BED-MW20	Soil	10/29/94

NOTES: WCB - Wooden Core Boxes include samples from PB-BED-MW14, PB-BED-MW15, PB-BED-MW17.
A total of 11 core boxes are staged at the Pentolite Road Drum Storage Area.

There are no drums of soil or rock cores staged at the NASA Igloo 9155 Drum Storage Area.

Table 2-3

PPE / Used Sampling Equipment IDW Drum Inventory, Pentolite Road Drum Storage Area

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
A	1	Site Wide	PPE or Sampling Waste	10/94 - 1/95
	2			
	3			
	4			
	5			
	6			
	7			
	8			
	9			
	10			
	11			
	12			
	13			
	14			
	15			

Location / Row	Drum Number	Source of IDW	Drum Contents	Date
A (continued)	16	Site Wide	PPE or Sampling Waste	10/94 - 1/95
	17			
	18			
	19			
	20			
	21			
	22			
	23			
	24			
	25			

NOTES: There are no drums of PPE or Used Sampling Equipment staged at the NASA Igloo 9155 Drum Storage Area.

3.0 Analytical Results and IDW Evaluation

In order to determine disposal recommendations for the IDW presented in Section 2.0, available analytical results for soil and groundwater samples have been evaluated. Specifically, drill water and purge water IDW have been evaluated using analytical results from 25 groundwater samples collected during the investigation, while soil cuttings were evaluated using analytical results from background soil samples and limited soil samples from monitoring well soil borings. Analytical results for the evaluation of rock cores, decontamination water, and other IDW were not available for evaluation.

Data were evaluated using RBCs adopted from EPA guidance (EPA, 1995). RBCs are media-specific contaminant levels used to compare concentrations of site-related chemicals to determine whether the site-related concentrations contribute significantly to total site risk. RBCs are conservatively derived by assuming a residential receptor, applying high-end values for most of the exposure variables, and setting the target cancer risk at 10^{-6} and the target hazard index (HI) at 0.1. The cancer risk of 10^{-6} reflects the lower end of the target risk range as defined in the National Contingency Plan (EPA, 1990). The HI of 0.1 provides additional protection from noncancer effects arising from exposure to multiple chemicals.

RBCs were obtained preferentially from the EPA Region III tables compiled for this purpose (EPA, 1995).

Residential rather than commercial/industrial RBCs were used as the more conservative screening concentration for contaminants in soils. RBCs for tap water were used to screen contaminants in groundwater, assuming that household use of groundwater results in the most restrictive contamination levels. RBCs for screening contaminants in surface water were obtained by multiplying the tap-water RBCs by ten, reflecting the assumption that exposure to and ingestion of surface water is expected to be less than exposure to or ingestion of household water.

Surface water RBCs are used in the evaluation to determine if the surface disposal of this IDW, and potential runoff, may exceed acceptable risks to human health. Additionally, aqueous IDW analytical data were compared to groundwater maximum contaminant levels (MCL) to determine if the levels of contaminants were greater than the acceptable levels of contaminants in groundwater.

3.1 Aqueous IDW

3.1.1 Purge and Drill Waters

As presented in section 2.1, 79 drums of purge, drill, and rock core water IDW are staged at the former PBOW. These IDW have been evaluated using analytical results from groundwater samples summarized in the following sections.

TNT Manufacturing Area A Aqueous IDW. Six drums containing purge water were generated from monitoring wells installed at TNT Manufacturing Area A (TNTA) during the investigations. Two of these drums contain purge water from monitoring well PB-TNTA-MW10 (drum 106 and 107), one contains purge water from monitoring well PB-TNTA-MW11 (drum 108), one contains purge water from monitoring well MK-MW22 (drum 110), one contains purge water from well MK-MW23 (drum 111), and one contains purge water from well MK-MW24 (drum 109). Analytical results exceeding RBCs or MCLs from these wells are summarized in Table 3-1.

Manganese exceeded the surface water RBC in each of the five sampled wells, ranging from 280 µg/L in PB-TNTA-MK-MW22 to 1,300 µg/L in PB-TNTA-DM-MW11. However, manganese concentrations in groundwater and surface water at the Pentolite Road Red Water Pond (PRRWP) disposal area are commonly on the same order of magnitude. Lead exceeded the MCL in three of the wells, ranging from 7 to 14 µg/L, but the surface water RBC was not exceeded. Monitoring well PB-TNTA-DM-MW11 also exhibited arsenic at a concentration above the RBC.

TNT Manufacturing Area B Aqueous IDW. Two drums containing purge water were generated from monitoring wells installed at TNT Manufacturing Area B (TNTB) during the investigations. One of these drums contains purge water from monitoring well PB-TNTB-MK-MW16 (drum 113) and one contains purge water from monitoring well PB-TNTB-MK-MW17 (drum 112). Analytical results exceeding RBCs or MCLs from these wells are summarized in Table 3-2.

Manganese exceeded the surface water RBC in each of the sampled wells, with concentrations of 17,000 µg/L in PB-TNTB-MK-MW16 and 2,300 µg/L in PB-TNTB-MK-MW17. However, manganese concentrations in groundwater at the PRRWP disposal area are commonly on the same order of magnitude.

