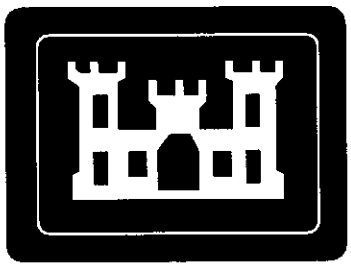
PRELIMINARY ASSESSMENT

FOR

THE CHARACTERIZATION OF AREAS OF CONTAMINATION RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

PREPARED FOR



U.S. ARMY CORPS OF ENGINEERS NASHVILLE DISTRICT

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FINAL

PRELIMINARY ASSESSMENT FOR THE RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

Prepared for

United States Army Corps of Engineers
Nashville District
Nashville, Tennessee 37202

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ACRONYMS

AOCs	Areas of concern
BGS	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DERP	DoD Defense Environmental Restoration Program
DoD	Department of Defense
GPD/ft	gallons per day per foot
GPM	gallons per minute
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HRS	Hazard Ranking System
NFA	no further action
OB/OD	Open Burning/Open Detonation
OEPA	Ohio Environmental Protection Agency
PA	Preliminary Assessment
PAS	Preliminary Assessment Screening
PCOCs	Potential Chemicals of Concern
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
REC	Record of Consideration
RFA	RCRA Facility Assessment
RMIS	Restoration Management Information System
RVAAP	Ravenna Army Ammunition Plant
SAIC	Science Applications International Corporation
SARA	Superfund Amendments and Reauthorization Act
SWMUs	Solid Waste Management Units
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers
USAEHA	U.S. Army Environmental Hygiene Agency
USATHMA	U.S. Army Toxic and Hazardous Materials Agency
USEPA	U.S. Environmental Protection Agency

DEFINITIONS

Action Plan (AP)	An annual plan submitted by U.S. Army installations statusing current and future planned environmental activities at the installations.
Area of Concern (AOC)	Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a site where contamination is known or suspected to exist.
Ammatol	A mixture of ammonium nitrate and TNT.
Defense Environmental Restoration Program (DERP)	A program established by Congress in 1984 to evaluate and clean up contamination from past U.S. Department of Defense (DoD) activities (Title 10 U.S. Code 2701-2707 and 2810).
Facility-wide Sampling and Analysis Plan (SAP)	A submittal document comprised of the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP); used to define all aspects of sampling and analytical work expected to be common to an installation. Not implementable without an investigation-specific SAP Addendum.
Facility	All contiguous land and structures, other appurtenances, and improvements within the boundaries of a property or parcels.
Facility-wide	A term used to reference all land and structures comprising a facility.
Feasibility Study (FS)	Based on data collected during the remedial investigation, options for final cleanup actions are developed and evaluated in the FS. The FS is divided into two phases: (1) an initial screening of alternatives, followed by (2) the detailed analysis of alternatives. The detailed analysis considers, among other things, cost-effectiveness, short- and long-term effectiveness, and the overall protection of human health and the environment.
Installation	A military facility or base.
Interim Remedial Action (IRA)	An early response action that is identified and implemented at any time during the study or design phase. IRAs are limited in scope, and they address only areas or media for which a final remedy will be developed by the remedial investigation (RI)/FS process. An IRA should be consistent with the final remedy for a site.
Investigation-Specific Sampling and Analysis Plan (SAP) Addendum	A submittal document comprised of the FSP and QAPP; used to define specific aspects of sampling and analytical work during the investigation of one or more AOCs. Tiered under the Facility-wide SAP and not implementable without the Facility-wide SAP.

No Further Action (NFA)	A no further action decision is a decision to close out a site from further response action. Such decisions can be made at different points in the process if data indicate that risks are within acceptable levels.
Pink Water	Waste water colored pink as a result of the photochemical reaction of TNT in water.
Phase I Remedial Investigation	Performed if the Preliminary Assessment (PA) recommends further investigation. Phase I investigations typically collect waste and environmental samples to determine the hazardous substances present at a site and whether they are being released to the environment.
Phase II Remedial Investigation (RI)	A field investigation that is more extensive than a Phase I RI. Its purpose is to characterize the nature and extent of contamination at a site. The Phase II RI also assesses the risks posed by on-site contamination to human health and the environment.
Preliminary Assessment (PA)	A limited-scope investigation designed to distinguish between sites that pose little or no threat to human health and the environment and sites that require further investigation. The PA is based on installation record searches, visual site inspections, and interviews of site personnel.
Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA)	The first step in the RCRA corrective action process. The RFA acts as a screen, first identifying and then eliminating solid waste management units (SWMUs), environmental media, or entire facilities from further consideration for corrective action. RFAs are performed as part of the RCRA permitting process.
Relative Risk	The grouping of sites or AOCs in the DERP into High, Medium, and Low categories based on an evaluation of site information using three key factors: the contaminant hazard factor, the migration pathway factor, and the receptor factor.
Remedial Action (RA)	Involves the construction, operation, and implementation of the final cleanup remedy. Long-term RAs require continued monitoring, operation, and maintenance for a number of years.
Remedial Design (RD)	Involves the development of the actual design of the selected cleanup remedy, including preparation of all technical drawings and specifications needed to implement the cleanup action.
Removal Action	Taken to respond to a release, or threat of a release, of hazardous substances, pollutants, or contaminants so as to prevent, minimize, or mitigate harm to human health or the environment. Such actions may be taken during any phase of the site cleanup.

Site	An area(s) of known or suspected release or source of contamination including all potentially affected media (soil, groundwater, surface water, sediment, air).
Solid Waste Management Unit (SWMU)	Under RCRA, a site where solid waste or wastelike material is known or suspected to exist.
Strategic and Critical Materials	A government phrase referring to substances/materials essential to the effective conduct of war.

1. INTRODUCTION

1.1 PURPOSE AND SCOPE

This Preliminary Assessment (PA) has been prepared for the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio, by Science Applications International Corporation (SAIC) under Contract DACA62-94-D-0029 with the U.S. Army Corps of Engineers (USACE), Nashville District. The PA has been developed following the requirements for PAs under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA) of 1986, including U.S. Environmental Protection Agency (USEPA) (USEPA 1991). The purpose of this PA was to collect information concerning conditions at the RVAAP sufficient to assess the potential threat posed to human health and the environment and to determine the need for additional characterization of areas identified at RVAAP containing potentially hazardous materials from former munitions assembly and demilitarization operations at the installation. The scope of the PA included review of available relevant information, interviews with former employees, and field visits to review and identify potential sites. Because considerable information concerning potential sites at RVAAP has previously been collected and reported in various assessments and investigations, the PA has additionally focused on confirming, where possible, and consolidating this information for each potential site.

The consolidated information presented in the PA is intended to be used to preliminarily evaluate each site as to the potential threat posed to human health and the environment, and to additionally determine a relative ranking of the AOCs at RVAAP to guide additional characterization activities. The PA presents a comparative overview of the USEPA Hazard Ranking System (HRS) and the U.S. Department of Defense (DoD) Relative Risk Site Evaluation (RRSE) methodologies for preliminary assessment of the relative risk associated with potentially hazardous sites. Under the guides of the DoD Defense Environmental Restoration Program (DERP), sites at RVAAP are scored using the RRSE methodology. The PA does not include a scoring of sites using the RRSE because scoring is performed annually and presented in the facility Action Plan. The facility Action Plan is used to establish annual funding priorities for environmental activities at RVAAP.

2. FACILITY DESCRIPTION, OPERATIONAL HISTORY, AND WASTE CHARACTERISTICS

2.1 FACILITY LOCATION

The RVAAP is located in northeastern Ohio in Portage and Trumbull Counties. The installation headquarters lies approximately 56.3 kilometers (35 miles) southeast of Cleveland, 14.5 kilometers (9 miles) east of the town of Ravenna, and 24.1 kilometers (15 miles) west of the town of Warren. The area is bounded by State Route 5 to the south, State Route 534 to the east, and the Erie-Lackawanna Railroad right-of-way to the north. Exit No. 14 of the Ohio Turnpike is located on State Route 5, 4 kilometers (2.5 miles) east of the eastern boundary of the plant. Figure 2-1 illustrates the location of the RVAAP within the state of Ohio.

2.2 FACILITY DESCRIPTION

RVAAP consists of 8668.3 hectares (21,419 acres) contained in a 17.7 by 5.6 kilometers- (11 mile by 3.5 mile-) wide tract bounded as stated above. The elevation ranges from approximately 368.8 meters (1210 feet) above sea level in the western areas of the installation to 283.5 meters (930 feet) in the eastern section with the majority of land being 335.3 meters (1100 feet) and 365.8 meters (1200 feet) above sea level. The general terrain is post glacial terminal moraine in character, and is slightly rolling; well defined drainage patterns in several large creeks carry the surface water adequately. The installation is located mainly in Portage County which is the present North-South geophysical watershed divide. The Michael Kirwan Dam and Reservoir is located on the west branch of the Mahoning River, immediately upstream from the town of Wayland, Ohio. RVAAP is located adjacent to the north boundary of the reservoir area.

2.3 DESCRIPTION OF FACILITY ACTIVITIES

RVAAP was constructed for the primary purpose of loading medium and major caliber artillery ammunition, bombs, mines, fuzes and boosters, primers, and percussion elements, as well as finished ammunition and ammunition components. However, over the years, RVAAP handled and stored strategic and critical materials for various government agencies and received, stored, maintained, transported, and demilitarized military ammunition and explosive items. Strategic and critical materials implies a substance essential to the effective conduct of war. Until 1992, RVAAP has maintained the capability to load, assemble, and pack military ammunition even though the facility is inactive.

2.4 OPERATIONAL HISTORY

2.4.1 Facility Ownership History

RVAAP is a government-owned, contractor-operated U.S. Army Armament, Munitions and Chemical Command facility. In early 1940, the U.S. Government purchased 10117.5 hectares (25,000 acres) from private land owners in the area.

