

APPENDIX A

RESULTS OF PREVIOUS INVESTIGATIONS

AT THE

ERIE BURNING GROUNDS

APPENDIX A-1

SELECTED PORTIONS FROM

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

AT

ERIE BURNING GROUNDS

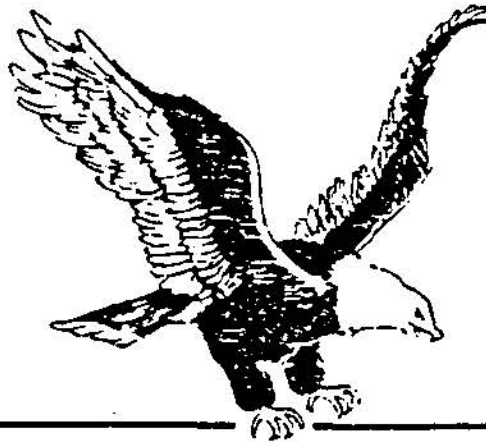
INSTALLATION ASSESSMENT (1978)

7-10
X T O 1 3 6 M A I D U P

INSTALLATION ASSESSMENT
OF
RAVENNA ARMY AMMUNITION PLANT

REPORT NO. 132

NOVEMBER 1978



US ARMY
TOXIC AND HAZARDOUS MATERIALS AGENCY

ABERDEEN PROVING GROUND, MARYLAND 21010

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EVALUATING ANOTHER COMMAND: NOVEMBER 1978
OTHER REQUESTS FOR THIS DOCUMENT MUST BE
REFERRED TO: COMMANDER, RAVENNA ARMY
AMMUNITION PLANT, RAVENNA, OH 44266

A-5

B-1

1. Demolition Area (Old)
2. Demolition Area (New)
3. Burning Grounds (YHK 49)
4. Burning Grounds (Fuze & Booster)
5. Burning Grounds (Winktepeck)
6. Landfill (Old)
7. Landfill (New) Remsdell O
8. Test Sites (40min)
9. Test Sites (Firestone's 4 cubicles)
10. Test Sites (Firestone's Demolition Area Rangel)
11. Test Sites (FBI Demolition Area Rangel)
12. Test Sites (Pistol Rangel)
13. Test Sites (Blug. F. 15)
14. Test Sites (Sectionalizing Area 1200)
15. Test Sites (14.5mm Range, Net'l Guard)
16. Lead Azide Igloo

Reserve Training Areas A, B, C, D, E, F, G

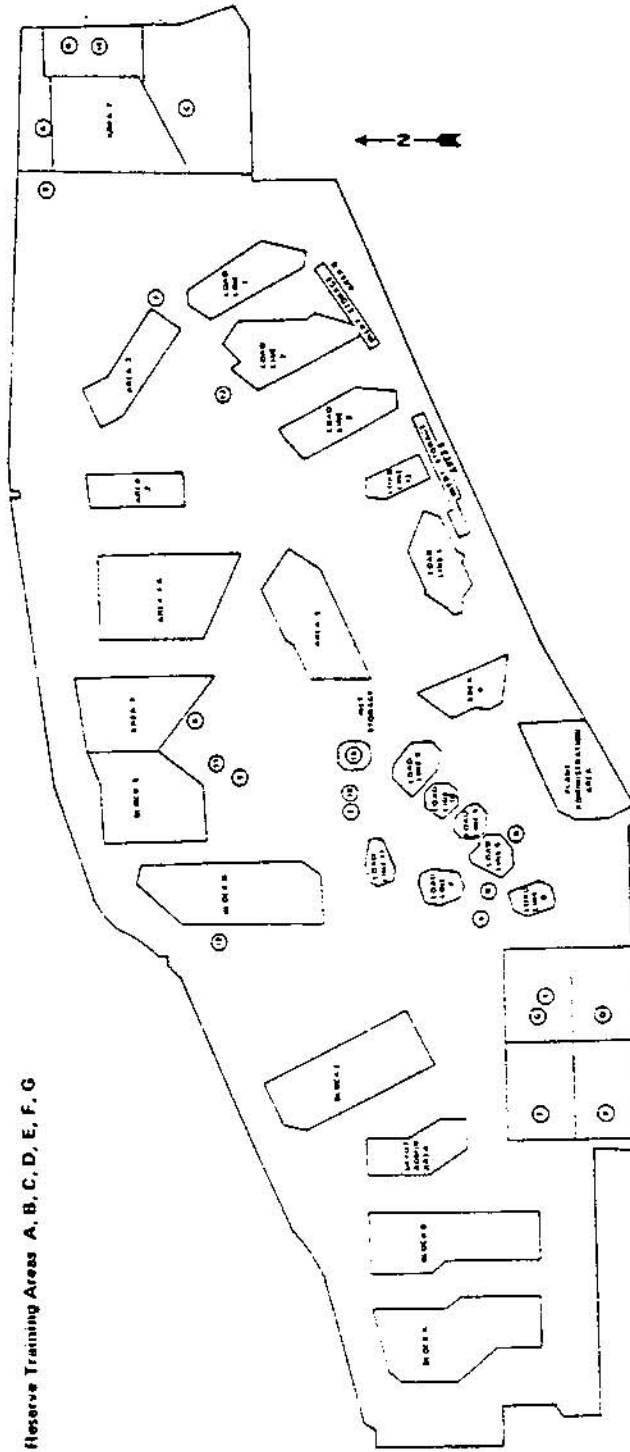


FIGURE 6 POTENTIALLY CONTAMINATED AREAS

The Ammonium Nitrate Plant Load Line 12 was operated to produce ammonium nitrate for explosives and fertilizers. There were no wash water collection tanks or settling ponds in Load Line 12 during these operations. All residues, dusts, and spills were washed into the storm drainage system.

Since 1942, millions of pounds of waste have been destroyed at the burning grounds. There are three areas where wastes could have been burned, and two areas where demolition activities occurred. The first is Track 49, or the Erie Burning Grounds (3), located north of Area 7. It was used during World War II for the destruction of TNT and propellant. Next, north of Load Line 8, are the Fuze and Booster Burning Pits (4), named such because of their proximity to the fuze and booster load lines, and not because they were exclusively used for the destruction of fuzes and boosters. This area was active between 1945-1948. The third and present burning area is the Winklepeck Burning Grounds (5) dating from about 1948. The first Demolition Area (1) was used between 1945-1949 and was located west of Greenleaf Road and south of South Patrol Road. Since then, the area northwest of Load Line 11 just across Newton Fall Road (2) has been the current demolition grounds. All burning and demolition areas were used extensively not only for production wastes, but also for many demilitarization operations that have occurred at RVAAP. Although specific dates have been given, use of all the disposal areas actually overlaps, especially immediately after World War II when large quantities of returning munitions had to be destroyed. Furthermore, some burning took place at demolition grounds, but no demolition activities occurred at burning areas.

In addition to explosives waste, sanitary wastes from family housing, offices, and the hospital were routinely disposed of by burning. Pit 4 in the northwest part of the burning grounds was used for this purpose. A wire cage to protect the paper and ash from winds surrounded the pit. Since the practice of open pit burning has not been allowed for the past few years, the installation has taken to landfilling this waste at Ramsdell Quarry (7) in an EPA approved manner.

Between 1952-1954 and again between 1969-1971, a total of 136 million (approximately 2.6 million per month) M54 primers were manufactured in Load Line 10. Aside from normal explosives residue, associated with this production on a monthly basis was the generation of 22.5 kilograms of antimony sulfide and 11.25 kilograms of lead thiocyanate waste.⁶ These two toxic materials were also disposed of by burning with other contaminants.

In order to eliminate open field burning of future waste materials, RVAAP presently has submitted requests for the acquisition of an Explosive Waste and Contaminated Waste Incinerator. The explosive waste incinerator is programmed to be installed in 1981, but no action has been

APPENDIX A-2

SELECTED PORTIONS FROM

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

AT

ERIE BURNING GROUNDS

REASSESSMENT OF RVAAP (1982)

REASSESSMENT OF RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO
Report No. 132R

J.D. Wienand, J.J. Cichowicz, and N.P. Leibel

CHEMICALS SYSTEMS LABORATORY
Environmental Technology Division
Installation Restoration Branch
Aberdeen Proving Ground, Md. 21010

December 1982

Report for Period Apr. 8-10, 1981

Distribution limited to U.S. Government Agencies only for protection of privileged information evaluating another command: December 1982. Other requests for this document must be referred to: Commander, Ravenna Army Ammunition Plant, Ravenna, Ohio 44266.

Prepared for:

COMMANDER
Ravenna Army Ammunition Plant
Ravenna, Ohio 44266

and

U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY
Assessment Division
Aberdeen Proving Ground, Md. 21010

- 1 QUARRY USED AS DUMP AND POSSIBLE ACID DISPOSAL (1960's)
- 2 LANDFILL - GENERAL REFUSE DISPOSAL (1941-69)
- 3 WASTE OIL DISPOSAL (UNTIL 1973)
- 4 DEMOLITION AREA (1949 TO PRESENT)
- 5 LANDFILL - GENERAL REFUSE (1980-78)
- 6 WINKLEPECK BURNING GROUNDS (1948 TO PRESENT)
- 7 OLD DEMOLITION AREA (1945-49)
- 8 SUSPECTED MUSTARD BURIAL SITE
- 9 RAMSDALE QUARRY - CURRENT LANDFILL
- 10 QUARRY USED AS LANDFILL FOR GENERAL REFUSE (1960's)
- 11 TRACK 49 BURNING GROUND (WW II)