Table 3-1

Detected Concentrations Above RBCs or MCLs in Groundwater Samples, TNT Manufacturing Area A

Parameter	Units	RBC-SW	MCL	PB-TNTA-DM-MW10	PB-TNTA-DM-MW11	PB-TNTA-MK-MW22	PB-TNTA-MK-MW23	PB-TNTA-MK-MW24
Antimony	µg/L	15	6					
Arsenic	µg/L	0.45	na		10			
Lead	µg/L	15	5	7	14		7	
Manganese	µg/L	180	na	980	1300	280	880	310

Disposal Area Analytical Results (Pentolite Rd. Red Water Reservoir Area)								
Parameter	Units	RBC-SW	MCL	SW04	PB-PR-IT-MW05	PB-PR-DM-MW07	PB-PR-DM-MW08	PB-PR-DM-MW09
Antimony	µg/L	15	6					
Arsenic	µg/L	0.45	na					
Lead	µg/L	15	5					
Manganese	µg/L	180	na	370	100	12000	8000	1800

Table 3-2

Detected Concentrations Above RBCs or MCLs in Groundwater Samples, TNT Manufacturing Areas B and C

Parameter	Units	RBC-SW	MCL	PB-TNTB-MK-MW16	PB-TNTB-MK-MW17	PB-TNTC-DM-MW05	PB-TNTC-DM-MW06	
Antimony	µg/L	15	6			8		
Arsenic	µg/L	0.45	na		13			
Beryllium	µg/L	0.16	4	2				
Copper	µg/L	1500	na					
Lead	µg/L	15	5	6	9	13	5	
Manganese	µg/L	180	na	17000	2300	570	1400	
Nickel	µg/L	730	na					
Thallium	µg/L	2.3	2	2.6				

Disposal Area Analytical Results (Pentolite Rd. Red Water Reservoir Area)								
Parameter	Units	RBC-SW	MCL	SW04	PB-PR-IT-MW05	PB-PR-DM-MW07	PB-PR-DM-MW08	PB-PR-DM-MW09
Antimony	µg/L	15	6					
Arsenic	µg/L	0.45	na					
Beryllium	µg/L	0.16	4					
Copper	µg/L	1500	na			1400	1600	
Lead	µg/L	15	5					
Manganese	µg/L	180	na	370	100	12000	8000	1800
Nickel	µg/L	730	na			2000	2500	1500
Thallium	µg/L	2.3	2			0.9		

Arsenic exceeded the RBC in MW17. Arsenic was not detected in groundwater or surface water at concentrations above the RBC at the PRRWP; however, the detection limit for arsenic was 10 µg/L, which is on the same order of magnitude as the detected concentration in MW17. Beryllium exceeded the RBC but not the MCL in MW16, while lead exceeded the MCL in both wells but was below the surface water RBC. As with arsenic, neither beryllium or lead were detected at the PRRWP but the respective detection limits of 1 and 3 g/L are on the same order of magnitude as the recorded detections. Finally, thallium exceeded both the MCL and RBC in MW16 but not in MW17. Thallium was also detected at the PRRWP at a concentration of 0.9 µg/L, identical to that seen in MW17.

TNT Manufacturing Area C Aqueous IDW. Three drums containing purge water were generated from monitoring wells installed at TNT Manufacturing Area C (TNTC) during the investigations. Two of these drums contain purge water from monitoring well PB-TNTC-DM-MW05 (drums 115 and 116) and one contains purge water from monitoring well PB-TNTC-DM-MW06 (drum 114). Analytical results exceeding RBCs or MCLs from these wells are summarized in Table 3-2.

Antimony exceeded MCL in MW05 but did not exceed the surface water RBC. However, the detected concentration is on the same order of magnitude as the MCL. Manganese exceeded the surface water RBC in each of the sampled wells, with concentrations of 570 µg/L in PB-TNTC-DM-MW05 and 1,400 µg/L in PB-TNTC-DM-MW06. However, manganese concentrations in groundwater at the PRRWP disposal area are on the same order of magnitude or greater.

Lead exceeded the MCL in both wells, but the RBC was not exceeded.

West Area Red Water Ponds Aqueous IDW. Two drums containing purge water were generated from monitoring wells installed at the West Area Red Water Ponds (WARWP) during the investigations. One of these drums contains purge water from monitoring well PB-WA-DM-MW02 (drum 117) and one contains purge water from monitoring well PB-WA-IT-MW02 (drum 118). Analytical results exceeding RBCs or MCLs from these wells are summarized in Table 3-3.