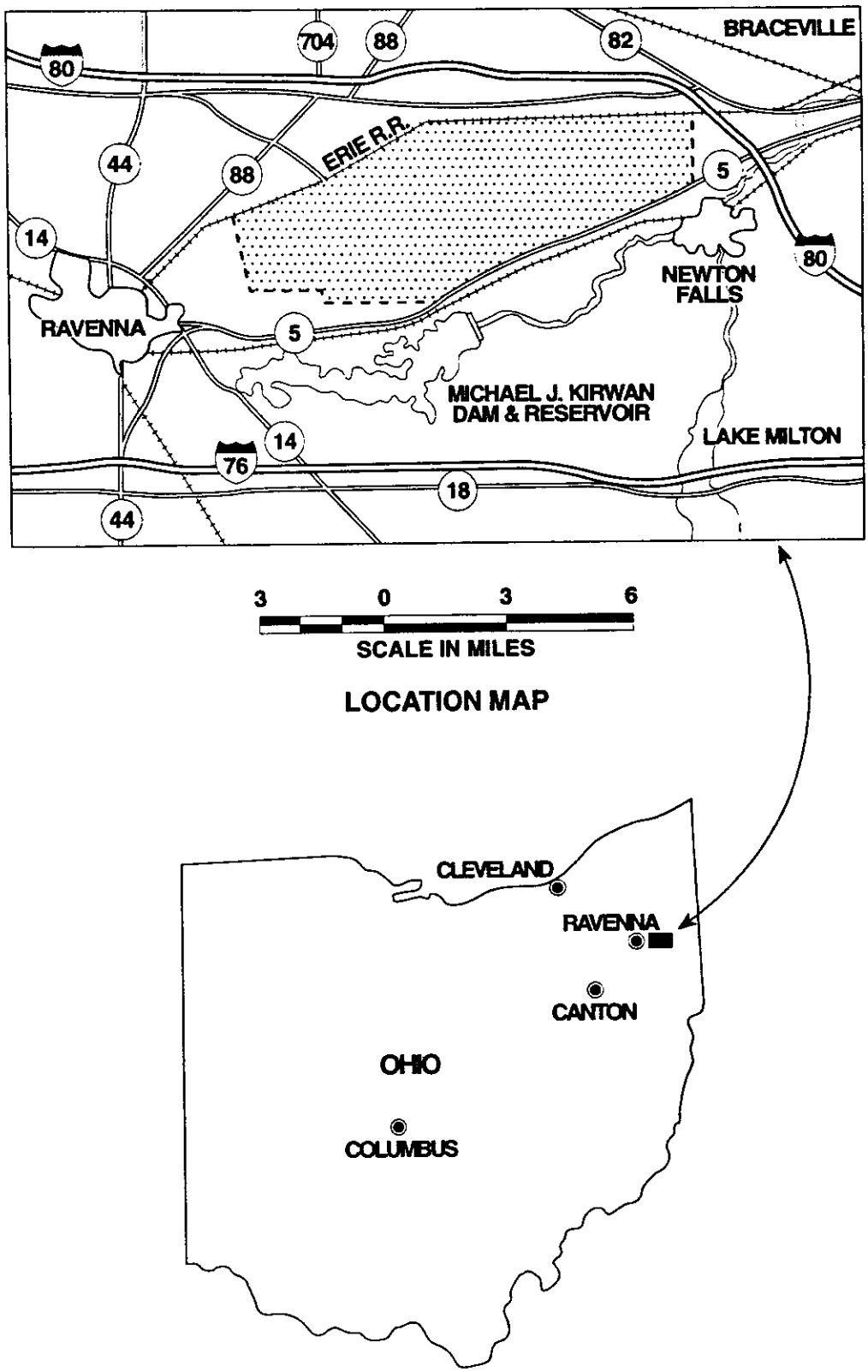


Figure 2-1. General Location and Orientation of RVAAP

On August 26, 1940, plant construction was contracted with Hunkin-Conkey Construction and building was initiated. On the same day, Wilbur-Watson and Associates began planning, designing buildings and equipment, and organizing what was then called the Ravenna Ordnance Plant. The Atlas Powder Company was the original operations contractor for the facility.

In October of 1941, the installation was divided into two separate units, one designated as the Portage Ordnance Depot, with the primary mission being of depot storage activities and the other as the Ravenna Ordnance Plant for primarily ammunition loading activities. In August 1943, the installation was designated the Ravenna Ordnance Center and then in November 1945, Ravenna Arsenal. On November 2, 1961, the industrial portion of the Ravenna Arsenal was redesignated the Ravenna Depot Activity. Finally, on August 1, 1963, the installation was redesignated as the Ravenna Army Ammunition Plant.

From 1951 to 1982 the installation was operated by Ravenna Arsenal, Inc. a subsidiary of the Firestone Tire and Rubber Company of Akron, Ohio. In 1982 Physics International Corp., a subsidiary of Rockcor Inc., became the operations contractor. Then in 1985 Rockcor was purchased by the Olin Corporation. At the present time, RVAAP is an inactive facility maintained by a contracted caretaker, Mason and Hanger-Silas Co., Inc.

2.4.2 Facility Regulatory History

There have been multiple environmental related investigations conducted at the RVAAP. A brief summary of these investigations is provided below:

Year	Investigation
1978	U.S. Army Toxic and Hazardous Materials Agency (USATHMA) conducted an Installation Assessment of RVAAP and concluded that no migration of contamination to groundwater had occurred at the installation (USATHMA 1978).
1982	Reassessment by USATHMA also concluded that no migration of contamination to groundwater had occurred (USATHMA 1982).
1988	U.S. Army Environmental Hygiene Agency (USAEHA) conducted a groundwater contamination survey and an evaluation of Solid Waste Management Units (SWMUs). Twenty nine potentially contaminated SWMUs were identified. Further investigation was recommended for 15 of the 29 SWMUs to determine if contaminants had migrated from these units.
1989	USEPA contracted Jacobs Engineering to perform a Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) - Preliminary Review and Visual Site Inspection (USEPA 1989). The report identified 31 SWMUs, 13 of which were recommended for no further action (NFA). These 31 SWMUs are listed as sites in the Restoration Management Information System (RMIS).
1992	USAEHA conducted a hydrogeologic study of the Open Burning/Open Detonation (OB/OD) areas as part of a response to a Notice of Deficiency issued by OEPA regarding the installation's RCRA, Part B Permit Application. Minor amounts of contamination were reported at these areas.

1994 USAEHA performed a Preliminary Assessment Screening (PAS) of the Boundary Load Line areas at RVAAP, and provided a Statement of Findings to support a Record of Consideration (REC) along with recommendations for additional activities at these sites.

2.5 WASTE CHARACTERISTICS

Hazardous wastes formerly generated as a result of munitions operations at the RVAAP primarily included explosives and heavy metals. Table 2-1 summarizes the waste constituents of concern.

2.6 WASTE CONTAINMENT PRACTICES

RVAAP has historically handled hazardous materials and operated several waste management sites in support of their operations. Potentially hazardous materials were treated, stored, and disposed in landfills, burned on site, or more recently stored in drums awaiting appropriate disposal in accordance with RCRA. Table 2-1 summarizes the waste generating and containment sites at the RVAAP and Table 2-2 lists the contaminants of concern at those facilities.

RVAAP has maintained several landfill sites during the course of the plant's operating history. The landfills varied in size from .2 hectares to 4 hectares (0.5 acres to 10 acres). All of the sites were unlined and received explosive waste which, at some of the sites, was thermally destroyed on site prior to disposal.

The practice of open-burning was used primarily to desensitize and destroy waste explosive materials. These materials ranged from the raw explosives to items that were contaminated with explosives (rags, cardboard, etc.). Prior to 1980, waste explosives were burned directly on the ground surface. Since 1980, waste explosives and explosive munitions were burned in metal trays or in the deactivation furnace with ash residue being collected, containerized, and placed in regulated hazardous waste storage, pending proper disposal in accordance with RCRA.

Surface water impoundments began operation in 1948 and continued throughout the operational history. These sites were utilized to collect and act as a dilution media for effluent coming from the operational sawdust filtration processes. The dilution/settling ponds were utilized in conjunction with storm water run-off to minimize the effect of "pink-water" generated by the photochemical reaction of trinitrotoluene (TNT) contaminated wastewater. These ponds are unlined and most have a receiving stream that drains from the settling ponds, some of which discharge off of the installation.

Fifteen concrete "basins" referred to as "settling tanks" are scattered throughout the load line facilities at RVAAP and serve as sawdust filters and holding receptacles for explosive waste solutions. They range in capacity from 1520 to 18,240 liters (400 to 4800 gallons). These concrete basins (RVAAP-26) are located within their associated load line facility that produced that explosive waste. During production schedules, these tanks served as settling basins for explosive compound mixtures poured into the tanks. At designated frequencies, the settled sludge was drawn off and taken to one of the burning grounds for further destruction. These tanks have all been covered and abandoned in place. Three additional tanks (RVAAP-23, 24, and 25) contained waste oil. One tank has been excavated (RVAAP-23) and the other two (RVAAP-24 and RVAAP-25) are above ground.

Table 2-1. Waste Containment Facilities

Sites		Contaminants of Concern
Landfills		
RVAAP-01	Ramsdell Landfill Quarry Landfill	Explosives, Metals
RVAAP-06	C-Block Quarry	Metals
RVAAP-19	Landfill North of Winklepeck Burning Grounds	Explosive, Metals
RVAAP-28	Mustard Agent Burial Site	Mustard Agent
RVAAP-32	40 and 60 mm Firing Range	Explosives, Metals
RVAAP-34	Sand Creek Disposal Road Landfill	Asbestos, Metals
RVAAP-36	Pistol Range	Metals
RVAAP-38	NACA Test Area	Petroleum Hydrocarbons
Burning Grounds		
RVAAP-02	Erie Burning Grounds	Explosives, Metals
RVAAP-03	Demolition Area and 1	Explosives, Metals
RVAAP-04	Demolition Area and 2	Explosives, Metals
RVAAP-05	Winklepeck Burning Grounds	Explosives, Metals, Laboratory Chemicals, Waste Oil
Surface Impoundments		
RVAAP-08	Load Line 1 and Dilution/Settling Pond	Explosives, Metals
RVAAP-09	Load Line 2 and Dilution/Settling Pond	Explosives, Metals
RVAAP-10	Load Line 3 and Dilution/Settling Pond	Explosives
RVAAP-11	Load Line 4 and Dilution/Settling Pond	Explosives, Metals
RVAAP-12	Load Line 12 and Dilution/Settling Pond	Explosives, Metals
RVAAP-13	Building 1200 and Settling Pond	Explosives, Metals
RVAAP-16	Quarry Landfill/Former Fuze and Booster Burning Pits	Explosives, Metals
RVAAP-29	Upper and Lower Cobbs Pond Complex	Explosives, Metals, Aluminum Chloride
RVAAP-31	Ore Pile Retention Pond	Explosives, Manganese
RVAAP-14	Load Line 6 Evaporator Unit	Explosives, Metals

Table 2-1 (continued)

Sites		Contaminants of Concern
Tanks		
RVAAP-23	Unit Training Equipment Site Waste Oil Tank	Waste Oil
RVAAP-24	Reserve Unit Maintenance Area Waste Oil Tank	Waste Oil
RVAAP-25	Building 1034 Motor Pool Waste Oil Tank	Waste Oil
RVAAP-26	Fuze and Booster Area Settling Tanks	Explosives, Metals
RVAAP-35	Building 1037 Laundry Waste Water Tank	Explosives
Buildings		
RVAAP-07	Building 1601 Hazardous Waste Storage	Explosives, Metals
RVAAP-15	Load Line 6 Pink Water Treatment Plant	Explosives
RVAAP-17	Deactivation Furnace	Explosives, Metals
RVAAP-18	Load Line 12 Pink Waste Water Treatment Plant	Explosives
RVAAP-20	Sand Creek Sewage Treatment Plant	Metals
RVAAP-21	Depot Sewage Treatment Plant	Metals
RVAAP-22	George Road Sewage Treatment Plant	Explosives, Metals
RVAAP-27	Building 854, PCB Storage	PCBs
RVAAP-30	Load Line 7 Pink Water Treatment Plant	Explosives
RVAAP-33	Firestone Test Facility	Explosives, Metals
RVAAP-37	Pesticide Building S-4452	Synthetic Organic Compounds

Reference: FY95 Installation Action Plan for Ravenna AAP

Table 2-2. Contaminants of Concern

Explosives	Metals
TNT	Lead
HMX	Chromium
Composition B	Mercury
RDX	Arsenic
Napalm	**Acids**
White Phosphorus	Chromic Acid
Antimony Sulfide	Sulfuric Acid
Lead azide	Sodium Ortho Silicate
Black Powder	Mustard Agent
Tritonol	

RVAAP at one time supported six wastewater treatment plants: three were for treatment of domestic sewage (RVAAP-20, RVAAP-21, and RVAAP-22) and three for treatment of pink (TNT-contaminated) wastewater (RVAAP-15, RVAAP-18, and RVAAP-30).