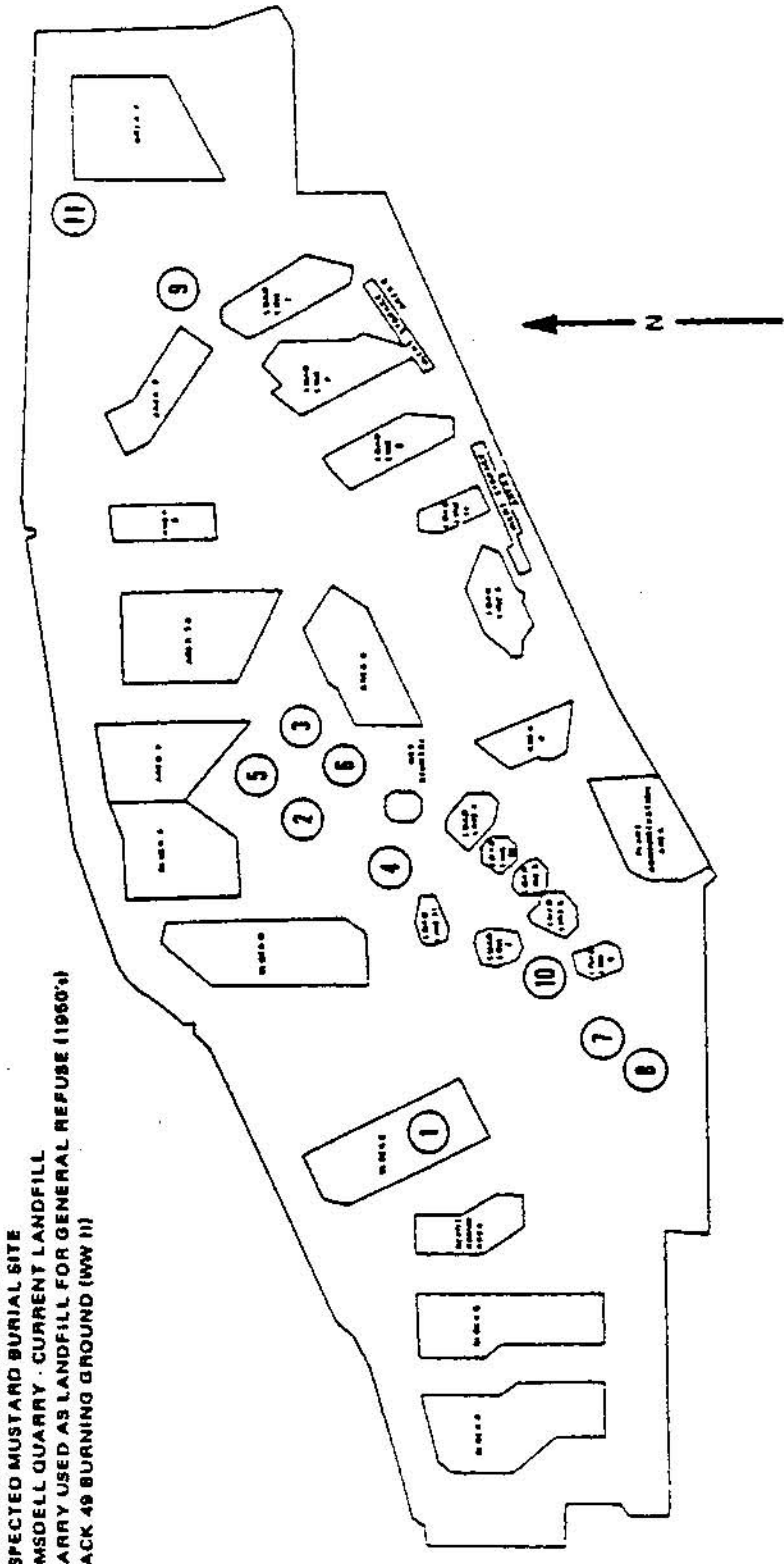


Fig. 1. Sites on RVAAP

APPENDIX A-3

SELECTED PORTIONS FROM

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

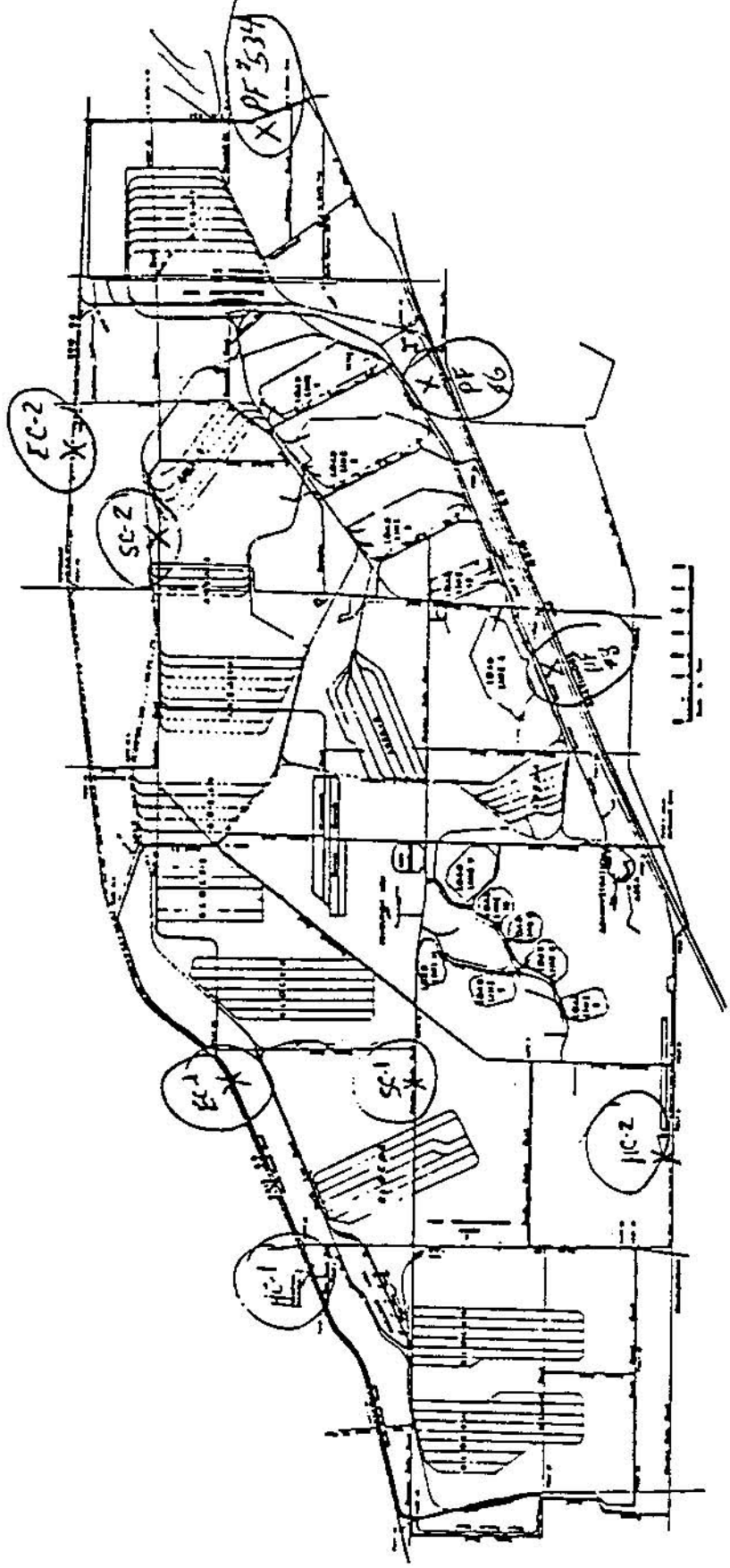
AT

ERIE BURNING GROUNDS

WATER QUALITY SURVEILLANCE PROGRAM RESULTS

(1980 - 1992)

Location of surface water sampling points



RAVENHOLM ARMY AMMUNITION PLANT	
Map No.	A-109
Scale	1" = 100'
Projection	Universal Transverse Mercator
Zone	18N
Grid	18N 109
GENERAL AREA MAP	

ERIE VICINITY

Re: Water Quality Surveillance Program

PARAMETER	SAMPLE STATION								
	EC-1	EC-2	SC-1	SC-2	HC-1	HC-2	PF #8	PF #6	PF #534
pH	Q	Q	Q	Q	Q	Q	Q	Q	Q
Temperature	Q	Q	Q	Q	Q	Q	Q	Q	Q
Specific Conductance	Q	Q	Q	Q	Q	Q	Q	Q	Q
Total Suspended Solids	Q	Q	Q	Q	Q	Q	Q	Q	Q
Biochemical Oxygen Demand -5 day	Q	Q	Q	Q	Q	Q	Q	Q	Q
Total Organic Carbon	S	S	S	S	S	S	S	S	S
Total Kjehldal Nitrogen	S	S	S	S	S	S	S	S	S
Nitrate	S	S	S	S	S	S	S	S	S
Nitrite	S	S	S	S	S	S	S	S	S
Phosphorous	S	S	S	S	S	S	S	S	S
Oil & Grease	Q	Q	Q	Q	Q	Q	Q	Q	Q
Dissolved Oxygen	Q	Q	Q	Q	Q	Q	Q	Q	Q
TNT		A		A		A	A	A	A
RDX		A		A		A	A	A	A
Copper	A	A	A	A	A	A	A	A	A
Chromium, Total (Hex & Tri)	A	A	A	A	A	A	A	A	A
Zinc	A	A	A	A	A	A	A	A	A
Lead	A	A	A	A	A	A	A	A	A
Fecal Coliform	Q	Q	Q	Q	Q	Q	Q	Q	Q

Q = Quarterly - 4/times a year (March, June, September & December)
 S = Semi-Annually - 2 times a year (June (June & September
 A = Annual - Once a year (September).

- NOTE: (1) All samples will be taken as a grab sample unless otherwise notified at a future date.
 (2) The Wastewater Treatment Plant Operator will be responsible for obtaining the Grab Samples.

Re: Water Quality Surveillance Program

PARAMETER	SAMPLE STATION								
	EC-1	EC-2	SC-1	SC-2	HC-1	HC-2	PF #8	PF #6	PF #5
pH	Q	Q	Q	Q	Q	Q	Q	Q	Q
Temperature	Q	Q	Q	Q	Q	Q	Q	Q	Q
Specific Conductance	Q	Q	Q	Q	Q	Q	Q	Q	Q
Total Suspended Solids	Q	Q	Q	Q	Q	Q	Q	Q	Q
Biochemical Oxygen Demand -5 day	Q	Q	Q	Q	Q	Q	Q	Q	Q
Total Organic Carbon	S	S	S	S	S	S	S	S	S
Total Kjehldal Nitrogen	S	S	S	S	S	S	S	S	S
Nitrate	S	S	S	S	S	S	S	S	S
Nitrite	S	S	S	S	S	S	S	S	S
Phosphorous	S	S	S	S	S	S	S	S	S
Oil & Grease	Q	Q	Q	Q	Q	Q	Q	Q	Q
Dissolved Oxygen	Q	Q	Q	Q	Q	Q	Q	Q	Q
TNT		A		A		A	A	A	A
RDX		A		A		A	A	A	A
Copper	A	A	A	A	A	A	A	A	A
Chromium, Total (Hex & Tri)	A	A	A	A	A	A	A	A	A
Zinc	A	A	A	A	A	A	A	A	A
Lead	A	A	A	A	A	A	A	A	A
Fecal Coliform	Q	Q	Q	Q	Q	Q	Q	Q	Q

Q = Quarterly - 4/times a year (March, June, September & December)
 S = Semi-Annually - 2 times a year (June & September)
 A = Annual - Once a year (September).

NOTE: (1) All samples will be taken as a grab sample unless otherwise notified at a future date.
 (2) The Wastewater Treatment Plant Operator will be responsible for obtaining the Grab Samples. A-17

RAVENNA ARMY AMMUNITION PLANT
WATER QUALITY SURVEILLANCE PROGRAM

Ravenna Arsenal, Inc.

March 12, 1980

SAMPLING STATIONS

A.	EAGLE CREEK	Influent	(North of Area #1 & Block E)
	" "	Effluent	(North of Area #3)
B.	SAND CREEK	Influent	(1/2 Mi. West of Slagle Rd.)
	" "	Effluent	(Smalley Road Bridge)
C.	HINCKLEY CREEK	Influent	(500 Ft. West of Post #32 - Rte. 80)
	" "	Effluent	(East of Post #24 - Charleston Perimeter Rd.)
D.	PARSHALL FLUME (Area #8)	Effluent	(Between Wayland-Wilcox and Parris Windham Rds on South Perimeter Fence Line Rd.)
E.	PARSHALL FLUME (Area #6)	Effluent	(South of Kelly's Pond and East of Post #20 on South Perimeter Fence Line Rd.)
F.	PARSHALL FLUME	Effluent	(Rte. #534)

Nomenclature:

Sampling Station:

EC-1	Influent	Eagle Creek
EC-2	Effluent	Eagle Creek
SC-1	Influent	Sand Creek
SC-2	Effluent	Sand Creek
HC-1	Influent	Hinckley Creek
HC-2	Effluent	Hinckley Creek
PF #8	Effluent	Parshall Flume - Area #8
PF #6	Effluent	Parshall Flume - Area #6
PF #534	Effluent	Parshall Flume - Rte. #534.

TMA/ERG

7777 Exchange Street
Cleveland, OH 44125-3337

(216) 447-0790

Ravenna Arsenal
8451 State Route 5
Ravenna, Ohio 44266

Attn: Mr. Joe Mound

Samples Received: 9/04/87

Date: November 5, 1987

Project Number: V2466

Results reported in mg/l
except where noted.

TMA-Cleve Sample ID's 43454-43461

FINAL REPORT

FILE #
SAMS

Parameters	Sample		WATER		FILTR		SAMS	
	EC1	EC2	HCl	HCl	PF8	PF534	SC1	SC2
pH (S.U.)	7.8	7.8	7.6	7.9	7.9	7.9	7.9	8.0
Specific Conductivity (uhmos/cm)	500	430	590	390	430	460	470	460
Total Suspended Solids	12	13	10	15	12	8	9	8
Nitrate	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrite	<0.010	<0.010	<0.010	0.016	0.014	0.012	0.015	0.015
Total Phosphorus	0.062	0.054	0.15	0.064	0.054	0.040	0.044	0.054
Oil & Grease	2	2	<1	5	1	4	9	1
Copper	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Total Chromium	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Hexavalent Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Trivalent Chromium	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Zinc	<0.010	<0.010	<0.010	<0.010	0.021	0.099	<0.010	<0.010
Lead	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Fecal Coliform	90	500	880	130	340	81	160	78
Total Organic Carbon	5.7	3.5	4.6	4.9	6.6	1.8	5.9	4.3
Total Kjeldahl Nitrogen	0.44	0.65	0.96	0.52	0.70	0.60	0.60	0.52
INT (ug/l)	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6	<1.6
RNX (ug/l)	15	<1.5	45	4.8	<1.5	54	5.4	18

RDX?

Mistake
Industrial
Filter

Incoming Signal ???

Incoming Signal ???

Approved by: Gunars Zikmanis
Gunars Zikmanis
Laboratory Manager

Hand To Bolivar

A-20

I would probably tend to think this
An RDX positive interference problem



Thermo Analytical Inc

Analytical Report

Project: V2925
Report Date: 01-29-88

7777 EXCHANGE STREET
CLEVELAND, OH 44125 (216) 447-0790

Client P. O. 10604-CH-3
Report: 30195

Samples Recvd: 01-20-88
Refer Questions To:
GUNARS ZIKMANIS

Client:
RAVENNA ARSENAL
RAVENNA, OH 44266
Attention: TOM CHANDA

Approved: *[Signature]*

Residual Samples Will Be Held
TWO WEEKS

ReTest From November 5, 1987

Client I. D.: EAGLE CREEK INFLUENT (Ec-1)
ERG Sample No.: 01/181989
Matrix: GROUND WATER
Date Sampled: 01-13-88

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
RDX	<0.50	ug/L

AVERAGE OF DUPLICATE RUNS

Client I. D.: HINKLEY CREEK (RT 80) (HC-1)
ERG Sample No.: 01/181990
Matrix: GROUND WATER
Date Sampled: 01-13-88

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
RDX	<0.50	ug/L

Client I. D.: PF534
ERG Sample No.: 01/181991
Matrix: GROUND WATER
Date Sampled: 01-13-88

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
RDX	<0.25	ug/L

Client I. D.: SAND CREEK INFLUENT (SC-1)
ERG Sample No.: 01/181992
Matrix: GROUND WATER
Date Sampled: 01-13-88

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
RDX	<0.25	ug/L

Ravenna Arsenal, Inc.
Ravenna, Ohio 44256

Date: August 31, 1983

Attn: Mr. Al Custar

Project Number: 6511

Samples Received: 8/04/83

Results reported in mg/l
except where noted.