Manganese exceeded the surface water RBC in each of the sampled wells, with concentrations of 1,600 µg/L in PB-WA-DM-MW02 and 2,500 µg/L in PB-WA-IT-MW02. However,

Table 3-3

Detected Concentrations Above RBCs or MCLs in Groundwater Samples, West Area Red Water Ponds

Parameter	Units	RBC-SW	MCL	PB-WA-DM-MW02	PB-WA-IT-MW02	PB-WA-MK-MW11	PB-WA-DM-MW22	
Lead	µg/L	15	5	10				
Manganese	µg/L	180	na	1600	2500	180	1800	
Nickel	µg/L	730	na					

Disposal Area Analytical Results (Pentolite Rd. Red Water Reservoir Area)								
Parameter	Units	RBC-SW	MCL	SW04	PB-PR-IT-MW05	PB-PR-DM-MW07	PB-PR-DM-MW08	PB-PR-DM-MW09
Lead	µg/L	15	5					
Manganese	µg/L	180	na	370	100	12000	8000	1800
Nickel	µg/L	730	na			2000	2500	1500

manganese concentrations in groundwater at the PRRWP disposal area are commonly on the same order of magnitude.

Lead exceeded the MCL in DM-MW02 but was below the surface water RBC.

Pentolite Road Red Water Pond Area Aqueous IDW. Four drums containing purge water were generated from monitoring wells installed at PRRWP Area during the investigations. One of these drums contains purge water from monitoring well PB-PR-IT-MW05 (drum 119), one contains purge water from PB-PR-DM-MW07 (drum 120), one contains purge water from PB-PR-DM-MW08 (drum 121), and one contains purge water from monitoring well PB-PR-DM-MW09 (drum 122). Because these IDW were generated from the proposed disposal area, analytical results for these wells have been summarized in Tables 3-1 through 3-4.

Bedrock Monitoring Wells Aqueous IDW. Sixty drums containing purge water or drill water were generated from bedrock monitoring wells installed at the PBOW during the investigations. Eight of these drum contains purge or drill water from monitoring well PB-BED-DM-MW13 (drums 123 through 130), seven from monitoring well PB-BED-DM-MW14 (drums 131 through 135, 182, and 183), seven from monitoring well PB-BED-DM-MW15 (drums 136 through 142), six from monitoring well PB-BED-DM-MW16 (drums 143 through 148), six from monitoring well PB-BED-DM-MW17 (drums 149 through 151, 184, 212, and 213), nine from monitoring well PB-BED-DM-MW18 (drums 152 through 160), eight from monitoring well PB-BED-DM-MW19 (drums 161 through 168), and nine from monitoring well PB-BED-DM-MW20 (drums 169 through 175, 180, and 181). Analytical results exceeding RBCs or MCLs from these wells are summarized in Table 3-4.

The bedrock monitoring wells exhibited several organic compounds at concentrations above the RBC or MCL. 1,2,4-trimethylbenzene was detected in monitoring well MW15 at a concentration of 300 µg/L, matching the surface water RBC; this compound was not detected in samples collected from the PRRWP area. 1,3,5-trinitrobenzene (1,3,5-TNB) exceeded the surface water RBC in wells MW13 and MW16 with a concentration of 22 µg/L in each well; however, 1,3,5-TNB was detected at concentrations two orders of magnitude higher at the PRRWP area. Finally, benzene exceeded the RBC and MCL in seven of the eight wells, ranging from 5 µg/L in MW19 to 2,000 µg/L in MW16. Benzene was not detected at the PRRWP area.

Table 3-4

Detected Concentrations Above RBCs or MCLs in Groundwater Samples, Bedrock Wells

Parameter	Units	RBC-SW	MCL	PB-BED-DM-MW13	PB-BED-DM-MW14	PB-BED-DM-MW15	PB-BED-DM-MW16	PB-BED-DM-MW17
1,2,4-Trimethylbenzene	µg/L	300	na			300		
1,3,5-Trinitrobenzene	µg/L	1.8	na	22			22	
Benzene	µg/L	3.6	5	50		830	2000	33
Antimony	µg/L	15	6	14		18		7
Arsenic	µg/L	0.45	na					18
Manganese	µg/L	180	na				280	
Thallium	µg/L	2.3	2					

Parameter	Units	RBC-SW	MCL	PB-BED-DM-MW18	PB-BED-DM-MW19	PB-BED-DM-MW20	PB-BED-DM-MW21	
1,2,4-Trimethylbenzene	µg/L	300	na					
1,3,5-Trinitrobenzene	µg/L	1.8	na					
Benzene	µg/L	3.6	5	14	5	8	16	
Antimony	µg/L	15	6		8			
Arsenic	µg/L	0.45	na					
Manganese	µg/L	180	na					
Thallium	µg/L	2.3	2					

Disposal Area Analytical Results (Pentolite Rd. Red Water Reservoir Area)								
Parameter	Units	RBC-SW	MCL	SW04	PB-PR-IT-MW05	PB-PR-DM-MW07	PB-PR-DM-MW08	PB-PR-DM-MW09
1,2,4-Trimethylbenzene	µg/L	300	na					
1,3,5-Trinitrobenzene	µg/L	1.8	na			5700	1300	4
Benzene	µg/L	3.6	5					
Antimony	µg/L	15	6					
Arsenic	µg/L	0.45	na					
Manganese	µg/L	180	na	370	100	12000	8000	1800
Thallium	µg/L	2.3	2					

Four inorganic compounds also exceeded the RBC or MCL in at least one of the eight sampled wells. Antimony exceeded the RBC in MW15, but was not detected at the PRRWP area. Arsenic exceeded the RBC in MW17; this inorganic compound was not detected in samples from the PRRWP area. Manganese exceeded the RBC in MW16, but was detected at a concentration up to two orders of magnitude below those seen at the PRRWP area.