All six outfalls from these facilities were permitted under Ohio NPDES Permit No. 3I000000BD.

The remaining facilities are buildings of various operational design. These facilities are a RCRA Permitted hazardous waste storage area (RVAAP-07), a deactivation furnace (RVAAP-17), and a permitted PCB storage facility (RVAAP-27)

3. ENVIRONMENTAL SETTING

3.1 GENERAL ENVIRONMENTAL CONDITIONS

3.1.1 Climatic Conditions

The general climate of RVAAP area is considered continental and is characterized by moderately warm and humid summers, reasonably cold and cloudy winters, and wide variations in precipitation from year-to-year. The following climatological data were obtained from the National Weather Service Office at the Youngstown-Warren Regional Airport located in Trumbull County and are based on a 30-year average.

Total annual rainfall in the RVAAP area is approximately 94.7 centimeters (37.3 inches), with the highest monthly average occurring in July [10.3 centimeters (4.07 inches)] and the lowest monthly average occurring in February [5.16 centimeters (2.03 inches)]. Average annual snowfall totals approximately 142.7 centimeters (56.2 inches) with the highest monthly average occurring in January [32.8 centimeters (12.9 inches)]. It should be noted that due to the influence of lake-effect snowfall events associated with Lake Erie (located approximately 35 miles to the northwest of RVAAP), snowfall totals vary widely throughout northeastern Ohio.

The average annual daily temperature in the RVAAP area is 48.3 degrees F, with an average daily high temperature of 57.7 degrees F and an average daily low temperature of 38.7 degrees F. The record high temperature of 100 degrees F occurred in July 1988, and the record low temperature of minus 22 degrees F occurred in January 1994. The prevailing wind direction at RVAAP is from the southwest, with the highest average windspeed occurring in January [56.3 kilometers (11.6 miles)] per hour and the lowest average windspeed occurring in August [11.9 kilometers (7.4 miles)] per hour.

Thunderstorms occur on approximately 35 days per year and are most abundant from April through August. The RVAAP area is susceptible to tornadoes. Minor structural damage to several buildings on facility property did occur as a result of a tornado in 1985.

3.1.2 Geologic Setting

3.1.2.1 Unconsolidated Sediments

Two glacial advances during the Wisconsonian Age of the Pleistocene Epoch resulted in the deposition of a veneer of glacial till over the entire RVAAP installation. The first glacial advance deposited the Kent Till over the facility. The Kent Till consists mostly of sand and silt with a few cobbles and sporadic boulders, and ranges in depth from 6.1 to 12.2 meters (20 to 40 feet) below ground surface (BGS). The second glacial advance deposited the Hiram Till over the eastern two-thirds of the facility only. The Hiram Till consists of 12 percent sand, 41 percent silt, and 47 percent illite and chlorite clay minerals, and ranges in depth from 1.5 to 4.6 meters (5 to 15 feet) BGS. The Hiram Till overlies thin beds of sandy outwash material in the far northeastern corner of the facility. Field observations during site walk-overs of AOCs indicate that overall till thickness is less than .6 meter (2 feet) in some areas of the RVAAP facility. The reduced till thickness may be due to natural erosion or construction grading operations and is not necessarily the result of deposition.

A buried glacial valley, oriented in a southwest-northeast direction, is located in the central portion of the facility. This valley is filled with glacial outwash consisting of poorly sorted clay, till, gravel, and silty sand. Depths of unconsolidated sediments in the valley range from 30.5 to 60.7 meters (100 to 200 feet) BGS.

3.1.2.2 Bedrock

The bedrock geology of RVAAP consists of Carboniferous Age sedimentary rocks that lie stratigraphically beneath the glacial deposits of the Kent and Hiram Tills. The oldest bedrock that outcrops within the facility is the Cuyahoga Formation of the Mississippian Age. Three members comprise this formation: (1) the Orangeville Shale, (2) the Sharpsville Sandstone, and (3) the Meadville Shale. The Cuyahoga outcrops in the far northeastern corner of the facility, and generally consists of a blue-gray silty shale with interbedded sandstone. The regional dip of the Cuyahoga strata is between 1.5 to 3 meters (5 to 10 feet) per mile to the south.

The remainder of the facility is underlain by bedrock associated with the Pottsville Formation of the Pennsylvanian Age. The Pottsville Formation, which lies unconformably on an erosional surface of the Cuyahoga Formation, is divided into four members: (1) the Sharon, (2) the Connoquenessing Sandstone, (3) the Mercer, and (4) the Homewood Sandstone. The Sharon Member consists of two individual units: the Sharon Conglomerate and the Sharon Shale. The Sharon Conglomerate is a porous, coarse-grained, gray-white sandstone that often exhibits thin layers of milky white quartz pebbles. The Sharon Conglomerate also has locally occurring thin shale lenses in the upper portion of the unit. Due to the differences in lithology between the Sharon Conglomerate and the underlying shales of the Cuyahoga Formation, the contact between the Pottsville and Cuyahoga Formations usually is quite distinct. The Sharon Shale overlies the Sharon Conglomerate and consists of sandy, gray-black, fissile shale with some plant fragments and thin flagstone beds.

The Connoquenessing Sandstone member of the Pottsville Formation unconformably overlies the Sharon Member and is a medium-to coarse grained, gray-white sandstone with more feldspar and clay than the Sharon Conglomerate. Thin interbeds and partings of sandy shale also are common in the Connoquenessing. The Mercer member of Pottsville Formation overlies the Connoquenessing and consists of silty to carbonaceous shale with abundant thin, discontinuous sandstone lenses in the upper portion. Regionally, the Mercer also has been noted to contain interbeds of coal. The Homewood Member of the Pottsville Formation unconformably overlies the Mercer member and consists of coarse-grained crossbedded sandstones that contain discontinuous shale lenses.

The Connoquenessing, Mercer, and Homewood members are present only in the western half of the RVAAP facility. The Sharon Conglomerate unit is the upper bedrock surface in most of the eastern half. The regional dip of the Pottsville Formation strata is between 1.5 and 3 meters (5 and 10 feet) per mile to the south.

3.1.3 Hydrologic Setting

3.1.3.1 Unconsolidated Sediments

The largest groundwater supplies within Portage County come from two buried valleys that underlie Franklin, Brimfield, and Suffield Townships; and Streetsboro, Shalersville, and Mantua Townships, respectively. The sand and gravel within these buried valleys are favorably situated to receive recharge

from surface streams and surface infiltration. The water bearing characteristics for the sand and gravel aquifers in the vicinity of the RVAAP installation are poorly documented. Wells that penetrate these aquifers can yield up to 6080 liters [1600 gallons per minute (GPM)]. However, yields from wells penetrating silty or clay till materials are significantly lower. In general, the Kent and Hiram Tills are too thin and impermeable to produce useful quantities of water.

3.1.3.2 Bedrock

The most important bedrock sources of groundwater in the vicinity of the RVAAP facility are the sandstone/conglomerate members of the Pottsville Formation. These aquifers, together with two other deeper Mississippian/Devonian sandstone aquifers, represent the most important bedrock sources of groundwater in Northeastern Ohio.

The Sharon Conglomerate is the primary source of groundwater at RVAAP and maintains the most significant well yields of the Pottsville Formation members with hydraulic conductivity values of 5 to 2000 gallons per day per foot (GPD/ft). Past studies of the Sharon Conglomerate indicate that the highest yields are associated with the true conglomerate phase (coarse-grained sandstone with abundant quartz pebbles) and with joints and fractures in the bedrock; however, there is no facility-specific information available regarding variations in aquifer properties due to these factors. Where present, the overlying Sharon Shale acts as a relatively impermeable confining layer for the Sharon Conglomerate. Several flowing artisan production wells have been noted at the facility.

The Connoquenessing Sandstone and the Homewood Sandstone are the remaining aquifers of the Pottsville Formation and exhibit hydraulic conductivities of 5 to 300 GPD/ft, and 5 to 200 GPD/ft, respectively. Well yields in the Connoquenessing and Homewood Sandstones, although lower than the Sharon Conglomerate, are high enough to provide significant quantities of water. Several wells at the RVAAP facility have penetrated both the Sharon Conglomerate and the Connoquenessing Sandstone and reportedly produced water from both units.

In general, hydraulic conductivities for the shales of the Sharon and Mercer members of the Pottsville Formation are low and result in insignificant groundwater yields. The primary porosity of the shales is likely secondary, owing to joints and fractures in the bedrock; however, there is no facility-specific information available regarding the occurrence of joints and fractures in these units.

3.1.3.3 Surface Water

The entire RVAAP facility is situated within the Ohio River Basin with the West Branch of the Mahoning River representing the major surface stream in the area. This stream flows adjacent to the west end of the facility, generally in a north to south direction, before flowing into the M.J. Kirwan Reservoir that is located to the south of State Route 5. The West Branch flows out of the reservoir along the southern facility boundary before joining the Mahoning River east of RVAAP.

The western and northern portions of the RVAAP facility display low hills and a dendritic surface drainage pattern. The eastern and southern portions are characterized by an undulating to moderately level surface, with less dissection of the surface drainage. The facility is marked with marshy areas and flowing and intermittent streams whose headwaters are located in the facility's hills. Three primary water courses drain RVAAP: (1) the South Fork of Eagle Creek, (2) Sand Creek, and (3) Hinkley Creek. All of these water courses have many associated tributaries.

Sand Creek, with a drainage area of 36 square kilometers (13.9 square miles), flows generally in a northeast direction to its confluence with the South Fork of Eagle Creek. In turn, the South Fork of Eagle Creek then continues in a northerly direction for 7 kilometers (2.7 miles) to its confluence with Eagle Creek. The drainage area of the South Fork of Eagle Creek is 67.9 square kilometers (26.2 square miles), including the area drained by Sand Creek. Hinkley Creek originates just southeast of the intersection between State Routes 88 and 303 to the north of the facility. The Hinkley Creek, with a drainage area of 28.5 square kilometers (11.0 square miles), flows in a southerly direction through the installation to its confluence with the West Branch of the Mahoning River south of the facility.

Approximately 50 ponds are scattered throughout the installation. Many were built within natural drainageways to function as settling ponds or basins for process effluent and runoff. Others are natural in origin resulting from glacial action or beaver activity. All water bodies at RVAAP support an abundance of aquatic vegetation and are well stocked with fish. None of the ponds within the installation are used as water supply sources.

Storm water runoff is controlled primarily by natural drainage except in facility operations areas where an extensive storm sewer network helps to direct runoff to drainage ditches and settling ponds. In addition, the storm sewer system was one of the primary drainage mechanisms for process effluent during the period that production facilities were in operation.