Parameter	EC-1 21,323	EC-2 21,824	HC-1 21,825	HC-2 21,825	PF-5 21,827	PF-8 21,328	PF-534 21,829	SC-1 21,830	SC-2 21,831
pH ¹	7.6	7.5	7.4	7.3	7.4	7.0	7.5	7.5	7.5
Conductivity ²	<110	360	380	290	360	140	390	290	360
Total Suspended Solids	4	22	13	8	6	13	7	7	4
Biochemical Oxygen Demand	3	2	5	3	2	2	3	2	4
Total Organic Carbon	4	3	4	5	5	9	4	5	2
Total Kjeldahl Nitrogen	0.14	0.16	0.15	0.27	0.44	0.95	0.057	0.12	0.093
Nitrate	0.71	0.45	0.10	0.07	0.15	0.10	0.02	0.01	0.11
Nitrite	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010
Total Phosphorus	0.03	0.02	0.08	0.05	0.02	0.04	0.06	0.02	0.07
Oil & Grease	4	3	3	2	2	3	2	<1	2
Dissolved Oxygen	8.8	8.3	6.2	5.6	7.2	6.3	6.9	7.0	7.2
Copper	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Chromium	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Hexavalent Chromium	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Zinc	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Lead	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Fecal Coliform	TNTC	320	TNTC	220	160	120	120	590	400
TNT	-----	ND-10	-----	ND-10	ND-10	ND-10	ND-10	-----	ND-10
RDX	-----	ND-10	-----	ND-10	ND-10	ND-10	ND-10	-----	ND-10

¹ pH is reported as S.U.


² Conductivity is reported as uhms/cm

³ Fecal Coliform is reported as /100 ml

⁴ TNT and RDX are both reported as ug/l

ND-non-detectable. Detection limits are shown next to "ND" notations.

Certified by:


Art Czabaniuk
Laboratory Manager



ANALYTICAL REPORT

ENVIRONMENTAL RESEARCH GROUP, INC.

Project: V9367
Report Date: 10-30-85

Client I.D.: HC-2
ERG Sample No.: 09/137684
Matrix: NATURAL WATER

Parameter	Result	Units
ZINC	ND (0.02)	mg/L
pH	7.6	S.U.

Client I.D.: PF-8
ERG Sample No.: 09/137685
Matrix: NATURAL WATER

Parameter	Result	Units
ORGANIC CARBON, TOTAL	4	mg/L
AVERAGE OF DUPLICATE RUNS		
HEXAVALENT CHROMIUM	0.07	mg/L
CHROMIUM, TOTAL	0.03	mg/L
FECAL COLIFORM BACTERIA	4200	TC/. 1L
SPECIFIC CONDUCTANCE	500	umho/cm
COPPER, TOTAL	<0.02	mg/L
BIOCHEMICAL OXYGEN DEMAND	3	mg/L
LEAD, TOTAL	ND (0.05)	mg/L
NITRATE NITROGEN	0.03	mg/L
NITRITE NITROGEN	ND (0.01)	mg/L
KJELDAHL NITROGEN, TOTAL	0.46	mg/L
OIL AND GREASE	<1	mg/L
OXYGEN, DISSOLVED	7.2	mg/L
PHOSPHORUS, TOTAL	0.35	mg/L
RDX	ND (10)	ug/L
SUSPENDED SOLIDS	7	mg/L
TEMPERATURE	60	degF
TIME	11:09	AM

Comments: FLOW RATE IS LOW

TNT	ND (10)	ug/L
ZINC	<0.02	mg/L
pH	8.0	S.U.

Client I.D.: PF-534
ERG Sample No.: 09/137686
Matrix: NATURAL WATER

Parameter	Result	Units
ORGANIC CARBON, TOTAL	ND (1)	mg/L
HEXAVALENT CHROMIUM	0.11	mg/L
CHROMIUM, TOTAL	<0.02	mg/L
FECAL COLIFORM BACTERIA	1400	TC/. 1L
SPECIFIC CONDUCTANCE	430	umho/cm
COPPER, TOTAL	<0.02	mg/L
BIOCHEMICAL OXYGEN DEMAND	<1	mg/L
LEAD, TOTAL	<0.05	mg/L



ANALYTICAL REPORT
 ENVIRONMENTAL RESEARCH GROUP, INC.

Project: V9367
 Report Date: 10-30-85

Client I. D.: PF-534
 ERG Sample No.: 09/137686
 Matrix: NATURAL WATER

<u>Parameter</u>	<u>Result</u>	<u>Units</u>
NITRATE NITROGEN	0.04	mg/L
NITRITE NITROGEN	ND (0.01)	mg/L
KJELDAHL NITROGEN, TOTAL	0.14	mg/L
OIL AND GREASE	<1	mg/L
OXYGEN, DISSOLVED	5.6	mg/L
PHOSPHORUS, TOTAL	0.35	mg/L
RDX	ND (10)	ug/L
SUSPENDED SOLIDS	4	mg/L
TEMPERATURE	57	degF
TIME	9:36	AM
Comments: FLOW RATE IS NORMAL		
TNT	ND (10)	ug/L
ZINC	<0.02	mg/L
pH	6.8	S. U.

SD-Sample damaged
 FR-See field report for result
 SR-See attached report
 NA-Result not applicable to test

ND-Nondetected, Detection limit in ()
 <-Positive result at an unquantifiable
 concentration below indicated level

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Attn: Al Custar

Samples Received: 9/17/81

Date: September 30, 1981

ERG Project #4485

ERG Sample # 14,734

Client ID - PF 534

<u>Parameter</u>	<u>Results</u>	<u>Units</u>
pH	7.7	S.U.
Biochemical Oxygen Demand	3	mg/l
Suspended Solids	2	mg/l
Conductivity	315	umho/cm
Total Organic Carbon	6	mg/l
Total Kjeldahl Nitrogen	0.67	mg/l
Nitrate	0.021	mg/l
Nitrite	0.019	mg/l
Total Phosphorus	0.36	mg/l
Oil & Grease	<1	mg/l
Dissolved Oxygen	7.3	mg/l
Hexavalent Chromium	<0.010	mg/l
Copper	<0.010	mg/l
Chromium	<0.020	mg/l
Zinc	<0.010	mg/l
Lead	<0.2	mg/l
Fecal Coliform	32	/100 ml
RDX	ND	*
TNT	ND	**

*Detection limit for RDX is 10 ug/l.
**Detection limit for TNT is 0.18 ug/l.

Ravenna Arsenal
Ravenna, Ohio 44266

Attn: Al Custar

Samples Received: 3/26/81

Date: March 31, 1981

Project Number: 4007

Results reported in mg/l
except where noted.

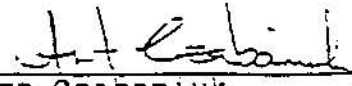
<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
13,102	EC-1	pH	6.2 S.U.
13,103	EC-2	"	7.1 S.U.
13,104	HC-1	"	6.6 S.U.
13,105	HC-2	"	6.6 S.U.
13,106	SC-1	"	7.0 S.U.
13,107	SC-2	"	7.0 S.U.
13,108	PF-534	"	6.8 S.U.
13,109	PF#6	"	6.7 S.U.
13,110	PF#8	"	7.0 S.U.
13,102	EC-1	Biochemical Oxygen Demand	5
13,103	EC-2	"	<1
13,104	HC-1	"	7
13,105	HC-2	"	<1
13,106	SC-1	"	<1
13,107	SC-2	"	<1
13,108	PF-534	"	<1
13,109	PF#6	"	<1
13,110	PF#8	"	5

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter .</u>	<u>Results</u>
13,102	EC-1	Dissolved Oxygen	10.3
13,103	EC-2	"	11.6
13,104	HC-1	"	10.7
13,105	HC-2	"	10.2
13,106	SC-1	"	12.7
13,107	SC-2	"	12.5
13,108	PF-534	"	9.3
13,109	PF#6	"	13.1
13,110	PF#8	"	12.1
13,102	EC-1	Fecal	<1.2
13,103	EC-2	"	31
13,104	HC-1	"	<u>12</u>
13,105	HC-2	"	4
13,106	SC-1	"	4
13,107	SC-2	"	<1.2
13,108	PF-534	"	13
13,109	PF#6	"	<1.2
13,110	PF#8	"	15

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
13,102	EC-1	Conductivity	230 umho/cm
13,103	EC-2	"	220 umho/cm
13,104	HC-1	"	170 umho/cm
13,105	HC-2	"	145 umho/cm
13,106	SC-1	"	175 umho/cm
13,107	SC-2	"	190 umho/cm
13,108	PF-534	"	130 umho/cm
13,109	PF#6	"	195 umho/cm
13,110	PF#8	"	225 umho/cm
13,102	EC-1	Oil & Grease	1
13,103	EC-2	"	<1
13,104	HC-1	"	<1
13,105	HC-2	"	2
13,106	SC-1	"	1
13,107	SC-2	"	1
13,108	PF-534	"	1
13,109	PF#6	"	1
13,110	PF#8	"	1

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
13,102	EC-1	Suspended Solids	1
13,103	EC-2	"	3
13,104	HC-1	"	<1
13,105	HC-2	"	3
13,106	SC-1	"	1
13,107	SC-2	"	6
13,108	PF-534	"	5
13,109	PF#6	"	2
13,110	PF#8	"	4

cc: Tom Chanda
Jack Powell

Certified by: 
Art Czabanuk
Laboratory Manager

Ravenna Arsenal
Ravenna, Ohio 44266

Date: December 31, 1980

Attn: Al Custar

Project Number: 3661

Samples Received: 12/4/80

Results reported in mg/l
except where noted.

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Temp.</u>	<u>Results</u>
12,263	EC-1	pH	38°F	7.0 S.U.
12,164	EC-2	"	33°"	6.9 S.U.
12,165	HC-1	"	33°"	6.6 S.U.
12,166	HC-2	"	33°"	6.8 S.U.
12,167	SC-1	"	33°"	7.0 S.U.
12,168	SC-2	"	33°"	6.6 S.U.
12,169	PF-534	"	33°"	6.6 S.U.
12,170	PF-6	"	33°"	6.6 S.U.
12,171	PF-8	"	33°"	6.8 S.U.
12,163	EC-1	Conductivity		560 umho/cm
12,164	EC-2	"		320 umho/cm
12,165	HC-1	"		380 umho/cm
12,166	HC-2	"		370 umho/cm
12,167	SC-1	"		7400 umho/cm
12,168	SC-2	"		370 umho/cm
12,169	PF-534	"		370 umho/cm
12,170	PF-6	"		230 umho/cm
12,171	PF-8	"		360 umho/cm

Ravenna Arsenal
Ravenna, Ohio 44266

Attn: Al Custar

Samples Received: 12/4/80

Date: December 31, 1980

Project Number: 3661

Results reported in mg/l
except where noted.

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
12,163	EC-1	Suspended Solids	4
12,164	EC-2	"	4
12,165	HC-1	"	3
12,166	HC-2	"	4
12,167	SC-1	"	7
12,168	SC-2	"	4
12,169	PF-534	"	16
12,170	PF-6	"	7
12,171	PF-8	"	14
12,163	EC-1	Biochemical Oxygen Demand	<1
12,164	EC-2	"	<1
12,165	HC-1	"	<1
12,166	HC-2	"	<1
12,167	SC-1	"	<1
12,168	SC-2	"	<1
12,169	PF-534	"	<1
12,170	PF-6	"	<1
12,171	PF-8	"	<1

Ravenna Arsenal
Ravenna, Ohio 44266

Date: December 31, 1980

Project Number: 3661

Attn: Al Custar

Results reported in mg/l
except where noted.

Samples Received: 12/4/80

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
12,163	EC-1	Oil & Grease	1
12,164	EC-2	"	<1
12,165	HC-1	"	<1
12,166	HC-2	"	<1
12,167	SC-1	"	<1
12,168	SC-2	"	<1
12,169	PF-534	"	<1
12,170	PF-6	"	<1
12,171	PF-8	"	3
12,163	EC-1	Dissolved Oxygen	11.7
12,164	EC-2	"	11.8
12,165	HC-1	"	10.8
12,166	HC-2	"	11.9
12,167	SC-1	"	12.3
12,168	SC-2	"	12.0
12,169	PF-534	"	11.4
12,170	PF-6	"	11.8
12,171	PF-8	"	11.9

Ravenna Arsenal
Ravenna, Ohio 44266

Date: December 31, 1980

Attn: Al Custar

Project Number: 3661

Samples Received: 12/4/80

Results reported in mg/l
except where noted.

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
12,163	EC-1	Fecal	1120 120/100 ml
12,164	EC-2	"	2000 200/100 ml
12,165	HC-1	"	3600 360/100 ml
12,166	HC-2	"	620 62/100 ml
12,167	SC-1	"	620 62/100 ml
12,168	SC-2	"	520 52/100 ml
12,169	PF-534	"	500 50/100 ml
12,170	PF-6	"	350 35/100 ml
12,171	PF-8	"	TNTC*

*Too numerous to count.