3.1.2 Decontamination Water

A total of 55 drums of decontamination water generated from the decontamination area and hand auger decontamination activities were generated during the investigations and are stored at the NASA Igloo. These drums (drums 178, 179, 185 through 211, and 214 through 239) contain decontamination water generated during steam cleaning and decontamination of drilling and sampling equipment; the source water for decontamination activities was potable water. Decontamination water has not been sampled and analyzed, but contaminants in this water are expected to be those present in other sampled site media.

3.2 Drill Cuttings and Rock Core IDW

A total of seventy-eight drums containing soil cuttings were generated during the investigation at PBOW. An additional two drums and eleven core boxes contain rock cores generated during the drilling and installation of bedrock wells. The following section summarize the analytical results for these IDW.

3.2.1 Drill Cuttings

These IDW have been evaluated using analytical results from background soil samples and a limited number of monitoring well soil samples summarized below. In addition to presenting the analytical results, the sections presents risk-based concentrations (RBC) for soils. The RBCs for soils are based upon the U.S. EPA Region III RBC tables, dated October 1995.

TNT Manufacturing Area A Soil Cuttings. Six drums containing soil cuttings were generated from monitoring wells and soil borings drilled and installed at TNTA during the investigations. Two of these drums contain soil cuttings from monitoring well PB-TNTA-MW10 (drum 26 and 42), two contain soil cuttings from monitoring well PB-TNTA-MW11 (drum 27 and 41), and two contain soil cuttings from soil borings (drums 28 and 29). Analytical results exceeding RBCs from soil samples collected from the various areas at PBOW are summarized in Table 3-5.

Table 3-5

Maximum Detected Concentrations Exceeding RBCs in Soil Samples
Plum Brook Ordnance Works

Description	Parameter:	1,3-DNB	1,3,5-TNB	2,4-DNT	2,6-DNT	2,4,6-TNT	Antimony	Arsenic	Beryllium	Copper	Chromium	Lead	Manganese
	Units:	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
	RBC:	0.78	0.39	16	7.8	21	3.1	0.43	0.15	310	39	400	39
TNT Area A Soil Samples - Maximum Detected Concentration			2.5	45	47	580	13	9.1		489	52	1809	7600
TNT Area B Soil Samples - Maximum Detected Concentration		2.5	2.5	11000	12000	29000	18	30	1.4			8111	1609
TNT Area C Soil Samples - Maximum Detected Concentration							13.2	10.9	4.8				1682
West Area Red Water Pond - Maximum Detected Concentration		2.4	5.5				7.4	7.7	14				3300
Pentolite Road Red Water Pond - Maximum Detected Concentration		6.7	58	19		12000	7.3	22					1500
Background Soil Samples - Maximum Detected Concentration							7.6	23					695

Constituents exceeding RBCs in soils from TNT Manufacturing Area A include 1,3,5-TNB, 2,4-DNT, 2,6-DNT, 2,4,6-TNT, antimony, arsenic, copper, chromium, lead, and manganese. The detected concentrations of 1,3,5-TNB, 2,4,6-TNT, and arsenic are less than those detected at the PRRWP disposal area. The detected concentration of 2,4-DNT is on the same order of magnitude as those at the PRRWP. The remaining constituents exceeded the detected concentrations at the PRRWP disposal area; however, the PRRWP area is known to be contaminated with nitroaromatics and metals and disposal of these soils in that area should not adversely impact the PRRWP site.

TNT Manufacturing Area B Soil Cuttings. Three drums containing soil cuttings were generated from TNT Manufacturing Area B. Two of these drums contain soil cuttings from soil borings (Drums 30 and 31) and one contains soil cuttings from monitoring well PB-TNTB-MW12 (drum 32).

Constituents exceeding RBCs in soils from TNT Manufacturing Area B include 1,3-DNB, 1,3,5-TNB, 2,4-DNT, 2,6-DNT, 2,4,6-TNT, antimony, arsenic, beryllium, lead, and manganese. The detected concentrations of 1,3-DNB and 1,3,5-TNB are less than those detected at the PRRWP disposal area. The detected concentration of 2,4,6-TNT, arsenic, and manganese are on the same order of magnitude as those at the PRRWP. The remaining constituents exceeded the detected concentrations at the PRRWP disposal area; however, the PRRWP area is known to be contaminated with nitroaromatics and metals and disposal of these soils in that area should not adversely impact the PRRWP site.

TNT Manufacturing Area C Soil Cuttings. Eleven drums containing soil cuttings were generated from TNT Manufacturing Area C. Five of these drums contain soil cuttings from soil borings or post holes (drums 34 and 43 through 46), one contains soil cuttings from monitoring well PB-TNTC-MW3 (drum 39), two contain soil cuttings from PB-TNTC-MW4 (drums 35 and 40), two contain soil cuttings from monitoring well PB-TNTC-MW5 (drums 36 and 37), and one contains soil cuttings from monitoring well PB-TNTC-MW6 (drum 38).