3.1.4 Air Quality for Surrounding Area

The RVAAP facility is located in a rural area and has air quality that generally can be described as good. Based on a southwesterly prevailing wind direction, the city of Akron [located 37 kilometers (23 miles) to the south-southwest] is the nearest significant upwind urban area. Currently, there are no significant airborne emissions from RVAAP due to its inactive status. In addition, there is no operating air monitoring program in place at the facility at this time. There are no significant documented air pollution sources in close proximity to facility property that would affect air quality at RVAAP.

3.2 TARGET POPULATIONS

3.2.1 Area Demographics

The RVAAP site consists of 8668.3 hectares (21,419 acres) and is located in northeastern Ohio approximately 37 kilometers (23 miles) east-northeast of Akron and 48.3 kilometers (30 miles) west-northwest of Youngstown. The RVAAP site also incorporates portions of two counties: east-central Portage County and southwestern Trumbull County. According to the 1990 Census, the total populations of Portage and Trumbull counties were 142,585 and 227,813 respectively. The population centers in closest proximity to RVAAP include the city of Ravenna, (population 12,069) located approximately 3.2 kilometers (2 miles) from the western site boundary in Portage County and the city of Newton Falls (population 4866), located approximately 1.6 kilometers (1 mile) from the southeastern site boundary in Trumbull County.

The RVAAP facility is located in a generally rural area, and is not in close proximity to any major industrial or otherwise developed areas. Based on data from the United States Census Bureau (1992) and the Portage County Soil and Water Conservation District Resources Inventory (1985), approximately 55 percent of Portage County, in which the majority of RVAAP acreage is located, consists of either

woodland or farmland acreage. The Michael J. Kirwan Reservoir (also known as the West Branch Reservoir) is the closest major recreational area and is located adjacent to the western half of RVAAP south of State Route 5.

3.2.2 Groundwater Utilization

All groundwater utilized at the RVAAP facility during past operations was obtained from on-site production wells, with the large majority of wells screened in the Sharon Conglomerate. Production wells scattered throughout the facility provided necessary sanitary and process water for RVAAP operations. All remaining process production wells were permanently abandoned in 1992. Currently, only two groundwater production wells remain in operation. These wells, located in the central portion of the facility, provide sanitary water to the remaining site personnel.

Residential groundwater use in the surrounding area is similar to that for RVAAP, with the Sharon Conglomerate acting as the major producing aquifer in the area. The Connoquenessing Sandstone and the Homewood Sandstone also provide limited groundwater resources, primarily near the western half of the RVAAP facility.

The *Ground Water Pollution Potential of Portage County* published by the Ohio Department of Natural Resources (1991) provides additional insight into the groundwater characteristics of the RVAAP area. This map indicates the relative vulnerability of groundwater in a specific area to contamination from surface sources. Intended primarily as a groundwater resource management and planning tool, the groundwater pollution potential map presents index values based on several hydrogeologic criteria including depth to water, hydraulic conductivity, topography, and others. Resulting index values range from a low pollution potential (zero) to a high pollution potential (200+).

Based on this mapping system, the majority of the RVAAP facility has a moderate pollution potential that ranges between 100 and 159, depending on location. In addition, three general hydrogeologic settings are defined for RVAAP and include (1) glacial till overlying bedded sedimentary rock, (2) glacial till overlying sandstone, (3) and alluvium overlying bedded sedimentary rock. In general, the highest pollution potential values at RVAAP occur in the areas where alluvium overlies bedded sedimentary rock (index range of 140 to 159); however, these areas occur primarily in the northeast portion of the facility. The majority of RVAAP has pollution potential indices that range between 100 and 139.

3.2.3 Surface Water Utilization

Past and present surface water utilization at RVAAP generally is limited to use by wildlife and limited recreation. Although some surface water may have been used intermittently for various facility operations, the vast majority of process water was provided by on-site groundwater production wells. There is no available documentation that indicates any past irrigation or other agricultural use of surface water sources on facility property. It is likely that some agricultural use of surface water was conducted in this area prior to facility construction due to the presence of homesteads and farms at that time. On site recreational surface water use is limited to managed fishing programs conducted in the past and at the present. Based on conversations with site personnel, it is likely that some recreational trespasser use of surface water does occur on a limited basis, primarily for fishing.

The major surface water drainages at RVAAP all exit facility property and eventually flow into the Mahoning River to the east. Surface water from Sand Creek, that flows to the northeast across the facility, joins the South Fork of Eagle Creek that flows to the east inside the northern property boundary. The South Fork of Eagle Creek continues to the east until it eventually discharges to the Mahoning River. It is possible that limited agricultural and recreational use of the South Fork of Eagle Creek does occur off of facility property, although no data is available to allow a more detailed study. The Hinkley Creek, which enters facility property from the north and flows to the south across the western portion of RVAAP, eventually discharges to the West Branch of the Mahoning River (and the West Branch Reservoir) south of State Route 5. It is doubtful that the Hinkley Creek is used for any agricultural purposes, although limited recreational use may occur.

3.2.4 Potentially Impacted Wetlands, Parks, Protected Areas and Endangered Species

Available estimates indicate that approximately one-third of the RVAAP facility property meets the regulatory definition of a wetland, with the majority of the wetland areas located in the eastern portion of the facility. Wetland areas at RVAAP include seasonal wetlands, wet fields, and forested wetlands. Many of the wetland areas are the result of natural drainage or beaver activity; however, some wetland areas are associated with anthropogenic settling ponds and drainage areas. There is a high potential for impacts on wetland areas at RVAAP, due to the amount of process effluent discharged to settling ponds and the natural drainage of the area in the past.

The flora and fauna present at RVAAP are varied and widespread. A total of 18 plant communities have been identified on facility property including marsh, swamp, and forest communities. Twelve plant types listed as State Potentially Threatened have been identified at RVAAP including:

- Gray Birch,
- Round-leaved Sundew,
- Closed Gentian,
- Butternut,
- Blunt Mountain-mint,
- Northern Rose Azalea,
- Large Cranberry,
- Hobblebush,
- Fox Grape,
- Woodland Horsetail,
- Long Beech Fern, and
- Eel Grass.

In addition to being listed as a State Potentially Threatened Plant species, the Butternut also is listed as a Federal Candidate (Category 2) species.

A large number of animal species have been identified on facility property including 26 species of mammals, 143 species of birds, and 41 species of fish. Two animal species identified at RVAAP are listed as Federal Candidate (Category 2) species: the Cerulean Warbler and the Henslow's Sparrow. Animal species listed as Ohio State Endangered (1993 inventory) include the Northern Harrier, Common Barn-Owl, Yellow-bellied Sapsucker, Mountain Brook Lamprey, and the Graceful Underwing. Several animal species present at RVAAP also are listed as Ohio State Special Concern:

- Woodland Jumping Mouse,
- Solitary Vireo,
- Sharp-shinned Hawk,
- Sora,
- Virginia Rail,
- Four-toed Salamander, and
- Smooth Green Snake.

There is no documentation available to determine if any of the above animal or plant species have been affected by past facility operations. Future Installation Restoration Program activities will require consideration of these species to ensure that detrimental effects on threatened or endangered RVAAP flora and fauna do not occur. There are no federal, state, or local parks or protected areas on RVAAP facility property.

4. POTENTIAL SOURCES OF ENVIRONMENTAL CONTAMINATION

4.1 IDENTIFICATION AND CHARACTERISTICS OF POTENTIAL CONTAMINATION SOURCES

The following section presents a description of the sites currently identified at RVAAP and potentially new sites identified as a result of this PA. Figure 4-1 illustrates the location of sites.

4.1.1 RVAAP-01 (Ramsdell Quarry Landfill)

RVAAP-01 (Ramsdell Quarry Landfill) is located in the eastern section of the RVAAP facility and is a 4-hectare (10-acre) unlined landfill, with an 5.5 to 6.1 meters- (18 to 20 foot-) depth, in the bottom of an abandoned quarry. The soil covering is only a few feet in thickness and the quarry is excavated to the underlying Sharon Sandstone/Conglomerate. A pool of water is present at the bottom of the quarry at approximately 10.7 meters (35 feet) below ground surface (BGS).

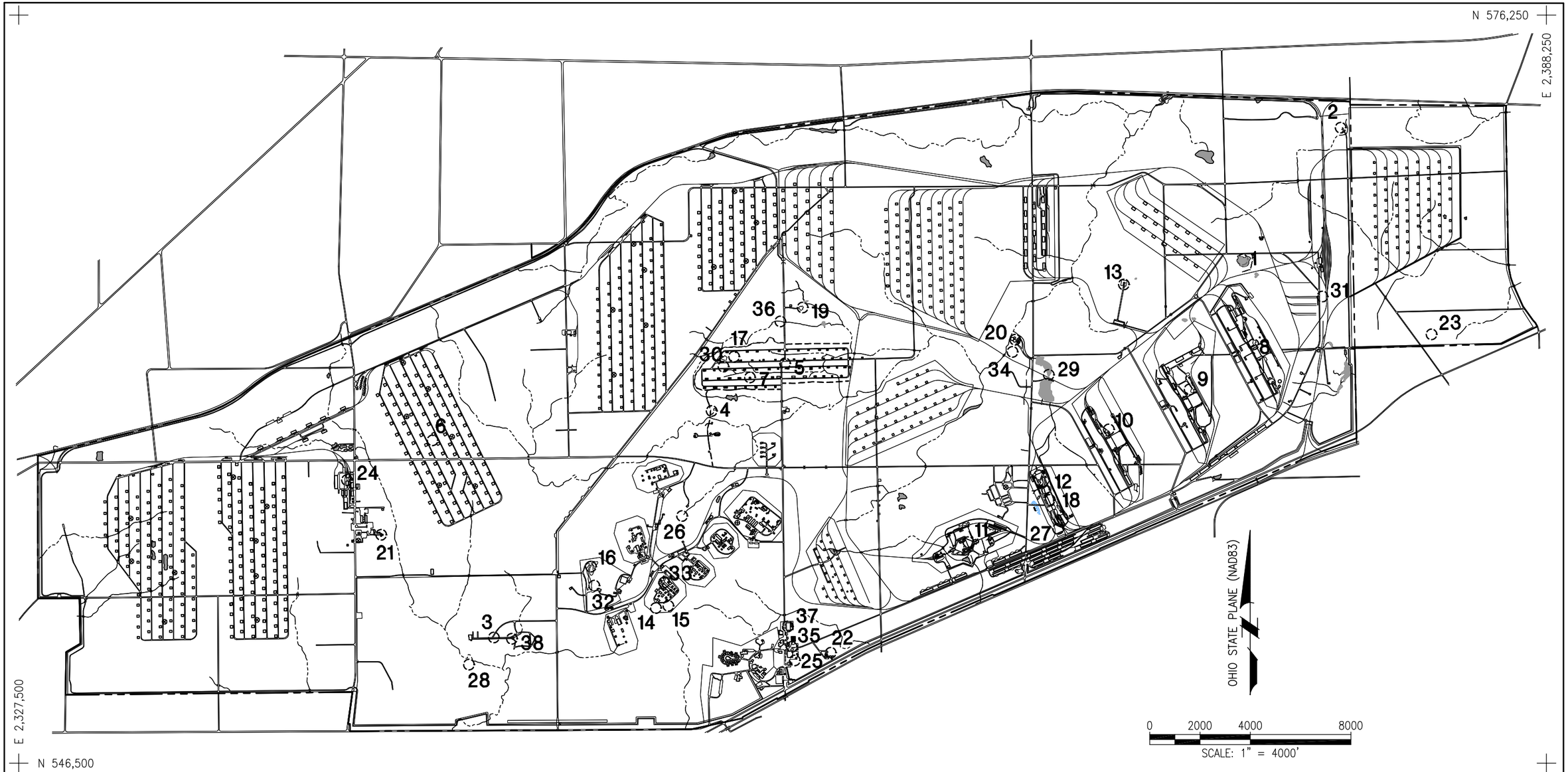
This landfill was used from 1941 to 1989. During the period of 1946 to 1950 the site was used as a land-surface burning site to thermally treat waste explosives from Load Line 1 and napalm bombs. From 1976 to 1989, the site was used strictly as a nonhazardous solid waste landfill. No historical information has been located for 1950 to 1976. The landfill ceased operation in September 1989. Closure of the landfill was completed in May 1990 under State of Ohio solid waste regulations. Monitoring wells were installed in 1991 as part of the closure and are checked quarterly for contaminants (Halliburton NUS 1992).