Certified by: David L. Lanzola
David L. Lanzola
Laboratory Manager
Environmental Research

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: September 30, 1980

Attn: Al Custar

Project Number: 3384

Samples Received: 9/4/80

Results reported in mg/l
except where noted

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>	<u>Temp</u>
11,302	EC-1	pH	6.7 S.U.	62°
11,303	EC-2	"	7.4 S.U.	62°
11,304	SC-1	"	7.4 S.U.	62°
11,305	SC-2	"	7.5 S.U.	62°
11,306	HC-1	"	7.2 S.U.	63°
11,307	HC-2	"	7.4 S.U.	62°
11,308	PF-8	"	7.4 S.U.	60°
11,309	PF-6	"	NR	
11,310	PF-534	"	7.3 S.U.	65°
11,302	EC-1	Conductivity	440 umho/cm	
11,303	EC-2	"	150 umho/cm	
11,304	SC-1	"	320 umho/cm	
11,305	SC-2	"	420 umho/cm	
11,306	HC-1	"	480 umho/cm	
11,307	HC-2	"	420 umho/cm	
11,308	PF-8	"	420 umho/cm	
11,309	PF-6	"	NR	
11,310	PF-534	"	400 umho/cm	

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Attn: Al Custar

Samples Received: 9/4/80

Date: September 29, 1980

Project Number: 3384

Results reported in mg/l
except where noted

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Suspended Solids	12
11,303	EC-2	"	3
11,304	SC-1	"	7
11,305	SC-2	"	4
11,306	HC-1	"	3
11,307	HC-2	"	19
11,308	PF-8	"	4
11,309	PF-6	"	NR
11,310	PF-534	"	4
		Biochemical Oxygen Demand	
11,302	EC-2	"	2
11,303	EC-2	"	<1
11,304	SC-1	"	2
11,305	SC-2	"	<1
11,306	HC-1	"	4
11,307	HC-2	"	2
11,308	PF-8	"	1
11,309	PF-6	"	NR
11,310	PF-534	"	2

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: September 29, 1980

Attn: Al Custar

Project Number: 3384

Samples Received: 9/4/80

Results reported in mg/l
except where noted

<u>ERG-Cleve</u> <u>Sample ID</u>	<u>Ravenna</u> <u>Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Total Organic Carbon	32
11,303	EC-2	"	11
11,304	SC-1	"	8
11,305	SC-2	"	22
11,306	HC-1	"	28
11,307	HC-2	"	12
11,308	PF-8	"	25
11,309	PF-6	"	NR
11,310	PF-534	"	6
11,302	EC-1	Total Kjeldahl Nitrogen	0.20
11,303	EC-2	"	<0.010
11,304	SC-1	"	<0.010
11,305	SC-2	"	0.15
11,306	HC-1	"	0.22
11,307	HC-2	"	0.091
11,308	PF-8	"	<0.010
11,309	PF-6	"	NR
11,310	PF-534	"	<0.010

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Attn: Al Custar

Samples Received: 9/4/80

Date: September 29, 1980

Project Number: 3384

Results reported in mg/l
except where noted

<u>ERG-Cleve</u> <u>Sample ID</u>	<u>Ravenna</u> <u>Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Nitrate	0.69
11,303	EC-2	"	0.11
11,304	SC-1	"	0.024
11,3-5	SC-2	"	0.029
11,306	HC-1	"	0.065
11,307	HC-2	"	0.19
11,308	PF-8	"	0.12
11,309	PF-6	"	NR
11,310	PF-534	"	0.040
11,302	EC-1	Nitrite	0.016
11,303	EC-2	"	<0.010
11,304	SC-1	"	<0.010
11,305	SC-2	"	<0.010
11,306	HC-1	"	0.015
11,307	HC-2	"	0.015
11,308	PF-8	"	0.012
11,309	PF-6	"	NR
11,310	PF-534	"	<0.010

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: September 29, 1980

Attn: Al Custar

Project Number: 3384

Samples Received: 9/4/80

Results reported in mg/l
except where noted

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Total Phosphorus	<0.030
11,303	EC-2	"	0.072
11,304	SC-1	"	<0.030
11,305	SC-2	"	0.041
11,306	HC-1	"	0.14
11,307	HC-2	"	<0.030
11,308	PF-8	"	0.069
11,309	PF-6	"	NR
11,310	PF-534	"	<0.030
11,302	EC-1	Oil & Grease	<1
11,303	EC-2	"	<1
11,304	SC-1	"	<1
11,305	SC-2	"	<1
11,306	HC-1	"	<1
11,307	HC-2	"	<1
11,308	PF-8	"	<1
11,309	PF-6	"	NR
11,310	PF-534	"	<1

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: September 29, 1980

Attn: Al Custar

Project Number: 3384

Samples Received: 9/4/80

Results reported in mg/l
except where noted

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Dissolved Oxygen	6.4
11,303	EC-2	"	7.0
11,304	SC-1	"	6.9
11,305	SC-2	"	7.5
11,306	HC-1	"	4.0
11,307	HC-2	"	6.0
11,308	PF-8	"	8.1
11,309	PF-6	"	NR
11,310	PF-534	"	6.8
11,302	EC-1	Copper	0.008
11,303	EC-2	"	0.039
11,304	SC-1	"	0.012
11,305	SC-2	"	0.025
11,306	HC-1	"	0.067
11,307	HC-2	"	0.011
11,308	PF-8	"	0.006
11,309	PF-6	"	NR
11,310	PF-534	"	0.025

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Attn: Al Custar

Samples Received: 9/4/80

Date: September 29, 1980

Project Number: 3384

Results reported in mg/l
except where noted

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Chromium	<0.005
11,303	EC-2	"	<0.005
11,304	SC-1	"	<0.005
11,305	SC-2	"	<0.005
11,306	HC-1	"	<0.005
11,307	HC-2	"	<0.005
11,308	PF-8	"	<0.005
11,309	PF-6	"	NR
11,310	PF-534	"	<0.005
11,302	EC-1	Hexavalent Chromium	<0.010
11,303	EC-2	"	<0.010
11,304	SC-1	"	<0.010
11,305	SC-2	"	<0.010
11,306	HC-1	"	<0.010
11,307	HC-2	"	<0.010
11,308	PF-8	"	<0.010
11,309	PF-6	"	NR
11,310	PF-534	"	<0.010

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: September 29, 1980

Attn: Al Custar

Project Number: 3384

Samples Received: 9/4/80

Results reported in mg/l
except where noted

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Zinc	0.044
11,303	EC-2	"	0.050
11,304	SC-1	"	0.023
11,305	SC-2	"	0.051
11,3-6	HC-1	"	0.066
11,307	HC-2	"	0.031
11,308	PF-8	"	0.034
11,309	PF-6	"	NR
11,310	PF-534	"	0.035
11,302	EC-1	Lead	<0.039
11,303	EC-2	"	<0.039
11,304	SC-1	"	<0.039
11,305	SC-2	"	<0.039
11,306	HC-1	"	<0.039
11,307	HC-2	"	<0.039
11,308	PF-8	"	<0.039
11,309	PF-6	"	NR
11,310	PF-534	"	<0.039

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: September 29, 1980

Attn: Al Custar

Project Number: 3384

Samples Received: 9/4/80

Results reported in mg/l
except where noted

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>
11,302	EC-1	Fecal Coliform	120/100 ml
11,303	EC-2	"	140/100 ml
11,304	SC-1	"	120/100 ml
11,305	SC-2	"	230/100 ml
11,306	HC-1	"	<u>TNTC</u>
11,307	HC-2	"	270/100 ml
11,308	PF-8	"	270/100 ml
11,309	PF-6	"	NR
11,310	PF-534	"	100/100 ml

NR-Not Received

Certified by: David L. Lanzola
David L. Lanzola
Laboratory Manager

ADDENDUM

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: November 6, 1980

Attn: Al Custar

Project Number: 3384

Samples Received: 9/4/80

<u>ERG-Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>Parameter</u>	<u>Results</u>	<u>Detection Limit</u>
11,303	EC-2	TNT	ND	0.04 ppb
11,305	SC-2	"	ND	0.04 ppb
11,307	HC-2	"	ND	0.04 ppb
11,308	PF-8	"	ND	0.04 ppb
11,309	PF-6	"	ND	0.04 ppb
11,310	PF-534	"	ND	0.04 ppb
11,303	EC-2	RDX	ND	12 ppb
11,305	SC-2	"	ND	12 ppb
11,307	HC-2	"	ND	12 ppb
11,308	PF-8	"	ND	12 ppb
11,309	PF-6	"	ND	12 ppb
11,310	PF-534	"	ND	12 ppb

Certified by: David L. Lanzola
David L. Lanzola
Laboratory Manager

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: June 30, 1980

Project Number: 3164

Attn: Al Custar

Results reported in mg/l
except where noted

Samples Received: 6/12/80

<u>ERG/Cleve Sample ID</u>	<u>Ravenna Sample ID</u>	<u>pH</u>	<u>Conductivity</u>	<u>Suspended Solids</u>	<u>Biochemical Oxygen Demand</u>	<u>TKN</u>	<u>Nitrate-N</u>	<u>Nitrite-N</u>
10,740	EC-1	7.7 S.U.	410	10	3	.088	0.50	<0.010
10,741	EC-2	7.5 "	390	11	4	.044	0.29	<0.010
10,742	SC-1	7.1 "	340	7	2	1.1	0.19	0.017
10,743	SC-2	7.6 "	330	11	2	0.12	0.062	<0.010
10,744	HC-1	7.5 "	360	15	3	0.088	0.21	0.017
10,745	HC-2	7.5 "	310	16	6	0.41	0.40	<0.010
10,746	PF-8	7.5 "	370	10	5	0.73	0.18	<0.010
10,747	PF-6	7.4 "	260	28	3	0.36	0.14	<0.010
10,748	PF-534	7.3 "	340	5	2	0.42	0.055	<0.010

Date: June 30, 1980

Project Number: 3164


Results reported in mg/l
except where noted

Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Attn: Al Custar

Samples Received: 6/12/80

ERG/Cleve Sample ID	Ravenna Sample ID	Total Phosphorous	Oil and Grease	Dissolved Oxygen	Fecal Coliform	Temp (°F)	pH
10,740	EC-1	0.11	<1	9.3	110	56°	7.6
10,741	EC-2	0.21	<1	9.0	190	55°	7.6
10,742	SC-1	0.16	1	9.4	620	56°	7.8
10,743	SC-2	0.075	<1	9.6	310	56°	7.8
10,744	HC-1	0.16	<1	8.1	710	56°	7.3
10,745	HC-2	0.19	<1	7.9	260	56°	7.3
10,746	PF-8	0.19	<1	8.0	330	60°	7.3
10,747	PF-6	0.96	<1	9.3	270	60°	7.4
10,748	PF-534	0.35	1	8.0	680	58°	7.3

Certified by: 
 David L. Lanzoda
 Laboratory Manager

To: Al Custer
Ravenna Arsenal, Inc.
Ravenna, Ohio 44266

Date: March 26, 1980

Subject: Results of analysis of samples
received 3/20/80

Certified by:

Dave Lanzola
Dave Lanzola
Laboratory Manager

Parameter	STORET No.	Results		
		PF-6	PF-8	PF-534
Dissolved Oxygen	00300	10.8	11.4	9.5
Conductivity		110	170	170
Suspended Solids	00530	2	3	8
Biochemical Oxygen Demand	00310	<1	<1	<1
Oil & Grease	00550	1	1	2
Fecal Coliform	31616	2.4	4.7	4.7

Results reported in mg/l

	<u>PF-6</u>	<u>PF-8</u>	<u>PF-534</u>
pH	7.3	7.3	7.1
Temp.	44°	44°	42°

cc: Tom Chanda
Jack Powell

AQUA TECH ENVIRONMENTAL CONSULTANTS, INC.
P.O. BOX 76; STATE ROUTE 100
MELMORE , OHIO 44845

EXPLOSIVES ANALYSIS

METHOD : LIQUID-LIQUID EXTRACTION FOLLOWED BY HIGH PRESSURE LIQUID
CHROMATOGRAPHY WITH DIODE ARRAY
DETECTION.

CLIENT : RAVENNA ARSENAL, INC.
8451 STATE ROUTE 5, RAVENNA OHIO 44266-9297

ATEC SAMPLE NO. : 19963
CLIENT SAMPLE NO: PF-534
DATE SAMPLED : 12/14/88
DATE RECEIVED: 12/16/88
DATE ANALYZED: 12/20/88

COMPOUND	CONCENTRATION (MG/L)
Trinitrotoluene (TNT)	< 0.05
HPX	< 0.05
RDX	< 0.03

ANALYST SIGNATURE

W. L. Reed

RECEIVED
BY COMMUNICATIONS

JAN 10 1989

783201121213105



AQUA TECH
ENVIRONMENTAL CONSULTANTS, INC.

2000 W. P.O. Box 75, Merville, Ohio 44845 419-397-2659 or 497-2222
P.O. Box 436, 151 South Main Street, Marion, Ohio 43022 514-722-4591

LABORATORY ANALYSIS REPORT

DATE REC'D. 12-16-1988 LAB NO. 15000-88
 DATE REP'D. 12-27-1988 P.O. # 14500-475 CLIENT NO. 10272
 SAMPLE LOCATION #9 SURFACE WATER **PF534** DATE SAMPLED 12-14-1988
 SAMPLED BY LARRY JOHNSON *Parishel Kline - RT, 574* TIME SAMPLED 15:00

MR. JOE MOUND
RAVENNA ARSENAL, INC.
3451 SR 5
RAVENNA OH 44266

COMMENTS.