Constituents exceeding RBCs in soils from TNT Manufacturing Area C include antimony, arsenic, beryllium, and manganese. The detected concentration of arsenic is less than that detected at the PRRWP disposal area. The detected concentration of manganese is on the same order of magnitude as those at the PRRWP. The remaining constituents, antimony and beryllium, exceeded the detected concentrations at the PRRWP disposal area; however, the

PRRWP area is known to be contaminated with nitroaromatics and metals and disposal of these soils in that area should not adversely impact the PRRWP site.

West Area Red Water Pond Soil Cuttings. Eight drums containing soil cuttings were generated from the West Area Red Water Pond area. Four of these drums contain soil cuttings from soil borings or post holes (drums 50, 73, 76 and 77), two contain soil cuttings from monitoring well PB-WA-MW1 (drums 74 and 75), and two contain soil cuttings from monitoring well PB-WA-MW2 (drums 72 and 78).

Constituents exceeding RBCs in soils from the West Area Red Water Pond include 1,3-DNB, 1,3,5-TNB, antimony, arsenic, beryllium, and manganese. The detected concentration of 1,3-DNBm 1,3,5-TNB, and arsenic are less than those detected at the PRRWP disposal area. The detected concentration of antimony is on the same order of magnitude as those at the PRRWP. The remaining constituents, beryllium and manganese, exceeded the detected concentrations at the PRRWP disposal area; however, the PRRWP area is known to be contaminated with nitroaromatics and metals and disposal of these soils in that area should not adversely impact the PRRWP site.

Background Soil Cuttings. One drum containing soil cuttings were generated from the Background soil borings (drum 33).

Constituents exceeding RBCs in background soils include antimony, arsenic, and manganese. The detected concentration of each of these constituents are less than or of the same order of magnitude as those detected at the PRRWP disposal area.

Pentolite Road Red Water Pond Soil Cuttings. Eighteen drums containing soil cuttings were generated from the PRRWP area. All eighteen of these drums contain soil cuttings from soil borings or post holes (drums 47 through 49 and 57 through 71).

Constituents exceeding RBCs in soils from the PRRWP include 1,3-DNB, 1,3,5-TNB, 2,4-DNT, 2,4,6-TNT, antimony, arsenic, and manganese.

Bedrock Well Soil Cuttings. Thirty-three drums containing soil cuttings or rock cores were generated from the installation of the bedrock wells. Six of these drums contain soil cuttings from post holes (drums 51 through 56), two contain rock cores from monitoring wells PB-BED-MW13 through MW20 (drums 79 and 80), four contain soil cuttings from

monitoring well PB-BED-MW13 (drums 81 through 84), two contain soil cuttings from monitoring well PB-BED-MW14 (drums 85 and 86), three contain soil cuttings from monitoring well PB-BED-MW15 (drums 87 through 89), five contain soil cuttings from monitoring well PB-BED-MW16 (drums 90 through 94), four contain soil cuttings from monitoring well PB-BED-MW17 (drums 95 through 98), four contain soil cuttings from monitoring well PB-BED-MW18 (drums 99 through 102), one contains soil cuttings from monitoring well PB-BED-MW19 (drum 103), and two contain soil cuttings from monitoring well PB-BED-MW20 (drums 104 and 105).

Soils from the bedrock wells were not specifically sampled and analyzed during the investigations, and analytical results are not available for comparison. However, groundwater samples were collected and analyzed from each of the wells (Table 3-4). The bedrock monitoring wells exhibited several organic compounds at concentrations above the RBC or MCL. 1,2,4-trimethylbenzene was detected in monitoring well MW15 at a concentration of 300 µg/L, matching the surface water RBC; this compound was not detected in groundwater samples collected from the PRRWP area. 1,3,5-trinitrobenzene (1,3,5-TNB) exceeded the surface water RBC in wells MW13 and MW16 with a concentration of 22 µg/L in each well; however, 1,3,5-TNB was detected at concentrations two orders of magnitude higher at the PRRWP area. Finally, benzene exceeded the RBC in seven of the eight wells, ranging from 5 µg/L in MW19 to 2,000 µg/L in MW16. Benzene was not detected at the PRRWP area.

3.3 PPE, Used Sampling Equipment, and Miscellaneous IDW

Twenty-five drums of PPE/sampling wastes were generated during the PBOW investigations (drums 1 through 25). This waste will be disposed of in an off-site industrial landfill.

4.0 IDW Disposition Recommendations

On-site disposal of IDW generated during the PBOW investigations is proposed in an area selected during the December 1995 site visit. The area is located within the PRRWP area, located south of Pentolite Road (Figure 4-1). An environmental investigation was completed of the PRRWP by IT in 1989, which found areas of shallow soil contamination by inorganic compounds and nitroaromatic compounds (Table 4-1). These findings are supported by nitroaromatic and inorganic compounds in soils and groundwater documented in the Dames & Moore data.

The following sections provide disposition recommendations for the generated IDW, which are based on the analytical summaries presented in Section 3.0.