Landfilled material is variable domestic, commercial, industrial, and solid wastes including but not limited to explosives (TNT, Composition B), napalm, gasoline, acid dip liquor, annealing residue (sulfuric acid, shell casings, sodium ortho silicate, chromic acid and alkali), aluminum chloride, and inert material. The volume of landfilled material is unknown (Jacobs Engineering 1989).

4.1.2 RVAAP-02 (Erie Burning Grounds)

RVAAP-02 (Erie Burning Grounds) covers approximately 14.2 hectares (35 acres). This site was used from 1941 to 1951 to conduct open burning of explosives and related items. Previous documentation suggests that this site may have been used for brick manufacturing prior to the purchase by the Army in 1940. Bulk, obsolete, nonspecification propellants, and conventional explosives from throughout the installation were treated at this location. Unspecified large metal items were also treated to remove explosive residue before being salvaged and processed as scrap (Jacobs Engineering 1989).

Estimates regarding waste quantity have reached as high as a millon pounds of waste. This estimate, however, has been identified as an approximation of total wastes destroyed at all the burning grounds.The ash residues from the burning of explosive waste material containing hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), TNT, and propellants were left on the site. The ash residues potentially contain small amounts of explosives and some heavy metals. The site is now a swamp as a result of wildlife activity (beavers and muskrat) (Halliburton NUS 1992).



LEGEND OF SITES:

1 . . . . . RAMSDELL QUARRY LANDFILL
2 . . . . . ERIE BURNING GROUNDS
3 . . . . . DEMOLITIONS AREA #1
4 . . . . . DEMOLITIONS AREA #2
5 . . . . . WINKLEPECK BURNING GROUNDS
6 . . . . . C BLOCK QUARRY
7 . . . . . BLDG 1601 HAZARDOUS WASTE STORAGE
8 . . . . . LOAD LINE 1 AND DILUTION/SETTLING POND
9 . . . . . LOAD LINE 2 AND DILUTION/SETTLING POND
10 . . . . . LOAD LINE 3 AND DILUTION/SETTLING POND
11 . . . . . LOAD LINE 4 AND DILUTION/SETTLING POND
12 . . . . . LOAD LINE 12 AND DILUTION/SETTLING POND
13 . . . . . BLDG 1200 AND DILUTION/SETTLING POND
14 . . . . . LOAD LINE 6, EVAPORATION UNIT
15 . . . . . LOAD LINE 6, TREATMENT PLANT
QUARRY LANDFILL/FORMER
16 . . . . . FUZE & BOOSTER BURNING PITS
17 . . . . . DEACTIVATION FURNACE
18 . . . . . LOAD LINE 12 PINK WASTE WATER TREATMENT
19 . LANDFILL NORTH OF WINKLEPECK BURNING GROUND
20 . . . . . SAND CREEK SEWAGE TREATMENT PLANT
21 . . . . . DEPOT SEWAGE TREATMENT PLANT
22 . . . . . GEORGE ROAD SEWAGE TREATMENT PLANT
23 . . . . . UNIT TRAINING SITE WASTE OIL TANK
24 RESERVE UNIT MAINTENANCE AREA WASTE OIL TANK
25 . . . . . BLDG 1034 MOTOR POOL WASTE OIL TANK
26 . . . . . FUZE BOOSTER AREA SETTLING TANKS
27 . . . . . BLDG 854–PCB STORAGE
28 . . . . . MUSTARD AGENT BURIAL SITE
29 . . . . . UPPER AND LOWER COBBS POND COMPLEX
31 . . . . . ORE PILE RETENTION POND
32 . . . . . 40 AND 60 MM FIRING RANGE
33 . . . . . FIRESTONE TEST FACILITY
34 . . . . . SAND CREEK DISPOSAL ROAD LANDFILL
35 . . . 1037 BUILDING–LAUNDRY WASTEWATER SUMP
36 . . . . . PISTOL RANGE
37 . . . . . PESTICIDE BUILDING S–44S2
38 . . . . . NACA TEST AREA

US Army Corps of Engineers Nashville District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
NASHVILLE, TENNESSEE

RAVENNA ARMY AMMUNITION PLANT
RAVENNA, OHIO
FACILITY MAP

DRAWN BY:	REV. NO./DATE:	CAD FILE:
R. BEELER	REV. E/03–26–98	95021/DWGS/19111X17

Figure 1–1. Facility Map.

4.1.3 RVAAP-03 (Demolition Area 1)

RVAAP-03 (Demolition Area 1) is approximately .6 hectare (1.5 acres) used for the purpose of thermal treatment of munitions by open burning and detonation. The site now consists of a circular .3 to .4 meter (1 to 1.5 foot) berm surrounding a grassed area approximately .4 to .64 hectare (1 to 1.5 acres) in size. Around the perimeter of the berm are areas of bare ground approximately (100 to 150 square feet). Munitions fragments including scrap metal, small arms primers, and fuzes lie in the ground surface outside the bermed area and was operationally active from 1941 through 1949 (Jacobs Engineering 1989).

Waste types include shrapnel and other metallic munitions, and possibly explosive compounds (an estimated quantity is unknown) (Jacobs Engineering 1989).

4.1.4 RVAAP-04 (Demolition Area 2)

Demolition Area #2 is an elongate, horseshoe shaped, cleared area approximately 8 hectares (20 acres) in size. The site was used since 1948 to detonate large caliber munitions and "off spec" bulk explosives that could not be deactivated or demilitarized by any other means of destruction (Halliburton NUS 1992). Within the boundaries of this site, there are five distinct areas:

- Open Detonation Area - an area in which detonation was accomplished in a backhoe pit with a minimum depth of 1.2 meters (4 feet). After detonation, metal parts were typically picked up and removed from the site. The pit would be backfilled, mulched, and reseeded.

- Open Burning Area - [approximately .1 hectare (.25 acre)] the sludge from Load Line 6 Evaporation Unit from 1981 to 1986, was thermally destroyed in this location.

- Prototype Testing Range - an area where projectiles were fired into targets.

- Burial Site - an area where possible scrap bombs have been buried. This site is approximately 3 meters (10 feet) wide, 61 meters (200 feet) long and 1.2 meters (4 feet) deep. The area lies along a swale in the northwest corner of the Demolition Area.

- Past Disposal Area - an area that is posted "Off Limits, Dangerous Material" and is located along a 21.3-meter (70-foot) embankment overlooking Sand Creek.

Potential waste types at this site are unexploded ordnance, shrapnel, white phosphorus, explosive residues, and heavy metals. In 1984, an investigation revealed explosives in soil samples collected from a trench (Jacobs Engineering 1989). A RCRA permit application covering the 1.5 acres used for open burning and detonation was withdrawn on April 11, 1994. Closure plans are being prepared for the area defined in the permit application.

4.1.5 RVAAP-05 (Winklepeck Burning Ground)

The Winklepeck Burning Ground has been in operation since 1941 and consists of approximately 80.9 hectares (200 acres). Present activities are limited to an area of about 6 hectares (15 acres). Prior to 1980, the burning was carried out in four pits, pads, and sometimes on the roads. The pits consisted of areas bermed on three sides, approximately 15.2 by 22.9 meters (50 by 75 feet) in size. Of the four pits, Pit #1 was used most frequently. The pads consisted of 6 by 12.2 meters (20 by 40 foot) areas without berms.

Burning was conducted on bare ground, and the ash was abandoned on site. Scrap metal was reclaimed and taken to the landfill north of Winklepeck (RVAAP-19). It is not known how many pads were contained within this 80.9 hectare (200 acre) unit. According to reports from several former employees at RVAAP, some heavy artillery projectiles were melted out by being placed point side down on 7.6-centimeter (3-inch) channel irons. The channel irons were placed in a train configuration in a ditch along Lane E. Fires were built around the channel irons using scrap wood, straw, and No. 2 fuel oil. A train of projectiles up to 609.6 meters (2000 feet) long would sometimes be used in a ditch parallel to the road. The fire would cause the explosives to melt and flow out of the projectile and be burned. Some of the projectiles would explode and be ejected into the nearby area as far as 152.4 to 182.9 meters (500 to 600 feet), usually to the north side of the ditch. Many of the further flung projectiles are still in the field where they landed. In some instances, high energy material such as black powder and explosives were also laid out in a string along a road and burned (U.S. Army Toxic and Hazardous Materials Agency 1978).

Prior to 1980, wastes disposed included the burning of RDX, antimony sulfide, Composition B, lead oxide, TNT, propellant, black powder, sludge from load lines, and domestic wastes. Also, small amounts of laboratory chemicals were routinely disposed of during production periods. Shrapnel and other metallic munitions fragments were allowed to remain on the site after detonation as well as possible residual explosives. Waste oil (hydraulic oils from machines and lubrication oils from vehicles) was disposed in the northeast corner of the burning ground until 1973. Ash from these areas was not collected (Jacobs Engineering 1989).

Since 1980, burns have been conducted in metal, refractory lined trays (with subsequent ash collection), set on top of a bed of slag. These areas are also known as pads. The trays initially consisted of 1/4-inch boiler plate, 1.2 meter by 18.3 meters by 25.4 centimeters (4 feet by 60 feet by 10 inches) and refractory lined. The trays are set on a pad of crushed slag in an area approximately 30.5 by 30.5 meters (100 by 100 feet) in size. Ash residues are drummed and stored in RVAAP-07 (Building 1601 Hazardous Waste Storage) until tested for waste determination. In 1994, four groundwater wells were installed at the active portion of the site (Jacobs Engineering 1989). A closure plan is being proposed for the area defined in the RCRA permit application.