STORET	ANALYSIS	RESULT	UNITS	DATE OF ANALYS
00010	BOD, 5 DAY	<1	MG/L	12-27-1988
01007	CADMIUM, TOTAL, CD	<1	UG/L	12-21-1988
01034	CHROMIUM, TOTAL, CR	<30	UG/L	12-21-1988
00175	CONDUCTIVITY, LAB	420	UMHC	12-17-1988
01042	COPPER, TOTAL, CU <i>THen to Z 225ppm</i>	? 10	UG/L	12-21-1988
01051	LEAD, TOTAL, PB	<5	UG/L	12-21-1988
00620	NITRATE N	0.07	MG/L	12-21-1988
00615	NITRITE N	<0.05	MG/L	12-21-1988
00560	OIL/GREASE	<1.0	MG/L	12-21-1988
00665	PHOSPHORUS, TOTAL, P	? 0.25	MG/L	12-22-1988
00530	RESIDUE, T. NFLT. (SUSP)	2	MG/L	12-19-1988
00625	TOTAL KJELDAHL N	0.34	MG/L	12-22-1988
00620	CARBON, TOTAL ORGANIC, C	3.0	MG/L	12-20-1988
01092	ZINC, TOTAL, ZN	20	UG/L	12-21-1988
00403	PH, LAB	7.6	S.U.	12-18-1988

*check -
cut-off @
45 ug/L @ 150 ppm H.*

LABORATORY CERTIFICATION # 4053

A-48

SIGNED *Larry Johnson*

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RAVENNA ARSENAL
 8451 STATE ROUTE 5
 RAVENNA, OHIO 44266

SURFACE WATERS

TMA ID: 6912

DATE RECEIVED: 11/30/89

<u>PARAMETER</u>	<u>PF6</u>	<u>PF8</u>	<u>PF534</u>	<u>METHOD #</u>	<u>ANALYST</u>	<u>DATE OF ANALYSIS</u>	<u>TIME OF ANALYSIS</u>
Conductivity (uhmos/cm)	210	310	520	205	DF	12/04/89	0900
Fecal Coliform (colonies/100 ml)	1300	1600	710	909C	NG	12/01/89	1630
Suspended Solids (mg/l)	2	4	4	209C	JL	12/04/89	1000
Biochemical Oxygen Demand (mg/l)	<1	<1	<1	507	JL	12/05/89	1500
Nitrate (mg/l)	<0.01	<0.01	<0.01	418C	JL	12/07/89	1630
Nitrite (mg/l)	<0.01	<0.01	<0.01	419	JL	12/07/89	1630
Total Kjeldahl Nitrogen (mg/l)	1.2	2.8	1.4	420A	NG	12/13/89	1315
Total Phosphorus (mg/l)	0.02	0.02	0.04	424	DF	12/05/89	1500
Oil & Grease (mg/l)	<1	1	2	503A	SI	12/06/89	1000
Cadmium (mg/l)	<0.010	<0.010	<0.010	310A	NG	12/12/89	1200
Chromium (mg/l)	<0.030	<0.030	<0.030	312A	NG	12/12/89	1200
Copper (mg/l)	<0.010	<0.010	<0.010	313A	NG	12/12/89	1200
Lead (mg/l)	<0.020	<0.020	<0.020	316A	NG	12/12/89	1200
Zinc (mg/l)	0.025	0.013	<0.010	328A	NG	12/12/89	1200
Total Organic Carbon (mg/l)	14	18	15	505A	MB	12/12/89	1100
TNT (ug/l)	<1.0	<1.0	<1.0	8g	GH	12/13/89	0900
RDX (ug/l)	<1.0	<1.0	<1.0	8g	GH	12/13/89	0900
DNT (ug/l), 2-4 & 2-6	<1.0	<1.0	<1.0	8g	GH	12/13/89	0900

TMA/ERO

7777 Exchange Street
Cleveland, OH 44125-3337

(216) 447-0790

RAVENNA ARSENAL
8451 STATE ROUTE 5
RAVENNA, OHIO 44266

SURFACE WATERS

TMA ID: 0825
DATE RECEIVED: 06/20/91

<u>PARAMETER</u>	<u>PF8</u>	<u>PF534</u>	<u>ANALYST</u>	<u>DATE OF ANALYSIS</u>	<u>TIME OF ANALYSIS</u>
pH (S.U.)	8.0	8.0	JA	06/20/91	1600
Conductivity (uhmos/cm)	626	469	MM	06/20/91	0900
Fecal Coliform (colonies/100 ml)	2800	150	WR	06/21/91	1600
Suspended Solids (mg/l)	4	5	WR	07/09/91	1000
Biochemical Oxygen Demand (mg/l)	1	3	WR	06/26/91	1500
Nitrate (mg/l)	0.37	0.14	HS	07/13/91	1400
Nitrite (mg/l)	<0.01	<0.01	HS	07/13/91	1100
Total Kjeldahl Nitrogen (mg/l)	<1.0	<1.0	HS	07/16/91	1815
Total Phosphorus	<0.01	<0.01	HS	07/16/91	1400
Oil & Grease	<1	<1	HS	07/16/91	1300
Cadmium	<0.01	<0.01	RZ	07/16/91	1300
Chromium	<0.03	<0.03	RZ	07/16/91	1400
Copper	<0.01	<0.01	RZ	07/16/91	1300
Lead	<0.02	<0.02	RZ	07/16/91	1100
Zinc	<0.01	<0.01	RZ	07/16/91	1000
Total Organic Carbon	3	3	MD	06/26/91	0900
TNT	<1.0	<1.0	GH	07/03/91	1200
RDX	<1.0	<1.0	GH	07/03/91	1200
DNT	<1.0	<1.0	GH	07/03/91	1200

RAVENNA ARSENAL
 8451 STATE ROUTE 5
 RAVENNA, OHIO 44266

SURFACE WATERS

TMA ID: 1680
 DATE RECEIVED: 12/03/92

<u>PARAMETER</u>	<u>PF6</u>	<u>PF8</u>	<u>PF534</u>	<u>ANALYST</u>	<u>DATE OF ANALYSIS</u>	<u>TIME OF ANALYSIS</u>
pH (S.U.)	6.99	7.44	7.08	MM	12/03/92	1530
Conductivity (uhms/cm)	172	330	285	MM	12/03/92	1530
Fecal Coliform (colonies/100 ml)	1	224	71	WR	11/26/90	1500
Suspended Solids	9	4	8	JPA	12/04/92	1100
Biochemical Oxygen Demand	2	1	1	PS	12/08/92	1500
Nitrate	0.080	0.15	0.010	PS	12/16/92	1400
Nitrite	<0.010	<0.010	<0.010	PS	12/04/92	1200
Total Kjeldahl Nitrogen	<1	<1	<1	RZ	12/14/92	1800
Total Phosphorus	<0.010	0.020	0.060	PS	12/19/92	1350
Oil & Grease	<1	<1	<1	RZ	12/08/92	1100
Phosphate	<0.010	<0.010	<0.010	PS	12/04/92	1350
Cadmium	<0.010	<0.010	<0.010	BI	12/14/92	0900
Chromium	<0.030	<0.030	<0.030	BI	12/14/92	0900
Copper	<0.010	<0.010	<0.010	BI	12/14/92	0900
Lead	<0.020	<0.020	<0.020	BI	12/14/92	0900
Zinc	0.010	0.060	<0.010	BI	12/14/92	0900
Total Organic Carbon	4.3	4.9	5.9	JB	12/11/92	0900
TNT (ug/l)	<1.0	<1.0	<1.0	SJ	12/11/92	1200
RDX (ug/l)	3.3	<1.0	<1.0	SJ	12/11/92	1200
2,4 DNT (ug/l)	<1.0	<1.0	<1.0	SJ	12/11/92	1200
2,6 DNT (ug/l)	<1.0	<1.0	<1.0	SJ	12/11/92	1200

A-51

Results reported in mg/l unless otherwise specified.

APPENDIX A-4

SELECTED PORTIONS FROM

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

AT

ERIE BURNING GROUNDS

SOIL AND SEDIMENT ANALYSES (1982)

SOIL AND SEDIMENT ANALYSES

PERFORMED FOR:

RAVENNA ARSENAL
RAVENNA, OHIO

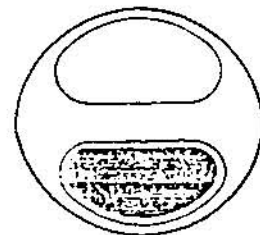
BY:

THE MOGUL CORPORATION
CHAGRIN FALLS, OHIO

MOGUL

enviro/service™

A-55 PROGRAMS



B-4

TEST DESCRIPTION

TEST DESCRIPTION

On May 4 and 5, 1982, Mogul Corporation personnel performed the soil and sediment sampling necessary for the TNT and RDX determinations.

All pond composite sampling consisted of combining four (4) individual pond sediment samples, from various locations in each pond, and then mixing and quartering the composite until one (1) representative sample suitable for analysis was obtained.

All land surface and stream samples were obtained from a test hole of 12"-24" in depth. The entire boring was considered a sample. The samples taken at the ore pile area had a minimum of six inches of surface removed prior to actual sampling in order to remove any transient material that may have been present. Land surface sample sites were selected by the Mogul Corporation personnel.

Grab samples from effluent and influent stream sediments were taken: (1) Immediately after discharge from the treatment facility; (2) Midpoint of flow route; and (3) At the end of travel prior to exiting from property or emptying into major stream.

Each stream and land surface sample location was physically marked with an orange tipped stake. A sample identification was placed on each location marker.

Soil and sediment sampling sites are as follows:

<u>Location</u>	<u>Number of Samples</u>
Load Line #1 Pond	1 Composite
Load Line #1 Stream	3 Stream Bed
Load Line #2 Pond	1 Composite
Load Line #2 Stream	3 Stream Bed
Load Line #3 Stream	3 Stream Bed
Load Line #4 Pond	1 Composite
Load Line #4 Stream	3 Stream Bed
Load Line #12 Pond	1 Composite
Load Line #12 Stream	3 Stream Bed

Test Description-Page 2

Ramsdell Quarry Pond	1 Composite
Ramsdell Quarry Pond	6 Land Surface *
Upper Cobbs Pond	1 Composite
Lower Cobbs Pond	1 Composite
Ore Area	6 Land surface *
Ore Pile Retention Pond	1 Composite
'C' Black Quarry	3 Land Surface
Erie Burning Grounds	5 Land Surface
Total Samples	43

*Includes one (1) background sample obtained in a non-contaminated area.

The analyses for explosives (RDX/TNT) in soil extract samples were performed as follows:

Approximately twenty (20) grams of each soil sample was extracted with ten (10) milliliters of acetonitrile. The acetonitrile extract was centrifuged to clarify these solutions prior to analysis by HPLC.

Separation and detection was performed on a Waters Associates High Performance Liquid Chromatograph, Pump Model 6000A, U6K injector, with a Model 450 variable wavelength detector set at 254nm. The reversed phase column was a 25cm X 4.6mm, 5um, Supelcosil^R LC-18 column (Supelco, Inc., Bellefonte, PA) held at 22°C. The isocratic mobil phase (75% water, 20% 1-propanol, 5% ethanol) flow as 1.5 ml/min.

Quantitation was based upon data provided by a Columbia Scientific Industries Supergrator 3A computing integrator. Analytical standards of TNT and RDX were supplied by the United States Army Ordinance, Quality Assurance Branch and 100% purity was assumed.

Confirmation was performed with a Tracor 560 Gas Chromatograph with a Nickel⁶³ electron capture detector operating in pulsed mode. The analytical conditions were as follows: Column - 6' X 2mm ID glass packed with 3% Dexsil 300 on 80/100 Supelcoport; 95% argon/5% methane carrier at 60ml/min; inlet 225°C, detector 300°C, column 150°C/2min then 10°/min to 200°C/8 min.

Results are reported in a tabular form in the data summary which follows this test description.

DATA SUMMARY

DATA SUMMARY
Explosives in Soil Extracts

Sample ID Number	Sample Location	Soil Percent Moisture	TNT Micrograms	RDX Milli-liter*
1A	RM Quarry Background	33.48	ND	ND
2B	RQ Sample #1A	9.80	ND	ND
3	LL #12 Pond	32.30	ND	ND
4	RQ Pond	48.48	ND	1.73
5	LL #4 Composite	63.83	ND	ND
6 →	Erie BG ND-2	16.24	ND	ND
7 →	Erie Burning Ground #1	16.33	ND	ND
8	Block #C	8.44	ND	ND
9	Ore Area #6	8.05	ND	.76
10	Ore Area Background	23.35	ND	ND
11	Ore Pond	13.95	ND	1.16
12	LL #4 Stream #1	18.17	ND	ND
13	^{#4} Stream Sample #2	15.64	.06	ND
14	LL 4 E 3 Stream	16.37	ND	.54
15	Upper Cobbs Pond	39.49	ND	1.16
16	LL 1 Stream 1	33.88	.30	1.51
17	Lower Cobbs Pond	47.87	ND	ND
18	LL 1 Stream 2	53.33	ND	1.60
19	LL 1 Stream 3	46.33	ND	1.39
20	LL 1 Pond Composite	46.61	ND	ND
21	Ore Area #4	12.92	ND	1.20

Data Summary--Page 2

22	Ore Area #1	16.14	ND	ND
23	Ore Area #2	11.83	ND	ND
24	Ore Area #3	8.19	ND	ND
24 ¹	Ramsdell Quarry Soil Sample #3	8.2	ND	ND
25	Ore Area #5	9.5	.06	1.17
27	Ore Area #5	26.52	.14	ND
28	Ramsdell Quarry Soil Sample #5	3.56	ND	ND
29	Ramsdell Quarry Soil Sample #2	9.01	ND	ND
30	Ramsdell Quarry Soil Sample #4	21.03	ND	ND
31	Erie Burning Ground #3	15.40	ND	ND
32	Erie Burning Ground #4	51.72	ND	ND
33	LL 2 Stream Sample #1	40.51	.33	1.75
34	ll #2 Stream #3	33.41	.15	.74
35	LL #2 Pond	47.51	.27	ND
36A	LL #2 Stream Sample #2	43.13	.60	.94
36B	LL #2 Stream Sample #2	43.00	.27	1.24
37	LL 12 Stream #1	40.96	.17	1.12
38	RQ Background	33.48	ND	1.32
39	LL 12 Stream Sample #3	58.04	ND	ND
40	LL 12 Stream #2	54.86	ND	ND
41	Block C Sample #3	19.36	ND	ND
42	LL Stream Sample #2	48.58	ND	ND
43	Block C Sample #1	19.88	ND	ND

*Results are micrograms per milliliter as dry soil.
ND means Not Detected. The limit of detection is approximately 0.05.
LL means Load Line.