4.1 Aqueous IDW

4.1.1 Purge and Drill Waters

As presented in section 3.1.1, purge and drill waters generated from the 25 wells sampled during the PBOW investigations exhibited contamination by explosives and inorganic compounds. Bedrock wells also exhibited volatile and semivolatile organic compounds; these parameters were not analyzed for in other wells. However, most of the remaining constituents were also present in groundwater at the PRRWP disposal area, and it is recommended that the 79 drums containing purge and drill water IDW be disposed of at the proposed disposal area. Although some constituents detected at concentrations exceeding the RBC or MCL across the site were not present at the PRRWP, the disposal area is known to be contaminated and disposal should not significantly increase site contamination at the PRRWP.

4.1.2 Decontamination Waters

Decontamination waters were not sampled and analyzed as part of the PBOW investigation. However, potable water was used in the decontamination process, and any contaminants introduced during the decon activities would be site related, similar to those seen in groundwater or soil samples. Therefore, it is recommended that the 55 drums containing decontamination IDW be disposed of at the PRRWP disposal area with the purge and drill water.

4.1.3 Aqueous IDW Disposal Procedures

As specified in the field work plan for IDW disposition at PBOW, aqueous IDW will be placed on the ground within the PRRWP disposal area. In order to minimize potential runoff, small berms will be constructed around the disposal area, thereby containing the liquids within the disposal area.

4.2 Soil Cuttings and Rock Cores

As presented in section 3.2, 78 drums containing soil cuttings or rock cores are stored at the PBOW. The analytical results for these materials show the presence of explosives, inorganic compounds, and some organic compounds at levels that exceed the RBCs. However, similar levels and types of contaminants are also evident in the proposed PRRWP disposal area, and the disposal of this IDW at the PRRWP should not adversely affect this already contaminated area. Therefore, it is recommended that this IDW be disposed of at the proposed disposal area.

Disposal of these materials, including soil cuttings and rock cores, will be accomplished by spreading the IDW on the surface within the PRRWP area in accordance with the procedures presented in the field work plan. Following the spreading of the soil, a front end loader or similar equipment will be used to backfill and compact the material to minimize the possibility of erosion.

4.3 PPE, Used Sampling Equipment, and Miscellaneous IDW

The 25 drums containing PPE and used sampling equipment generated during the field investigations at PBOW cannot be disposed of on-site. It is recommended that the contents of these drums be double bagged, placed in an industrial dumpster, and disposed of at an off-site industrial landfill.