4.1.6 RVAAP-06 (C-Block Quarry)

RVAAP-06 (C-Block Quarry) is an abandoned, unlined borrow pit approximately .1 hectare (0.3 acre) in size. The site was used as a disposal area for annealing process wastes for a short time during the 1950s. Liquid wastes were reported to have been openly disposed in the pit bottom. Spent pickle liquor from a brass finishing operation that contained lead, mercury, chromium, and sulfuric acid is also documented to have been reported at this site. The site is now heavily forested with trees at least .3 meter (1 foot) in diameter or better. Two empty 209-liter (55-gallon) drums, glass fragments, cinder blocks, and several empty 19-liter (5-gallon) buckets are visible at the site (Jacobs Engineering 1989).

The waste disposal volume is unknown.

4.1.7 RVAAP-07 (Building 1601 Hazardous Waste Storage)

RVAAP-07 (Building 1601 Hazardous Waste Storage) is a 6.1 by 6.7 meters (20 by 22 foot) concrete igloo, 4.9 meters (16 feet) in height, with a 1.2 to 1.8 meter (4 to 6 foot) soil mound on top. The site had been used since 1980 for dry hazardous waste storage. The waste was stored in 209-liter (55-gallon)

drums pending ultimate disposal at an approved facility. The drums were stored on pallets (four per pallet) and stacked three high. The capacity of the building is 72 drums (U.S. Army Environmental Hygiene Agency 1988).

The containerized waste was dry ash (from demilitarization activities) that exhibits EP toxic sulfide and explosive reactivity characteristics. Spent carbon from RVAAP-18 (Load Line 12 Pink Water Treatment Facility) and from RVAAP-30 (Load Line 7 Pink Water Treatment Facility) was also stored on site (U.S. Army Environmental Hygiene Agency 1988). Currently all drums have been removed from the building.

4.1.8 RVAAP-08 (Load Line 1 and Dilution/Settling Pond)

The industrial operations at RVAAP consisted of 12 load lines. Load Lines 1, 2, 3, and 4 were used to melt and load TNT and Composition B into large caliber shells and bombs. Components such as fuzes, primer, and boosters were manufactured on Load Lines 5 through 11. Load Line 12 housed the ammonium nitrate plant.

The explosive melt-pour process for large caliber shells was conducted in Load Lines 1, 2, 3, and 4 and was an integral step in the LAP operations. The melt-load system is a conventional World War II system housed in a three-story building and requiring large quantities of explosives in process during the melt-pour-cool cycle.

In operation, the TNT flake is transported from the storage igloos, in the shipping cartons, to the screening building that is located in an area remote from melt operations. The screened TNT flake is collected in metal hoppers and moved to the third story of the melt building using an overhead drag conveyor. At the dump station on the third story, the TNT is manually fed over permanent magnets for removal of foreign metal parts such as boxing staples. From the permanent magnets the TNT flows to melt grid feed hoppers to partially melt the TNT flake. The melted TNT feeds into a steam jacketed mixing kettle located on the second floor, to complete the melting and mixing process. The melted TNT flows from the mixing kettle to a holding kettle on the first floor and is vacuum drawn into a pouring cart. From the pouring cart the TNT is volumetrically poured into the shell cavities.

Composition B is transported directly from the storage igloo to the melt building and is manually inspected on a spread-out table as it is being fed through permanent magnets to the hoppers feeding the melt kettles. The process for Composition B bypasses the screening operation, which is specified for TNT. All load lines operated at full capacity during the period of 1941 through 1945.

The Load Line 1 Dilution/Settling Pond was in operation from 1941 to 1971. Explosive residues that collected on the walls and floors during assembly operations was periodically washed and wastewater (known as "Pink Water") from the plant was collected in concrete sumps located throughout the line area. The wastewater was then pumped to the sawdust filtration unit for chlorofication and removal of nitro-compounds prior to discharge. The sawdust filtration unit consisted of a set of three parallel 3 by 9.1 by 0.9 meter (10 by 30 by 3 foot) concrete settling tanks and a set of three 1.5 by 4.6 by 0.9 meter (5 by 15 by 3 foot) filter blocks in the bottom of the filtration tanks. Plant effluent introduced into the top of one end of the unit was ditched to a settling pond (Griggy's Pond). The settling pond at Load Line 1 was an unlined earthen impoundment approximately .4 hectare (1 acre) in size. The discharge from the impoundment was sent to a surface stream (Sand Creek) that exited the installation. The sawdust from

the filtration unit was disposed by open burning at the Winklepeck Burning Grounds (RVAAP-05) (Halliburton NUS 1992).

Waste constituents at this site include TNT, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), Composition B, lead, chromium, mercury, and arsenic. In 1981, wells were installed around the perimeter of the load line areas. The wells were sampled for heavy metals. Arsenic was detected at a level of 0.063 mg/l in one of the wells near Load Line 1 (Jacobs Engineering 1989). Frost heaving has since destroyed the well. TNT and RDX were detected in sediments from the ditch receiving the discharge from the sawdust filtration unit. TNT was detected at a concentration of 0.30 μg/ml. The highest concentration of RDX was detected at a second sample location at a concentration of 1.60 μg/ml (Jacobs Engineering 1989).

4.1.9 RVAAP-09 (Load Line 2 and Dilution/Settling Pond)

Similar in process, Load Line 2 was used to melt and load TNT and Composition B into large caliber shells and bombs. Pink water generated from cleaning the walls and equipment was collected in concrete sumps connected to Building DB-4. After settling, the supernatant water was pumped by low-pressure steam ejectors to two detonation tanks, approximately 26,220-liter (6900-gallon) capacity, for cooling. When the water cooled to 80 degrees, the water was pumped through an overhead pipe to a sawdust filter [4 cubic meter- (140 cubic foot-) capacity]. The sawdust filtration unit consisted of a set of two parallel 3 by 9.1 by .9 meter- (10 by 30 by 3 foot-) concrete settling tanks and a set of three 1.5 by 4.6 by .9-meter (5 by 15 by 3-foot) filtration tanks. Filtration through the sawdust caused clarification and removal of nitro-compounds prior to discharge into the drainage system. The top 5 centimeters (2 inches) of sawdust were removed periodically and the entire filter contents replaced weekly until laboratory analysis showed longer runs could be made by careful filter operation. The water was supplied to the filter at approximately 76 liters (20 gallons) per minute and the daily average volume treated is 19,000 liters (5000 gallons) for two shift operations at Building DB-4. Sludge was periodically removed from the sumps to the Winklepeck Burning Grounds. The effluent from the sawdust filtration units was discharged into Kelly's Pond, a triangular shaped, unlined earthen settling impoundment, approximately .8 hectare (2 acres) in size and 1.8 to 2.4 meters (6 to 8 feet) deep. The discharge from the impoundment was channeled to the Sand Creek, a surface stream that exits the installation (Halliburton NUS 1992).

Load Line 2 operated for 30 years (1941 to 1971). Approximately 9,211 kilograms of Composition B and 3,192,000 liters of pink water per month were generated when the facility was at full capacity (Jacobs Engineering 1989). Chromic acid waste (625 ppm hexavalent chromium) was also discharged from Building 802 into a ditch that empties into the West Branch of the Mahoning River (APCO, Ohio 1951). Approximately 5,166,000 cubic meters of scrap, sludge, and dust was produced each month. Bulk brick explosives were brought to the buildings, screened and broken up. The explosives were put into kettles and melted. The grinding and pouring allowed explosive particulate matter to escape and settle on the walls and floors of the buildings. Although the air inside the buildings was continuously vacuumed, the walls and floors had to be washed down on a weekly basis. The water was collected in drains running along the interior of the building and transferred to a sump on the first floor [approximately 4.6 meters (15 feet deep)]. This water was then pumped to the sawdust filtration units (Jacobs Engineering 1989). TNT and RDX were detected in sediment samples collected from the ditch receiving the discharge from the sawdust filtration unit. Concentrations ranged from 0.60 μg/ml TNT to 1.75 μg/ml RDX (U.S. Army Environmental Hygiene Agency 1988).

4.1.10 RVAAP-10 (Load Line 3 and Dilution/Settling Pond)

The washdown and steam decontamination of equipment generated pink-water waste from this load line which was also collected in concrete sumps located throughout the load line area. After settling, the wastewater was then pumped to the a set of three parallel 3 by 9.1 by .9 meters (10 by 30 by 3-foot) settling tanks via steam ejectors. After slight cooling, the waste was sent to the sawdust filtration unit, three 1.5 by 4.6 by .9-meter (5 by 15 by 3-foot) tanks, in which sawdust was placed on top of vitreous clay filter blocks. The sawdust removes the nitro-compounds prior to discharge into the drainage system. As previously mentioned, the sawdust and the settled sludge was periodically removed to the Winklepeck Burning Ground. The effluent from the sawdust filtration unit was discharged via a ditch into a settling pond that emptied into Upper Cobbs Pond and ultimately Lower Cobbs Pond (RVAAP-29) (Jacobs Engineering 1989).

Load Line 3 operated from 1941 to 1971 (30 years). Approximately 9,173 kilograms of scrap and sludge and 304,800 liters of pink water was generated per month when the facility was operating at full capacity. The waste consisted of TNT, HMX, Composition B, lead, chromium, mercury, and arsenic (Jacobs Engineering 1989).

RDX at a concentration of 1.6 μg/ml was detected in a sediment sample collected from Upper Cobbs Pond during a soil and sediment investigation conducted in 1982 by The Mogul Corporation. Since Load Lines 3 and 12 discharged into Cobbs Pond, it is unknown if this contamination originated from Load Line 3 (Jacobs Engineering 1989).

4.1.11 RVAAP-11 (Load Line 4 and Dilution/Settling Pond)

The Load Line 4 Wastewater Treatment System was in operation from 1941 to 1971. Washdown and steam decontamination of equipment generated pink water from the plant and collected in concrete sumps located throughout the line area. The wastewater was then pumped to a sawdust filtration unit. The sawdust filtration unit consisted of a set of three parallel 3 by 9.1 by .9-meters (10 by 30 by 3-foot) concrete settling tanks and a set of three 1.5 by 4.6 by .9-meters (5 by 15 by 3-foot) filtration tanks. Sawdust was placed on top of vitreous clay filter blocks in the bottom of the filtration tanks. After passing through the settling tanks, plant effluent was introduced into the top of one end of the filter tanks and discharged to a surface ditch from the bottom of the other end of the filter tanks. Effluent from the sawdust filtration unit was ditched to a .8 hectare (2-acre) settling pond within the Load Line 4 area. Sludge and spent sawdust was periodically removed and sent to the Winklepeck Burning Ground for thermal destruction (Jacobs Engineering 1989).

Approximately 11,930 kilograms of scrap, sludge and dust, 14,900,000 cubic meters of dust, and 3,390,000 liters of pink water were generated per month when the facility was operating at full capacity. The waste consisted of TNT, RDX, Composition B, lead, chromium, mercury and some unknown constituents. Previous characterization data indicated that RDX was detected at a concentration of 0.54 μg/ml while TNT was detected at a concentration of 0.06 μg/ml in samples collected from the drainage ditch (Jacobs Engineering 1989).

4.1.12 RVAAP-12 (Load Line 12 and Dilution/Settling Pond)

Load Line 12 was primarily used for the demilitarization of munitions. The projectile and fuse assembly was removed from the bomb casing and the projectile was placed in a double-jacketed steam canister.