METAL DATA SUMMARY

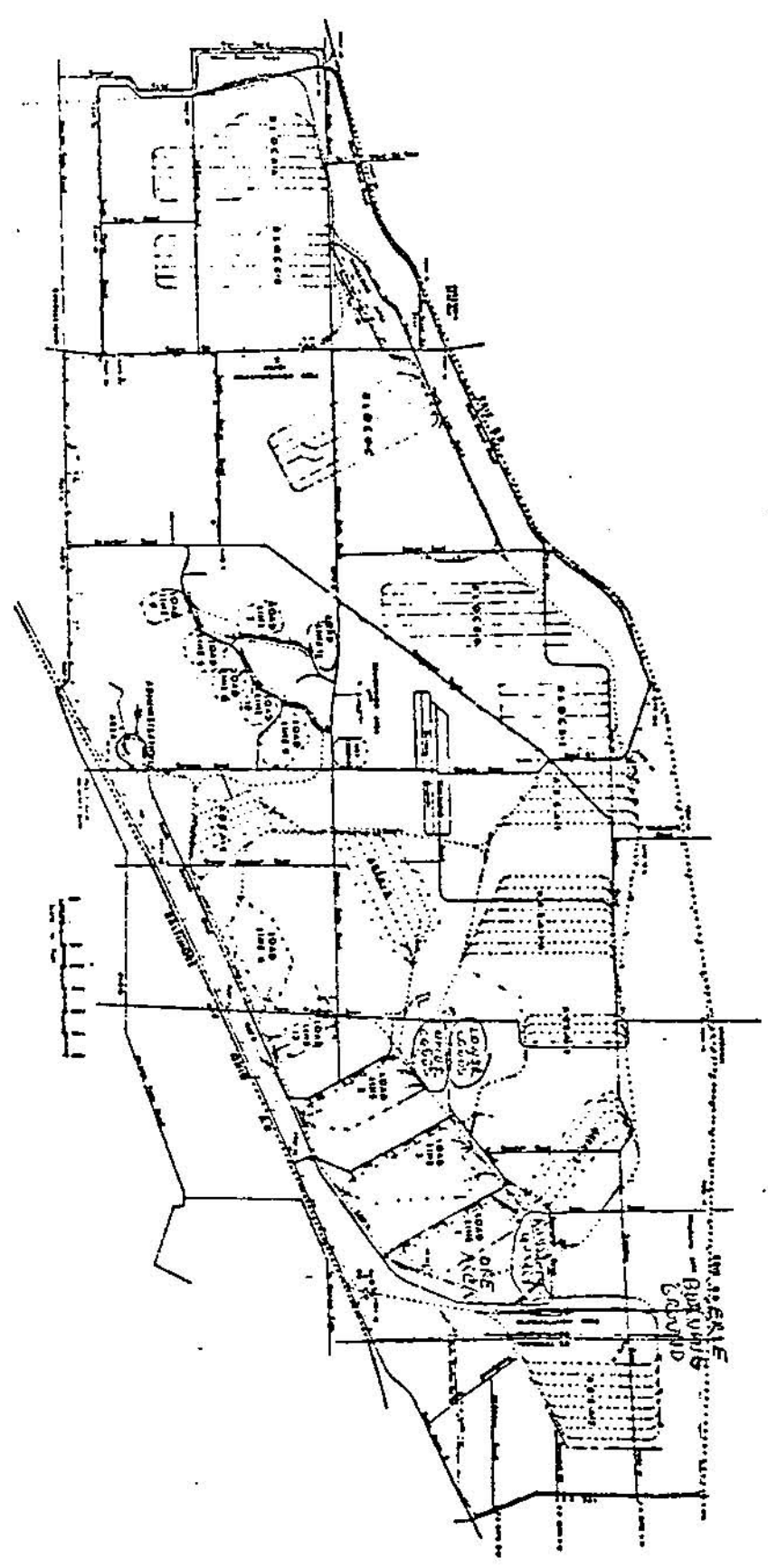
METAL DATA SUMMARY

Milligrams per Kilogram

Dry Weight

Sample Id Number	Sample Location	Chromium as Cr	Lead as Pb	Mercury as Hg
8	Block #C	290	150	1.24
9	Ore Area #6	15	22	1.04
10	Ore Area Background	25	51	1.24
11	Ore Pond	6		
21	Ore Area #4	15		
22	Ore Area #1	19		
23	Ore Area #2	16		
24	Ore Area #3	15		
25	Ore Area #5	16		
41	Block C Sample 3	13		
43	Block C Sample 1	16		
Blank		<1	<1	<.01

GENERAL AREA MAP A-109



RAVENNA ARMY AMMUNITION PLANT	
Scale: 1" = 100'	
Sheet: A-109	
Drawn by: [illegible]	
Checked by: [illegible]	
Approved by: [illegible]	
Date: [illegible]	
Project: [illegible]	
Sheet: [illegible]	
GENERAL AREA MAP	
A-109	

APPENDIX A-5

SELECTED PORTIONS FROM

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

AT

ERIE BURNING GROUNDS

GROUND-WATER CONTAMINATION STUDY (1988)

6-10



**UNITED STATES ARMY
ENVIRONMENTAL HYGIENE
AGENCY**

ABERDEEN PROVING GROUND, MD 21010-5422

INTERIM FINAL REPORT
GROUND-WATER CONTAMINATION SURVEY NO. 38-26-0302-89
EVALUATION OF SOLID WASTE MANAGEMENT UNITS
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
8-12 AUGUST 1988

**A
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TABLE 1. SOLID WASTE MANAGEMENT UNITS, RAVENNA ARMY AMMUNITION PLANT,
RAVENNA, OHIO

SWMU Site Number	SWMU Name	SWMU Type
1	Ramsdell Quarry Landfill	landfill
2	Erve Burning Grounds	thermal treatment
3	Demolition Area #1	thermal treatment
4	Demolition Area #2	thermal treatment
5	Winklepeck Burning Grounds	thermal treatment
6	C Block Quarry	chemical dump site
7	Bldg 1601 Hazardous Waste Storage	storage
8	Wastewater Treatment System - Load Line 1	industrial waste treatment
9	Wastewater Treatment System - Load Line 2	industrial waste treatment
10	Wastewater Treatment System - Load Line 3	industrial waste treatment
11	Wastewater Treatment System - Load Line 4	industrial waste treatment
12	Load Line 12 Bomb Meltout Facility	demilitarization
13	Bldg 1200, Ammunition Sectioning Area	demilitarization
14	Load Line 6 Evaporation Unit	evaporation tank
15	Load Line 6 Treatment Plant	industrial waste treatment
16	Quarry Landfill/Pond	landfill/ burning area/ brine water lagoon
17	Deactivation Furnace	thermal treatment
18	Load Line 12 Treatment Plant	industrial waste treatment
19	Landfill N. of Winklepeck Burning Ground	landfill
20	Sand Creek STP	sewage treatment
21	Debet STP	sewage treatment
22	George Road STP	sewage treatment
23	Unit Training Equipment Site (Tank Maintenance Area)	underground storage tank
24	Reserve Unit Maintenance Area Waste Oil Tank	aboveground storage tank
25	Bldg 1034 Motor Pool Waste Oil Tank	waste oil tank
26	Fuze Booster Area - Settling Tanks	munitions manufacturing
27	Building 854, PCB Storage	PCB storage
28	Mustard Agent Burial Site	possible mustard agent burial
29	Upper and Lower Cobbs Pond Complex	sedimentation basins

TABLE 2. SWMU'S REQUIRING ADDITIONAL INVESTIGATION

SWMU Site Number	Type of Investigation Proposed
RVAAP-1 ✓	Sample monitoring wells and pond for explosives, volatile organic compounds, acid and base-neutral extractable organics, herbicides, and pesticides. Also sample the pond for priority pollutant metals and nitrates.
RVAAP-3 ✓	Soil from bare ground areas should be sampled and analyzed for explosives and metals.
RVAAP-4 ✓	Conduct an RCRA Facility Investigation.
RVAAP-5 ✓	Conduct an RCRA Facility Investigation.
RVAAP-8, 9, 10 ✓	Monitoring wells need to be installed around the perimeter of the combined areas of Load Lines 1, 2, and 3 (RVAAP 8, 9, 10). Those wells need to be sampled for explosives and heavy metals.
RVAAP-11	Monitoring wells need to be installed around the perimeter of Load Line 4 (RVAAP-11) and sampled for heavy metals and explosives.
RVAAP-12 ✓	Monitoring wells need to be installed around the perimeter of the Load Line 12 Bomb Meltout Facility (RVAAP-12) and sampled for heavy metals and explosives.
RVAAP-13 ✓	Collect and analyze a series of soil samples in the drainage way upstream, downstream, and under the crushed slag where the wash water was drained. The soil samples should be analyzed for explosives and heavy metals.
RVAAP-16	Sample all three ponds for explosives, volatile organic compounds, acid and base-neutral extractable organics, herbicides, pesticides, priority pollutant heavy metals and selected inorganics.
RVAAP-19	Install monitoring wells around perimeter of the site. Sample the monitoring wells and nearby stream for explosives, volatile organic compounds, acid and base-neutral extractable organics, herbicides, pesticides, priority pollutant heavy metals and selected inorganics.
RVAAP-23	Sample the supply well for petroleum hydrocarbons and heavy metals.
RVAAP-24	Sample the oil in the ditch to verify its composition and determine if heavy metals are present.
RVAAP-28 ✓	Install monitoring wells around the perimeter of the site and sample for degradation products of mustard agent.

See attached 3/ further explanation of RFI

UTES Responsible

Complete

(2) Three of the line areas, Load Lines 1, 2, and 3 (RVAAP-8, 9, 10), were listed together on Table 2. Because those line areas adjoin each other, the most efficient means of investigating those three areas is to install monitoring wells around the perimeter of the combined areas. An investigative approach similar to this was used previously as part of the reference 22 investigation. Unfortunately, wells installed during that study were not sampled for explosives and have since been destroyed by frost heave.

(3) An environmental investigation is in progress at one SWMU, RVAAP-14, as part of a required closure plan for that SWMU. That investigation is adequate to determine if a release has occurred at that SWMU.

⇒ (4) No environmental investigations are needed at the remaining SWMU's. Those SWMU's are RVAAP-2, 6, 7, 15, 17, 18, 20, 21, 22, 25, 26, 27, and 29. *RELEASE*

5. CONCLUSIONS.

a. Additional environmental sampling is needed at 13 SWMU's to determine if a release of hazardous constituents has occurred. Those SWMU's are RVAAP-1, 5, 8, 9, 10, 11, 12, 13, 16, 19, 23, 24, and 28.

b. Resource Conservation and Recovery Act (RCRA) Facility Investigations are needed at two sites: RVAAP-3 and RVAAP-4.

c. Investigations are in progress at one SWMU to determine possible corrective or remedial action. That SWMU is RVAAP-14.

⇒ d. No further site specific environmental investigation is needed at the remaining 13 SWMU's due to either the very low potential for release or the demonstrated lack of a release by environmental investigation. Those SWMU's are RVAAP-2, 6, 7, 15, 17, 18, 20, 21, 22, 25, 26, 27, and 29.

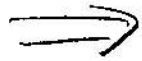
6. RECOMMENDATIONS.

⇒ a. To ensure regulatory compliance with 40 CFR 264.101 and 40 CFR 270.14, the following recommendation is made: implement environmental investigations at 15 SWMU's: RVAAP-1, 3, 4, 5, 8, 9, 10, 11, 12, 13, 16, 19, 23, 24, and 28. *DEMO I*

b. To ensure sound environmental practice, the following recommendations are made:

(1) Excavate and remove the two underground storage tanks at RVAAP-23 as soon as alternative provisions can be made. Any associated soil contamination should also be removed along with the tanks.

MAP LOCATION/SITE NUMBER. RVAAP-2 (See Figure A-2).



a. Unit Name. Erie Burning Grounds.

b. Unit Characteristics.

(1) Unit Type. Thermal treatment of munitions by burning.

(2) General Dimensions. Design Features: 35 acres.

(3) Approximate Dates of Usage. 1941 - 1951.

(4) Operating Practices. Open burning of explosive related items was conducted on the land surface. Large metal items that had been exposed to flame to be decontaminated of explosive residues were collected and processed through scrap and salvage. The ash residues from the burns were left behind.

(5) Present Condition and Status. The site is now a cattail swamp caused by an infestation of beavers. The area is inhabited by beavers, mink, muskrats, deer, coyotes, hawks, and numerous other forms of wildlife.

c. Waste Characteristics.

(1) Specific Wastes Disposed. The ash residues from the burning of explosives waste material containing RDX, TNT, and propellants were left on the site.

(2) Physical and Chemical Characteristics. Ash residues can contain small amounts of explosives and some heavy metals.