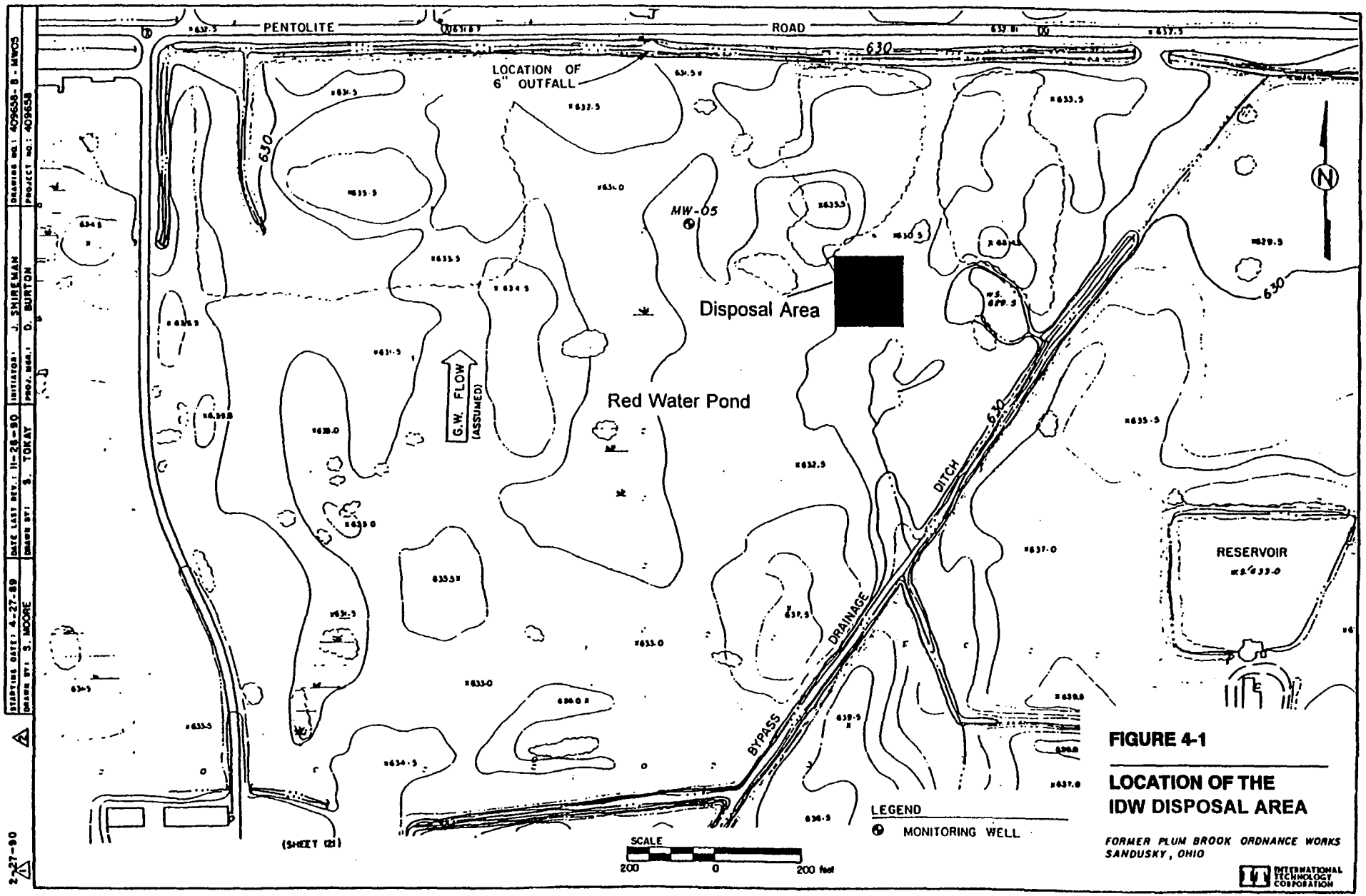

FIGURE 4-1

LOCATION OF THE IDW DISPOSAL AREA

FORMER PLUM BROOK ORDNANCE WORKS SANDUSKY, OHIO

INTERNATIONAL TECHNOLOGY CORPORATION

Table 4-1a

Analytical Results for Soil Samples
Metals and Nitroaromatic Compounds (mg/kg)
Plum Brook Ordnance Works

	Borehole Number											-----Background-----
Compound	SB-11	SB-12	Method Blank PBSC0897	SB-13 0-2	SB-14 0-2	SB-15 2-4	SB-15 4-6	SB-16 0-2	SB-16 4-6	SB-17 0-2	SB-18 0-2	SB-19 0-2	SB-19 0-2 Field Dup.
METALS													
Arsenic	2.3	3U	0.2	2.7U	1.8	4.6	3.2U	2.8	4.9	0.8	1.3	9.4	3U
Barium	48.4	52.2	0.2U	56.7	51.6	14.1	31.1	16.5	27.1	21.9	20.2	35.2	45.4
Cadmium	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Chromium	11	10	1U	13	10	8	10	8	6	6	5	10	8
Iron	12,800	18,000	44	15,500	12,000	10,900	13,100	5,910	7,700	8,370	6,890	23,800	9,800
Lead	14	14	3U	9	11	11	12	5	7	8	11	25	18
Maganese	211	262	0.2U	263	146	181	244	78.2	435	141	97.6	18.0	15.5
Mercury	0.5U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U	0.1U
Selenium	2.5U	0.5U	0.2U	1.0U	0.9U	0.5U	1.7U	0.7U	1.0U	0.4U	2.0U	0.2	1.0U
Silver	0.5U	U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U	0.5U
Sodium	539	1,660	20U	2,590	3,420	96.9	125	1,040	2,820	1,240	1,980	40.1	40

U - Compound was analyzed for but not detected; value listed is detection limit for that sample.
Method Blank PSC0836 applies to samples SB-13 0/2, SB-14 0/2, SB-15 2/4, SB-15 4/6, SB-16 0/2, SB-16 4/6, SB-17 0/2, SB-18 0/2, SB-19 0/2 replicate.

Table 4-1a

Analytical Results for Soil Samples
Metals and Nitroaromatic Compounds (mg/kg)
Plum Brook Ordnance Works

Compound	SB-11	SB-12	SB-13 0-2'	SB-14 0-2'	SB-15 2-4'	SB-15 4-6'	SB-16 0-2'	SB-16 4-6'	SB-17 0-2'	SB-18 0-2'	Background SB-19 0-2'	Background SB-19 Field Duplicate
1,3,5-Trinitrobenzene	0.050U	3.4	0.73	14	0.050U	0.050U	1.2	15	0.67	10	0.050U	0.050U
1,3-Dinitrobenzene	0.050U	0.59	0.62	3.7	0.50U	0.050U	0.55	6.4	0.25U	5.0	0.050U	0.050U
Nitrobenzene	0.048U	U	0.24U	2.5U	0.048U	0.048U	0.48	2.4U	0.24U	2.4U	0.048U	0.048U
2,4,6-Trinitrotoluene	0.074U	0.68	0.37U	3.7U	0.074U	0.074U	0.74	3.7U	0.37U	3.7U	0.074U	0.074U
2,6-Dinitrotoluene	0.053U	U	0.26U	2.6U	0.053U	0.053U	0.53	2.7U	0.27U	2.7	0.053U	0.053U
2,4-Dinitrotoluene	0.11U	0.91	2.2	20	0.11U	0.11U	3.2	16	1.1	19	0.11U	0.11U
Nitrotoluene	0.048U	U	0.24U	2.4U	0.048U	0.48U	0.48	2.4U	0.24U	2.4U	0.048U	0.048U

U - Compound was analyzed for but not detected; value listed is the detection limit for the sample.