Explosives were liquified into a tray, knocked out of the tray, packed, and shipped out. The building area was washed down weekly and the water was guttered and flowed through a pipe into a series of two stainless-steel tanks. One tank was used for settling and one for filtration. Prior to 1981, the tank effluent was ditched (from Building FJ-904) to a holding pond, where ultimately the water drained to Upper Cobbs and then Lower Cobbs Pond (RVAAP-29) (Jacobs Engineering 1989).

The Silas Mason Company of Shreveport, Louisiana was awarded a contract in 1946 to rehabilitate the ammonium plant and produce fertilizer grade ammonium nitrate to fulfill the U.S. Government's commitment for aid in rehabilitation of occupied foreign countries. A total of 518,264.1 tons of ammonium nitrate was produced until the contract was terminated in January 1950.

Approximately 324,000 liters of pink water were generated per month when the plant was fully operational during the 1950s. The effluent contained TNT, HMX, Composition B, Ammatol (a mixture of ammonium nitrate and TNT), lead, chromium, mercury, and other explosives. The facility was housed in a steel girder, transite-sided building approximately 30.5 meters by 18.3 meters (100 feet by 60 feet) (Halliburton NUS 1992). Dark, red-stained soil lies under and along the east and north edge of the building. In the vicinity of the red-stained soil are areas of absent vegetative growth. Sediment samples from Cobb Ponds were found to be contaminated with RDX at a concentration of 1.16 μg/ml and TNT at a concentration of 0.17 μg/ml. In the past, contaminated wastewater was allowed to drain into the environment. Overflow could have potentially gone into a drainage ditch approximately [30.5 meters (100 feet)] east of this unit (Jacobs Engineering 1989).

4.1.13 RVAAP-13 (Building 1200 and Dilution/Settling Pond)

Building 1200, the Ammunition Sectioning Area, is half concrete, half transite-sided building approximately 9.1 meters by 6.1 meters (30 feet by 20 feet) with a 3.7-meter (12-foot) peak. Building 1200 was used from 1941 to 1971 for ammunition demilitarization. Munition rounds were checked for flaws, steam cleaned, and the wastewater drained, via a pipe, through a crushed slag gravel bed and into a ditch and finally into a .2 hectare (.5 acre) sedimentation pond (Jacobs Engineering 1989). Currently the building area is inactive.

Effluent from the facility contained explosive contaminated wastewater. The water may have contained small amounts of TNT, HMX, Composition B, or other explosives as well as heavy metals such as lead, chromium, and mercury (Jacobs Engineering 1989).

4.1.14 RVAAP-14 (Load Line 6 Evaporation Unit)

RVAAP-14, also known as the Load Line 6 Evaporation Unit, is an 5.5 by 4.3 by 1.2-meters (18 by 14 by 4-foot) concrete tank with two compartments [1.5 by 4.3 meters and 4 by 4.3 meters (5 by 14 foot and 13 by 14 foot)]. The tank is enclosed in a 6 by 6-meters (20 by 20-foot) -prefabricated metal building having welded plate structural members, straight walls, and a clearspan shell (U.S. Army Environmental Hygiene Agency 1988).

The site was operational from 1981 to 1987 by Physics International, the operations contractor, and was used to collect wastewater (containing TNT and RDX residue) from Load Line 6 during research and development experiments. Explosive wastewater from washdown was evaporated in the larger of the two concrete compartments. Residuals from the tank were removed and transferred to RVAAP-04 (Demolition Area #2) for thermal destruction (U.S. Army Environmental Hygiene Agency 1988).

In 1985, an inspector from the Ohio EPA noted hairline cracks in the tank, and the tank was lined with PVC. In 1989, the tank was emptied, cleaned of explosive residues, and was issued a RCRA Closure Plan. Under the provisions of the closure plan, a soil investigation was performed (U.S. Army Environmental Hygiene Agency 1988). Soil samples that were collected from borings along the outside perimeter of the evaporation unit revealed TNT and RDX contamination in concentrations ranging up to 200 parts per million. These samples were collected from depths up to 0.6 meters (2 feet). Explosive contamination was also detected beneath the tank at concentrations up to 100 parts per million (Jacobs Engineering 1989). No information currently exists indicating that any cleanup has occurred.

Contaminants of concern include TNT, RDX, and HMX.

4.1.15 RVAAP-15 (Load Line 6 Treatment Plant)

RVAAP-15 (Load Line 6 Treatment Plant) consists of dual activated carbon units intended for pink water filtration. Two 75.7-kilograms (167 pound) carbon units are enclosed in a 6 by 6-meter (20 by 20-foot) steel girder, metal-sided building, set on a concrete pad. Plant effluent was stored in a 3420-liter (900-gallon) stainless-steel holding tank. The effluent was pumped through a Cuno filter that removes particulate matter. After the effluent was filtered, it was pumped through two activated carbon units; 30 minutes of carbon bed contact time was maintained for each treatment cycle. The liquid was then pumped to one of two 1900-liter (500-gallon) holding tanks. The treated water was then sampled and discharged at RVAAP-07 (George Road Sewage Treatment Plant) or retreated. The spent carbon was stored in the RVAAP-07 (Building 1601) until transported off site for ultimate disposal (Halliburton NUS 1992).

RVAAP-15 was operational from 1987 to 1993. The site was regulated as an internal monitoring point for National Pollutant Discharge System (NPDES) Permit No. 3I000000BD. The permit specified that the site may discharge a maximum allowable concentration of 0.14 ppm for each TNT, RDX, and HMX (Jacobs Engineering 1989).

Waste constituents at this site include TNT, RDX, and HMX.

4.1.16 RVAAP-16 (Quarry Landfill/Former Fuze and Booster Burning Pits)

This site consists of three elongate ponds situated end to end in an abandoned rock quarry. The ponds are 4.6 to 6 meter (15 to 20 feet) deep and separated by earthen berms. The total combined area of the three ponds is approximately .4 hectares (1 acre). Originally, the quarry site was used as an open burning area for sawdust waste potentially derived from Load Lines 6 and 11 during the period 1945 to 1949. The site was also used as a landfill, where spent brine regenerant and sand filtration backwash from the groundwater treatment plant, fuze and booster assemblies, projectiles, residual ash, and sanitary waste have all been disposed. In 1976, the existing debris was removed from the quarry bottom and transferred to either RVAAP-01 (Ramsdell Quarry) or one of the burning grounds (Jacobs Engineering 1989). Historical records do not indicate the absence or presence of regulatory oversight during the transfer of material. The ponds were originally constructed to receive filter backwash from the potable water system (groundwater pumped from a well and treated at Water Works 3). Outputs averaged 11,400 to 19,000 liters (3000 to 5000 gallons) per day and was permitted by Ohio NPDES Permit #3I000000BD (U.S. Army Environmental Hygiene Agency 1988). The ponds were operational from 1987 to 1993.

4.1.17 RVAAP-17 (Deactivation Furnace)

The RVAAP-17 (Deactivation Furnace) was used to deactivate fuzes, boosters, and munitions. The unit consists of an oil-fired, horizontal, rotary retort fed by a conveyor belt. The charging side of the conveyor belt is housed in a metal-sided building approximately 2.4 by 7.3 meters (8 by 24 feet). The retort is surrounded by a wooden earthen barricade open at the top. The retort consists of a metal cylinder, .9-meter (3-feet) in diameter and 3.6-meters (12-feet) long (U.S. Army Environmental Hygiene Agency 1988).

Built during the 1960s, the system was designed to destroy up to 400 grains of explosives. Explosives were fed via conveyor into the rotating retort tube. As they passed from the charging end of the tube to the opposite end, they were heated by an oil-fired flame at a temperature between 1000 to 1200 degrees F until ignition occurred. Scrap metal was removed from the opposite end of the tube into a hopper and disposed as scrap and salvage. The site was last operational in 1983 (Jacobs Engineering 1989). Currently, a RCRA Closure Plan is under review by the OEPA.

4.1.18 RVAAP-18 (Load Line 12 Pink Waste Water Treatment)

Load Line 12 Pink Water Treatment Plant consists of a dual mode activated carbon filtration system for filtering pink water. Twin 907.2-kilogram (2000-pound) carbon units are enclosed in a 6 by 13.2 meter (20 by 40 foot) steel girder, metal-sided building on a concrete slab. The spent carbon is stored in Building 1601 (RVAAP-07) until transported off site for disposal (Jacobs Engineering 1989).

The site was built in 1981, within the confines of Load Line 12, and was operational for two years. During operation, plant effluent was stored in a 38,000-liter (10,000 gallon) stainless-steel holding tank. When processing, the effluent was pumped through a bag prefilter that removed the particulate matter. After the prefilter, the effluent was pumped through a series of two activated carbon units to another holding tank. Approximately 30 minutes of carbon bed contact time was maintained during the treatment process (Jacobs Engineering 1989).

TNT wastewater with a maximum allowable concentration of 0.14 ppm was disposed. The site was designed to treat 76 liters (20 gallons) of wastewater per minute and averaged 19,000 liters (5000 gallons) per day (Jacobs Engineering 1989). The site currently has an active NPDES Permit (#3I000000BD) granted by the state of Ohio.

4.1.19 RVAAP-19 (Landfill North of Winklepeck Burning Ground)

This site is an unlined 4-hectares (10-acre) landfill used for general refuse. The site was operational from 1969 to 1976. The general appearance of the site suggests a trench and fill method of operation (Jacobs Engineering 1989).

An unknown quantity of material was landfilled at this site including booster cups, aluminum liners, sanitary waste, and possibly explosive and munition waste and ash (Jacobs Engineering 1989).

4.1.20 RVAAP-20 (Sand Creek Sewage Treatment Plant)

The RVAAP-20 (Sand Creek Sewage Treatment Plant) consisted of two Imhoff tanks, two trickling filters, and a final clarifier. Sludge was dried in two beds contained within a "greenhouse" type structure

and spread over land (location unknown). The design flow capacity was 1,330,000 liters (350,000 gallons) per day. Flows ranged between 570,000 to 760,000 liters (150,000 to 200,000 gallons) per day (U.S. Army Environmental Hygiene Agency 1988).

This site was intermittently operational from 1969 to 1978, 1981 to 1983, and 1983 to 1993. The waste handled at this site was exclusively domestic sewage. The effluent from this treatment plant discharged to Sand Creek and the unit had an active NPDES Permit (#3I000000BD) (Jacobs Engineering 1989) until 1993 when the site ceased operations.

4.1.21 RVAAP-21 (Depot Sewage Treatment Plant)

RVAAP-21 (Depot Sewage Treatment Plant) is very similar in design to RVAAP-20 (Sand Creek Sewage Treatment Plant). This unit, which was gravity fed, consisted of two Imhoff tanks, two small trickling filters (only one is functional), and a chlorinator. The design capacity was about 247,000 liters (65,000 gallons) per day. The flow rates were about 38,000 to 76,000 liters (10,000 to 20,000 gallons) per day (Jacobs Engineering 1989).

This unit had been operational since 1941 and was operated under Ohio NPDES Permit (#3I000000BD). The site was permitted to handle only NPDES regulated wastewater. Sludge was hauled to the George Road Sewage Treatment Plant for disposal and the effluent was discharged to Hinkley Creek (Jacobs Engineering 1989). The site ceased operations in 1993.