(3) Migration and Dispersal Characteristics. Explosives and the metals found in the ash residues show some solubility in water and can be water transported off the site if concentrations are high enough.

(4) Toxicological Characteristics. The toxicological characteristics of any remaining ash are unknown, but based on the observations of abundant plant and animal life at the site, the known toxicological characteristics of explosives and metals and the generally low concentrations that have been found in ash at other sites on this installation (reference 11), and the time that has elapsed since the burning last occurred, the toxicological characteristics of the ash are most likely very low.

d. Migration Pathways. Possible surface water runoff and infiltration into ground water.

MAP LOCATION/SITE NUMBER. RVAAP-3 (See Figure A-3).



a. Unit Name. Demolition Area #1.

b. Unit Characteristics.

(1) Unit Type. Thermal treatment of munitions by burning.

(2) General Dimensions. Design Features: 1.5 acres.

(3) Approximate Dates of Usage. 1941 - 1949.

(4) Operating Practices. Munitions, including fuses, boosters, bombs, and mortars, were detonated here on the open ground.

(5) Present Condition and Status. The site now consists of a circular 1-1.5 foot high berm surrounding a grassed area approximately 1-1.5 acres in size. Around the perimeter of the berm were several small bare ground areas of 100-150 square feet. Munitions fragments including scrap metal, small arms primers, and fuses were observed on the ground surface outside the bermed area.

c. Waste Characteristics.

(1) Specific Wastes Disposed. Shrapnel and other metallic munitions fragments were allowed to remain on the site after detonation along with possible residual explosives.

(2) Physical and Chemical Characteristics. The metallic fragments remaining after detonation are essentially inert. The characteristics of various explosives compounds that may be present are listed in Appendix B.

(3) Migration and Dispersal Characteristics. The solubilities of any residual explosives could result in water transport of the material.

(4) Toxicological Characteristics. See Appendix B for the toxicological characteristics of the various explosives compounds. The presence of bare ground areas suggests some toxicity to vegetation.

d. Migration Pathways. Possible infiltration into ground water.

e. Evidence of Release. Bare ground areas indicate possible soil contamination.

f. Exposure Potential. Medium, because of possible soil contamination and leaching into underlying ground water.

g. Recommendations for Sampling. Soil samples should be collected in the bare ground areas and analyzed for explosives and metals contamination.

h. Reference. 5.

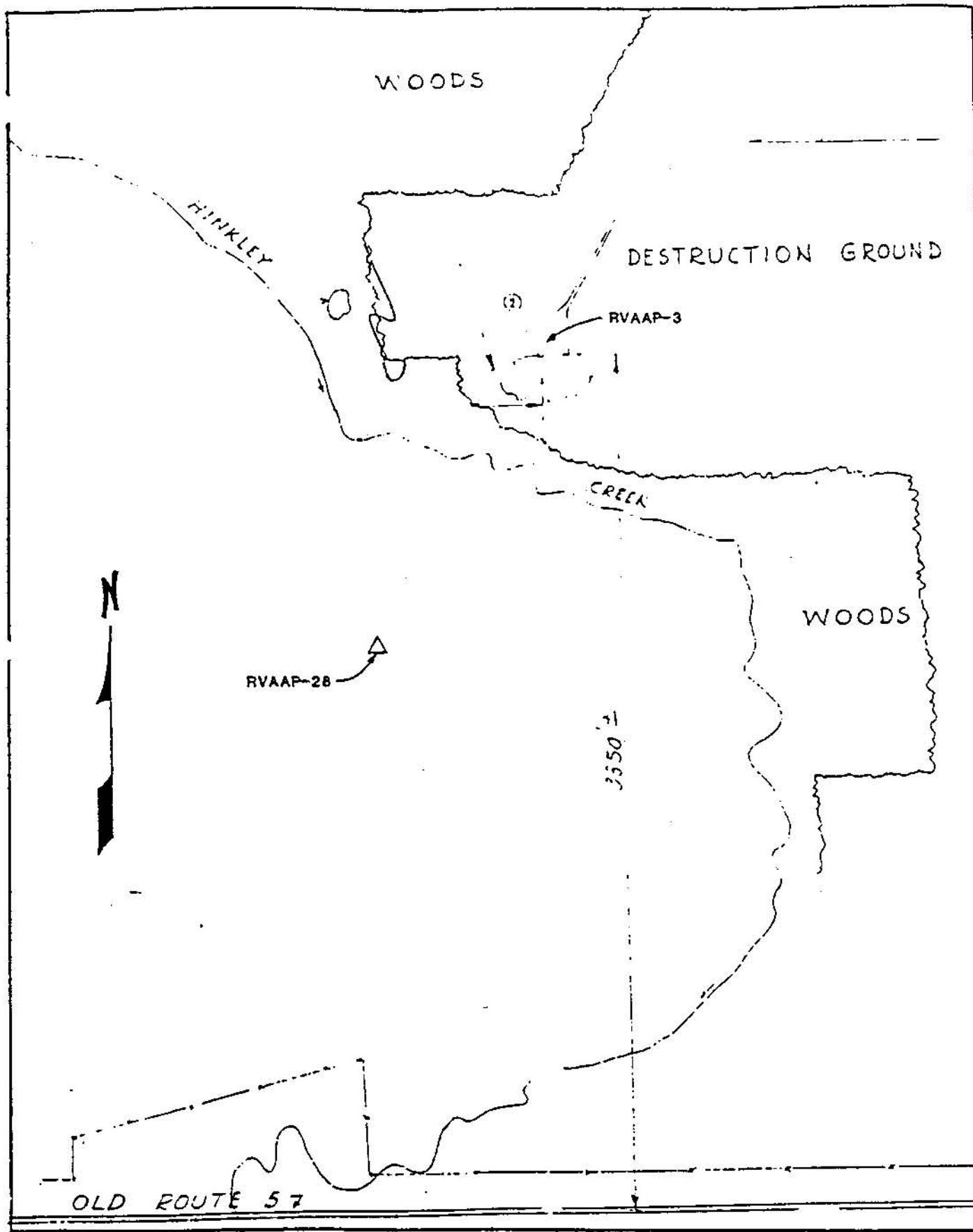


FIGURE A-3. DEMOLITION AREA #1 (RVAAP-3)
MUSTARD BURIAL SITE (RVAAP-28)

APPENDIX A-6

SELECTED PORTIONS FROM

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

AT

ERIE BURNING GROUNDS

RCRA FACILITY ASSESSMENT, DRAFT RR/VSI REPORT

(1989)

ENVIRONMENTAL PROTECTION AGENCY
TECHNICAL ENFORCEMENT SUPPORT
AT HAZARDOUS WASTE SITES

RECEIVED
OCT 07 1989

OFFICE OF RCRA
WASTE MANAGEMENT DIVISION
EPA REGION V

TES IV
CONTRACT NO. 68-01-7351
WORK ASSIGNMENT NO. R05031

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
RCRA FACILITY ASSESSMENT
DRAFT RR/VSI REPORT

U.S. EPA REGION V

JACOBS ENGINEERING GROUP, INC.

PREPARED BY:
METCALF & EDDY, INC.
111 WEST JACKSON BLVD.
CHICAGO, ILLINOIS 60604

PROJECT NO. 05-B990-00

OCTOBER 5, 1989

6.2 Unit Type: SWMU-2 - Erie Burning Grounds.

Regulatory Status: SWMU, inactive.

- A. **Unit Description:** A 35-acre site used to thermally treat munitions by opening burning on land surface. Bulk, obsolete, non-spec propellants, conventional explosives, rags, and army box cars, used for transporting explosives throughout the installation were treated at this location. Unspecified large metal items were also treated to remove explosive residue. These items were salvaged and processed as scrap. The ash residue from these burns were left on-site.
- B. **Age:** 48 years.
Period of Operation: 1941 to 1951.
- C. **Waste Type:** Ash residues from the burning of explosive waste material containing RDX, TNT, propellants, and sanitary wastes from family housing, offices and the base hospital.
- Very Q Section 401-402 Due to Location*
- Waste Volume/Capacity:** Unknown. Estimates have reached as high as a million pounds of waste. This estimate however has been identified as an approximate total of wastes destroyed at all the burning grounds.
- Waste Constituents:** RDX, TNT, heavy metals, and unknown.
- D. **Release Controls:** None.
- E. **Release History:** A soil sampling investigation was conducted at the Erie Burning Grounds in May, 1982 by the Mogul Corporation of Chagrin Falls, Ohio. At the direction of RVAAP personnel, 5 soil samples were collected from test borings ranging in depth from 12 inches (in.) to 24 in. and submitted for TNT and RDX analysis. The analyses revealed concentrations below detection limit.
- F. **Conclusions:**
- Soil/Groundwater:** There is a potential for releases from this unit to the surrounding soils and groundwater. Because this unit is unlined and because the open burning was conducted on the land surface with the ash residue left on-site, contamination to the soil and groundwater can/may have occurred.

Surface Water: The potential exists for surface water to be contaminated. Metals and explosives show some solubility in water.

Air: There is no potential for releases to the air since this unit is no longer active.

Subsurface Gas: This unit thermally treated wastes by open burning. Therefore, there is no potential for the generation of subsurface gas.

G. VSI Observations: The following observations were made by M&E (See Photographs 2 and 3):

- Unit is believed to be located in a low lying, marshy area presently inhabited by beavers.
- From M&E's vantage point, no discolored water, odors, or contaminated soil could be identified.
- Stressed vegetation was not observed.
- Damage to fauna was not observed.

According to the site representative, Mr. Thomas Chanda, this unit was identified within the Installation Assessment Report prepared by the U.S. Army, Toxic and Hazardous Materials Agency. Mr. Chanda could not confirm the exact location of this unit. His location was based upon assumptions, a set of railroad spurs, and wheel axles from a burned railroad car. Mr. Chanda also stated that this unit treated conventional explosives and propellants. Liquid wastes were not disposed of in this unit that he was aware of. Mr. Chanda also revealed that this area was used for brick manufacturing prior to the purchase by the Army. Evidence of this past usage included a partially submerged flag pole.

H. Sample Results: Contamination was not detected in the samples collected in 1982. However, the area that was sampled may not be the correct location of this unit.

*Information
from
M&E
documentation
is all
in the
file*

I. Suggested Further Actions: Further research is needed to identify the correct location of this unit. As part of the SV, sediment samples and surface water samples from the marsh area should be collected and submitted for TCL and explosive analysis. The facility should be requested to provide further documentation, if available, to help identify the location of this unit. If pursued, sampling points could be adjusted to reflect new information.

References: 2, 31, 32, 40

APPENDIX A-7

SELECTED PORTIONS FROM

PREVIOUS ENVIRONMENTAL INVESTIGATIONS

AT

ERIE BURNING GROUNDS

RELATIVE RISK SITE EVALUATION (1996)

U S A C H P M

U.S. Army Center for Health Promotion
and Preventive Medicine



HAZARDOUS AND MEDICAL WASTE STUDY NO. 37-EF-5360-97
RELATIVE RISK SITE EVALUATION
RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
28 OCTOBER - 1 NOVEMBER 1996