Table 4-1b

Analytical Results for Soil Samples
Volatile and Semivolatile Organic Compounds (µg/kg)
Plum Brook Ordnance Works

Compound	Method Blank VB1101	Method Blank 4983	SB-13 0-2'	SB-14 0-2'	SB-15 2-4'	SB-15 4-6'	SB-16 0-2'	SB-16 4-6'	SB-17 0-2'	SB-18 0-2'	Background SB-19 0-2'	Background SB-19 Field Duplicate	Soil Rinsate 1	Soil Rinsate 2
VOLATILE ORGANIC														
Acetone	10U	NA	170	80	12U	12U	160	54	150	12U	3,000E	11,000	10U	80
Toluene	5U	NA	6U	6U	1J	6U	6U	6U	25J	1J	9	7U	5U	5U
Methylene chloride	2J	NA	6	9	7	7	5J	8	5J	6U	7	6J	5U	5U
SEMIVOLATILE ORGANIC														
2,6-Dinitrotoluene	NA	330U	180J	1,700	390U	390U	320J	1,500	82J	1,000	440U	860U	NA	NA
2,4-Dinitrotoluene	NA	330U	1,600	11,000	390U	390U	1,900	7,300	740	5,900	440U	860U	NA	NA
Bis(2-ethylhexyl) phthalate	NA	79J	230J	180J	320J	450	340J	500J	280J	250J	410J	270J	NA	NA

U - Compound was analyzed for but not detected; value listed is the detection limit for that sample.
J - Indicates a value less than the detection limit; value listed is estimated.
E - Compound exceeded CLP calibration range.
NA - Not analyzed.

Table 4-1c

Analytical Results for Water Samples (mg/L)
Plum Brook Ordnance Works

	Method Blank EB1030	Method Blank BL4982	SW-01	SW-02	SW-03	SW-04	SW-04 Field Duplicate	Trip Blank JJ7938
Volatile Organics								
Acetone	10U	NA	10U	10U	10U	3J	10U	10U
Methylene chloride	3J	NA	5U	5U	5U	5U	5U	3J
4-methyl-2-pentanone	1J	NA	10U	10U	10U	10U	10U	10U
Semivolatile Organics								
bis(2-ethylhexyl)phthalate	NA	2J	10U	10U	10U	10U	10U	NR
butylbenzylphthalate	NA	10U	10U	10U	10U	10U	19	NR

U - Compound was analyzed for but not detected; value listed is the detection limit for that sample.
J - Indicates a value less than the detection limit; values listed are estimated.
NR - Not required.
NA - Not analyzed.

Table 4-1c

Analytical Results for Water Samples (mg/L)
Plum Brook Ordnance Works

Compound	Method Blank BL0141	SW-01	SW-02	SW-03	SW-04	SW-04 Field Duplicate
1,3,5-trinitrobenzene	0.050U	0.050U	0.050U	0.050U	0.050U	0.050U
1,3-dinitrobenzene	0.050U	0.050U	0.050U	0.050U	0.050U	0.050U
Nitrobenzene	0.048U	0.048U	0.048U	0.048U	0.048U	0.048U
2,4,6-trinitrotoluene	0.074U	0.074U	0.074U	0.074U	0.074U	0.074U
2-6-dinitrotoluene	0.053U	0.053U	0.054U	0.054U	0.054U	0.054U
2,4-dinitrotoluene	0.11U	0.11U	0.11U	0.11U	0.11U	0.11U
Nitrotoluene	0.048U	0.048U	0.048U	0.048U	0.048U	0.048U

U = Compound was analyzed for but not detected.

Table 4-1c

Analytical Results for Water Samples (mg/L)
Plum Brook Ordnance Works

Compound	Water Quality Criteria	SMCL	PMCL	Method Blank	SW-01	SW-02	SW-03	SW-04	SW-04 Field Duplicate
Arsenic	0		0.03	0.002U	0.003	0.002U	0.003U	0.002U	0.003U
Barium	N/L		5	0.002U	0.058	0.029	0.047	0.079	0.19
Cadmium	10		0.005	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Chromium	N/L		0.1	0.05U	0.01U	0.01U	0.01U	0.01	0.04
Iron	N/L	0.3		0.01U	0.89	0.36	1.1	9.6	40.6
Lead	50		0.02	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U
Manganese	N/L	0.05		U	0.030	0.021	0.039	0.37	0.94
Mercury	10		0.002	NR	0.001U	0.001U	0.001U	0.001U	0.001U
Selenium	10		0.05	0.002U	0.004U	0.004U	0.003U	0.003U	0.004U
Silver	50		0.05	0.005U	0.005U	0.005U	0.005U	0.005U	0.005U
Sodium	N/L			U	0.2U	6.7	7.1	92.7	102

U - Compound was analyzed for but not detected; value listed is the detection limit for the sample.
NR - Not required.
MCL - Maximum contaminant level.
SMCL - Secondary contaminant level.
PMCL - Proposed contaminant level.
N/L - Not listed.

All regulatory limits given are derived from the Safe Drinking Water Act and the Clean Water Act.