VOLUME I

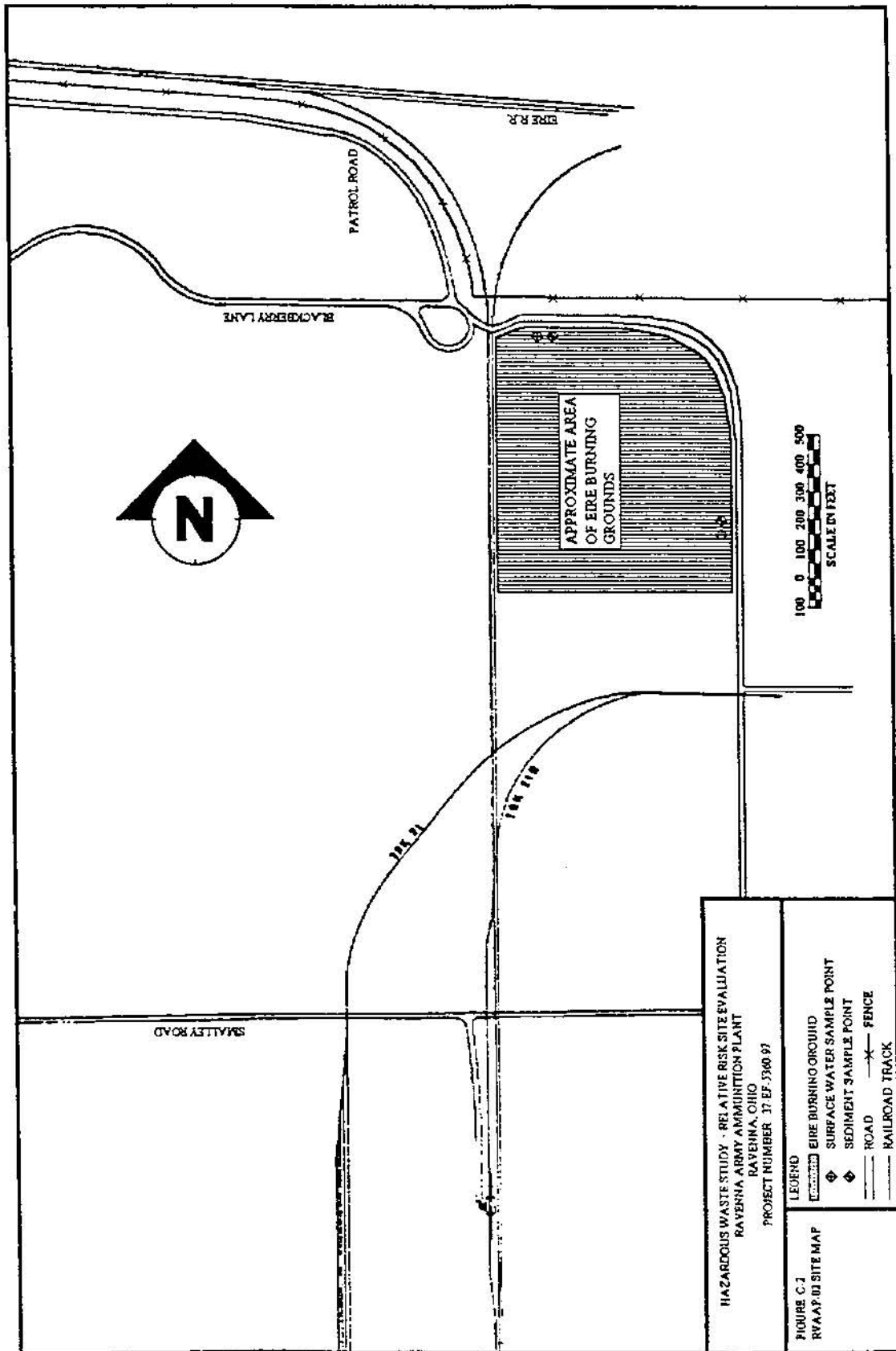
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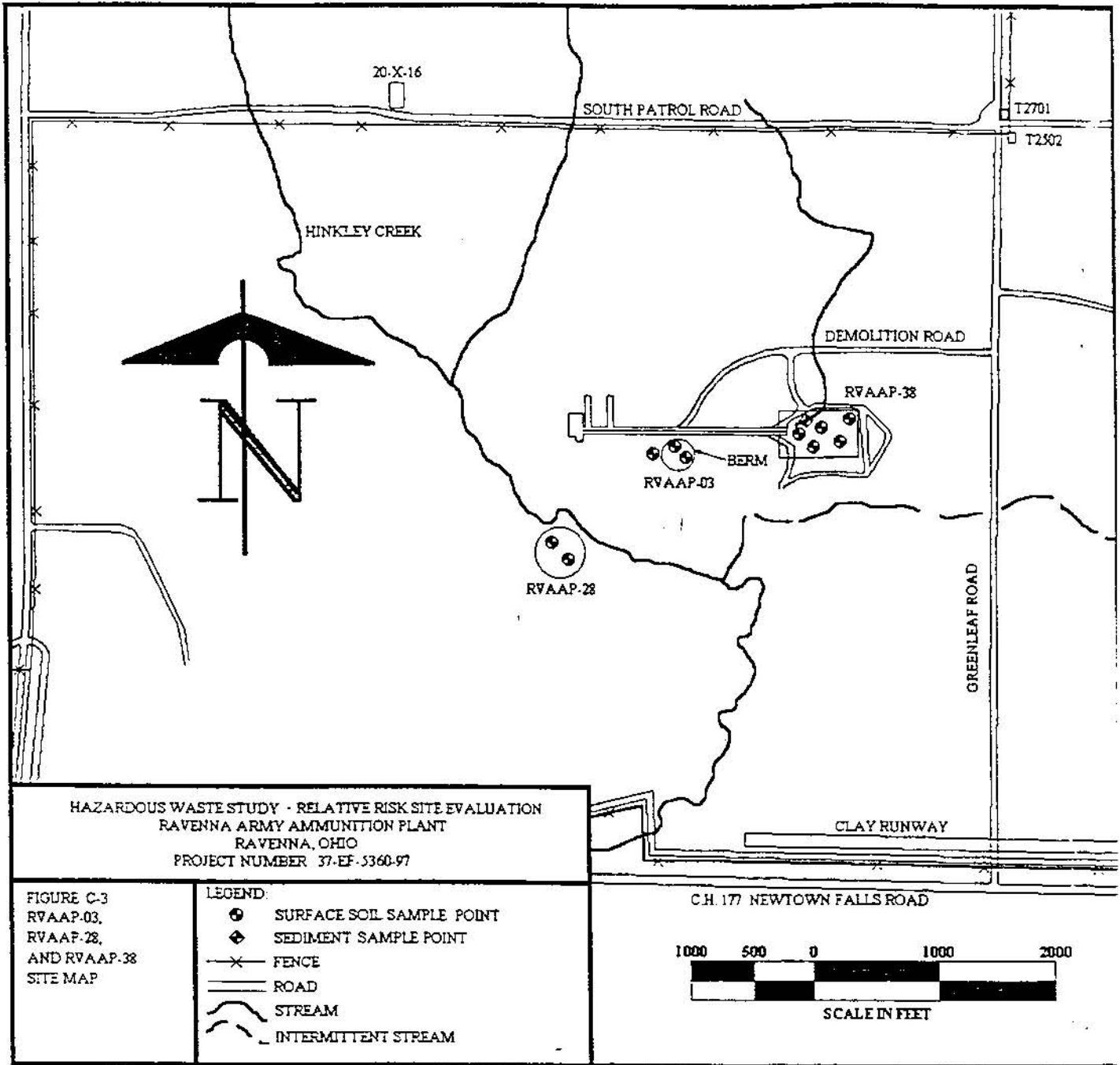
Readiness Thru Health

B-10

A-85

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→ 1. **Site Name:** RVAAP-02, Erie Burning Grounds.

2. **Site Summary:** This site was used from 1941 to 1951 to conduct open burning of explosives and related items. Bulk, obsolete, nonspecification propellants, and conventional explosives from throughout the installation were treated at the site. Metal items were treated to remove explosive residue before being processed as scrap. The area is now a swamp with up to several feet of water in places as a result of beaver activity. Two samples each of the surface water and sediment were collected from the site and analyzed for explosives and metals. There are no nearby workers. However, hunters have access to the site.

3. **Pathway Evaluation:**

a. **Ground Water:** *Not Evaluated.* There is no ground water associated with this site.

b. **Surface Water/Human Endpoint:** *High.*

(1) **Contaminant Hazard Factor:** *4.92 = Moderate*

Contaminant	Max Concentration (µg/L)	Standard (µg/L)	Ratio
arsenic	4	4.5	0.89
barium	29	2600	0.01
copper	29	1400	0.02
lead	16	4	4

(2) **Migration Pathway Factor:** *Potential.* There is no evidence that site contaminants are migrating. However, there are no physical barriers in place to prevent migration.

(3) **Receptor Pathway Factor:** *Identified.* This area is not used for production. However, hunters and fishermen have access to the site and use it for recreational activities. Access to the site is not restricted in any manner.

c. **Sediment/Human Endpoint:** *Medium.*

(1) **Contaminant Hazard Factor:** *0.50 = Minimal*

Contaminant	Max Concentration (mg/kg)	Standard (mg/kg)	Ratio
arsenic	9.94	22	0.45
barium	113	5300	0.02
chromium	18.6	3000	0.01
copper	32.8	2800	0.01
zinc	217	23000	0.01

(2) **Migration Pathway Factor:** *Potential.* There is no evidence that site contaminants are migrating. However, there are no physical barriers in place to prevent migration.

(3) **Receptor Pathway Factor:** *Identified.* This area is not used for production, but hunters and fishermen have access to the site and use it for recreational activities. Access to the site is not restricted in any manner.

d. **Surface Water/Ecological Endpoint:** *Not Evaluated.* The surface water at this site does not impact any critical habitat, as defined in the *Primer*.

e. **Sediment/Ecological Endpoint:** *Not Evaluated.* The sediment associated with this site does not impact any critical habitat, as defined in the *Primer*.

f. **Surface Soil:** *Not Evaluated.* There is no surface soil associated with this site.

4. **Final Score.** High (1), two Media of Concern.



C-4

A-90

Summary of Detected Compounds

ERIE 00-1

Site Number	RVAAP-02				RVAAP-03			RVAAP-06			RVAAP-15
	Sediment		Surface Water		Surface Soil			Surface Soil			Surface Soil
Sample Type	031B	032B	031W	032W	031	032	033	061	062	063	151
Sample Number											
antimony	-	-	-	-	-	-	-	-	-	-	-
arsenic	3.99	9.94	-	0.004	8.55	9.0	5.97	4.7	12.3	10.4	15.0
barium	35.7	113	0.029	0.027	74.7	126	162	32.8	79.6	104	158
cadmium	-	-	-	-	-	-	41.1	-	-	-	-
chromium	3.61	18.6	-	-	19.5	21.1	33.8	394	27.5	163	22.6
copper	5.31	32.8	0.029	0.029	10.2	13.3	6.2	11.7	15.4	20.3	11.7
lead	-	-	0.011	0.016	-	-	-	26.8	28.8	31.2	-
mercury	-	-	-	-	-	-	0.26	-	-	-	-
zinc	38.3	217	-	-	61.5	52.6	58.2	22.1	59.5	51.5	62.0
2,4,6-TNT	-	-	-	-	23,000	-	-	-	-	-	-
cyanide	-	-	-	-	-	-	-	-	-	-	-

Compound
 (soil/sediment mg/kg -
 surface/groundwater µg/L)

APPENDIX B

NOVEMBER 1998

**FIELD TRIAL AND SITE
RECONNAISSANCE NOTES**

30 NOV 1998 ERIE BURNING GROUNDS

SEDIMENT SAMPLING PROCEDURES

GENERAL WATER CONDITIONS

STAGNANT WATER

TYPICALLY 12-18" DEEP

MAXIMUM DEPTH = 36"

SAMPLES 1-5 ATTEMPTED AT LOCATIONS SITUATED IN LARGE WATER AREA -

1 - ATTEMPT MADE FROM BOAT W/ EXTENSION ON SAMPLER,

LOCATION THOUGHT TO BE NATURAL, WATER DEPTH ≈ 30"

SAMPLER COULD PENETRATE ONLY SEVERAL INCHES OF

LOOSE MATERIAL BEFORE REFUSAL

LITTLE OR NO SAMPLE COULD BE RECOVERED

2 - ATTEMPT MADE OUTSIDE BOAT WITH WADERS, WATER DEPTH 28"

LOCATION THOUGHT TO BE NATURAL

SAMPLER PENETRATED ≈ 6" (2" ORGANICS, 4" ORGANICS + CLAY)

COULD NOT PENETRATE > 6"

3 - ATTEMPT MADE OUTSIDE BOAT WITH WADERS, WATER DEPTH 15"

LOCATION HAD NUMEROUS RR TIMBERS,

SAMPLER REFUSED DURING SEVERAL ATTEMPTS

REACHED DOWN WITH HANDS AND FELT HARD, SMALL GRAVEL SURFACE

FINALLY BROKE LOOSE A PIECE ≈ 2" IN DIAMETER

MATERIAL WAS SMALL GRAVEL CEMENTED TOGETHER, BEEN ASHOUT

FINALLY PUNCHED SAMPLER TROUGH AT LOCATION & RECOVERED

ORGANICS & CLAY BENEATH HARD LAYER, COULD NOT

PENETRATE > 6"

4- ATTEMPT MADE OUTSIDE BOAT WITH WADERS, WATER DEPTH 2.15'
LOCATION HAD DEBRIS BELOW WATER + HAD A HARD LAYER
ONCE BROKE THROUGH HARD LAYER, RECOVERED ~ 6" ORGANICS + 4"

5- ATTEMPT MADE OUTSIDE BOAT WITH WADERS, WATER DEPTH 4.2'
LOCATION THOUGHT TO BE NATURAL
PENETRATED ~ 6" BEFORE REFUSAL; ~ 2" ORGANIC / 4" CLAY^{ORGANICS}

DITCH SAMPLE, LOCATION 6 -

PENETRATED ~ 6" BEFORE REFUSAL; ~ 2" ORGANICS / 4" CLAY^{ORGANICS}

CONCLUSIONS/RECOMMENDATIONS

1. SEDIMENT SAMPLING BEST ACCOMPLISHED WITH WADERS,
W/ADJ. BOAT FOR SUPPLIES, RECOVERING SAMPLE, ETC
2. IN AREAS W/HARD LAYER, PROBABLY A BURN AREA, NEED
TO TAKE A - SAMPLE OF THE HARD LAYER (CROWBAR OR PICK)
+ A SECOND SAMPLE OF SEDIMENT (~6") BELOW
THE HARD LAYER
3. IN AREAS W/O A HARD LAYER, ONE SAMPLE ~ 6" DEEP
IS ALL THAT IS POSSIBLE
4. AT WATER/LAND BOUNDARY, COULD PROBABLY HAND AUGER
A 6" SAMPLE & EITHER HAND AUGER OR
POWER AUGER A DEEPER SAMPLE
5. PROBABLY DO NOT HAVE A HARD LAYER IN CUT DITCHES
6. PROBABLY HAVE HARD LAYER IN BURN AREAS
7. WILL NEED UXO CLEARANCE FOR ALL SAMPLING, ON LAND
ESPECIALLY
8. CLEARING MAIN LAND AREAS NOW WILL HELP WHEN DO
WORK NEXT SUMMER-FALL
9. GO TO ADVANTAGES OF HTP WADERS INSTEAD OF BOAT - WATER IS LOW (SUMMER FALL
ESD.)
10. SAMPLE CATCHER MAY HAVE HELPED WITH SAMPLING, FROM BOAT