4.1.22 RVAAP-22 (George Road Sewage Treatment Plant)

The RVAAP-22 (George Road Sewage Treatment Plant) consists of two Imhoff tanks, two trickling filters, and a clarifier, and is gravity fed. Sludge was dried in a greenhouse structure and spread over the ground surface. Historical information does not indicate where the sludge was spread, or if it was tested prior to being spread. There are, however, effluent limitations specified in the NPDES permit. The design capacity was 133,000 liters (350,000 gallons) per day. Normal operation is 570,000 to 760,000 liters (150,000 to 200,000 gallons) per day. Approximately 1,114,800 square centimeters (1200 cubic feet) of sludge was spread every three years (Jacobs Engineering 1989).

The waste handled at this site was domestic sewage and discharge from RVAAP-15 and RVAAP-30. Effluent from this treatment plant was discharged to a receiving stream. The site did maintain a current Ohio NPDES permit (#3I000000BD) (Jacobs Engineering 1989) until 1993, when the facility ceased operations.

4.1.23 RVAAP-23 (Unit Training Equipment Site Waste Oil Tank)

RVAAP-23 (Unit Training Equipment Site Waste Oil Tank) was a (1000 gallon) underground waste oil tank. Adjacent to the waste oil tank was another tank which stores fuel oil No. 2. Both tanks were located just outside the rear of Building T-102, a maintenance shop (Jacobs Engineering 1989).

The exact age of the tank was unknown, but estimated to be at least 20-years old. The unit had been inactive since December, 1988 and was never been precision tested. The tank held waste oil from shop maintenance areas and was composed predominantly of crankcase and transmission oils, gear lubricants, and hydraulic/brake fluids. Lead was found in some of the waste oils. Generally motor and transmission oils as well as hydraulic fluid, are mineral oil based fractions of petroleum. Various antioxidants,

stabilizers, detergents, and solvents have been used as additives to provide the desired physical-chemical properties (Jacobs Engineering 1989).

Both tanks were located within 4.6 meters (15 feet) of the water supply well for the maintenance shop (Jacobs Engineering 1989), but were removed in 1989. No additional information is available concerning the removal and closure of these tanks.

4.1.24 RVAAP-24 (Reserve Unit Maintenance Area Waste Oil Tank)

RVAAP-24 (Reserve Unit Maintenance Area Waste Oil Tank) has been in operation since 1983. The steel tank is above ground, 1520 liters (400 gallons) and set on crushed slag next to the motor oil storage shed used for storing bulk lubricant. The tank has been operational since 1983. Waste oil from the motor pool area was stored in the waste oil tank until it was removed by an oil reclaimer. In 1993, the contents of the tank were emptied and has remained inactive (U.S. Army Environmental Hygiene Agency 1988). There are no data to suggest any integrity testing had been done on the tank.

The waste oil from the shop maintenance areas and is composed predominantly of crankcase and transmission oils, gear lubricants, and hydraulic/brake fluids. Lead has been found in some of the waste oils. Generally motor and transmission oils as well as hydraulic fluid, are mineral oil based fractions of petroleum. Various antioxidants, stabilizers, detergents, and solvents have been used as additives to provide the desired physical-chemical properties (U.S. Army Environmental Hygiene Agency 1988).

4.1.25 RVAAP-25 (Building 1034 Motor Pool Waste Oil Tank)

RVAAP-25 (Building 1034 Motor Pool Waste Oil Tank) is a 1900-liter (500-gallon) above ground steel tank set on a four wheeled chassis. The tank has been used since 1974 to hold waste oil from shop maintenance. Like the previous tanks mentioned above (RVAAP-23 and RVAAP-24), waste oils from shop maintenance areas is composed predominantly of crankcase and transmission oils, gear lubricants, and hydraulic/brake fluids. Lead has been found in some of the waste oils. Generally motor and transmission oils as well as hydraulic fluid, are mineral oil based fractions of petroleum. Various antioxidants, stabilizers, detergents, and solvents have been used as additives to provide the desired physical-chemical properties (Jacobs Engineering 1989).

This site stores approximately 1140 liters (300 gallons) of waste oil per year and is emptied by a reclaimer on an as-needed basis (Jacobs Engineering 1989).

4.1.26 RVAAP-26 (Fuze and Booster Area Settling Tanks)

RVAAP-26 (Fuze and Booster Area Settling Tanks) consists of 15 concrete tanks located throughout Load Lines 5,7,9,10 and 11. A summary of the settling tanks at each load line is as follows:

- Load Line 5: One tank, 2.4 by 2.4 meter (8 ft by 8 ft); 14,592 liter (3840 gallon) capacity. Load Line 5 manufactured fuses.

- Load Line 7: One underground tank, 3 by 18 by .9 meters (10 by 6 by 3 ft); 5130 liters (1350 gallon) capacity. Load Line 7 manufactured boosters. This tank was removed in 1988.

- Load Line 9: Two tanks, one 3 by 2.4 by 2.4 meters (10 by 8 by 8 ft); 18,240 liter (4800 gallon) capacity and one 2.4 by 2.4 by 1.8 meter (8 by 8 by 6 feet); 10,944 liter (2880 gallon) capacity. Load Line 9 manufactured detonators.

- Load Line 10: Nine tanks, seven, 2.4 by 2.4 by 2.4 meter (8 by 8 by 8 feet); 14,592 liter (3480 gallon) capacity, one .9 by 1.8 meter (3 by 6 feet); 1539 liter (405 gallon) capacity, and one above ground tank with unknown dimensions. Load Line 10 manufactured percussion elements.

- Load Line 11: Three tanks, each 2.4 by 2.4 by 2.4 meter (8 by 8 by 8 feet), 14,592 liter (3480 gallon) capacity (Jacobs Engineering 1989). Load Line 11 manufactured artillery elements.

All of these tanks were used as settling basins for the explosive contaminated wastewater during the production processes at these load line facilities from 1941 to 1971. The settled sludge was periodically collected from the tanks (every 1 to 3 months) and transferred to one of the burning grounds for thermal destruction. The disposition of the water from the tanks is not positively known. It may have been pumped onto the ground or into the sewer systems (USAEHA 1988). The soils surrounding the process buildings sourcing the effluent to the settling tanks may also be of concern because building washout operations historically resulted in the release of waste water on the ground adjacent to the building exits. In 1971, all of these tanks were emptied, cleaned, and covered. They have not been used since but remain in place with the exception of the Load Line 7 tank (Halliburton NUS 1992).

Waste constituents at these tanks may have included TNT, RDX, black powder, lead, lead azide, mercury, lead styphnate, and some unknown compounds (Jacobs Engineering 1989).

4.1.27 RVAAP-27 (Building 854, PCB Storage)

This site consists of approximately half the bay area of a wooden frame building with transite and corrugated metal siding. The portion of the building that is used for PCB storage is approximately 15.2 by 76.2 meters (50 by 250 feet), with a pitched roof, and a concrete floor. It was originally used for equipment storage. The PCB laden materials were stored inside the building on wooden pallets or metal trays. They were confined to a 33 by 6.4 meter (108 by 21 foot) section along the north and south wall of the building (U.S. Army Environmental Hygiene Agency 1988).

The site was active until 1992. Prior to that time, PCB-laden transformers and capacitors were stored awaiting final disposition by the Defense Reutilization Material Office (DRMO) (Jacobs Engineering 1989). All of the transformers have been removed and the only material left onsite are trays and buggies (containment for electrical equipment).

4.1.28 RVAAP-28 (Mustard Agent Burial Site)

The RVAAP-28 (Mustard Agent Burial Site) is approximately 4.6 by 5.5 by 5.5 meter (15 by 18 by 18 feet) where, according to reports of former employees, mustard agent was buried. In 1969, records indicate that a U.S. Army agency had excavated a suspected mustard agent burial site within the old demolition grounds, now known as Training Areas D & G, in 1969. One 190-liter (50-gallon) drum and 7 small rusty cans were recovered. All recovered items were empty and no contamination was discovered. Following this excavation, an unidentified and undocumented source reported that the site had not been correctly identified and was actually in an area adjacent to the excavation. This new area was reportedly

enclosed by a cyclone fence approximately 4.6 by 5.5 by 5.5 meter (15 by 18 by 18 feet) (U.S. Army Toxic and Hazardous Materials Agency 1978). Presently, the cyclone fence has fallen over.

The burial was supposedly prior to 1950. The waste of concern is mustard agent (dichlorodiethyl sulfide and thiodiglycol). The location of the site is approximately 152.4 meters (500 feet) south of Hinkley Creek along an abandoned powerline (Halliburton NUS 1992).

4.1.29 RVAAP-29 (Upper and Lower Cobbs Pond)

The Upper and Lower Cobbs Pond complex was active during from 1941 to 1971 as sedimentation basins for explosive pink wastewater. The Upper and Lower Cobbs Ponds complex consisted of two unlined ponds that received the effluent from RVAAP-10 (Load Line 3) and RVAAP-12 (Load Line 12) sawdust filtration units and storm and surface water runoff. Overflow from Upper Cobbs Pond discharged to Lower Cobbs Pond and from there to a receiving stream prior to exiting the facility. Upper Cobbs Pond is approximately 2 hectares (5 acres) in size and Lower Cobbs Pond is approximately 1.2 to 1.6 hectares (3 to 4 acres) in size. Both ponds have been used for recreational purposes and support abundant fish and wildlife (Jacobs Engineering 1989).

A ponded area known as the "backwater area", created by beavers, [about .4 hectare (1 acre) in size] presently exists south of Upper Cobbs Pond. This area did not exist during plant operations, and it also contains abundant fish and wildlife (Jacobs Engineering 1989).

In 1966, a large fish kill occurred at Cobbs Pond. The fish kill was attributed to the improper handling of aluminum chloride during the manufacturing operations at RVAAP-12 (Load Line 12). The bulk of the aluminum chloride was collected and disposed of at the RVAAP-01 (Ramsdell Quarry Landfill) (Jacobs Engineering 1989).

Contaminants of concern include TNT, HMX, Composition B, lead, chromium, mercury, and aluminum chloride. RDX was detected (1.16 μg/ml) in the sediment samples collected from Upper Cobbs Pond during the investigation conducted by The Mogul Corporation in 1982. TNT and RDX were not detected in the sediments from Lower Cobbs Pond (Jacobs Engineering 1989).

4.1.30 RVAAP-30 (Load Line 7 Pink Water Treatment Plant)

This site consists of dual activated carbon units for filtration of pink water from Load Line 7. Twin 167 pound carbon units are enclosed within a metal sided building, set on a concrete floor. Plant effluent was stored in a 3420-liter (900-gallon) stainless steel holding tank. A batch treatment process is used, treating 1900 liters (500 gallons) per batch. The effluent was pumped through a Cuno filter that removes particulate matter. Subsequent to the Cuno filter, the effluent was pumped through a series of two activated carbon units to another holding tank. Approximately 30 minutes of carbon bed contact time was maintained for each treatment cycle. The treated water was pumped to one of two 1900-liter (500-gallon) holding tanks, sampled and discharged to RVAAP-22 (George Road Sewage Treatment Plant). The floors of the enclosed building slope to a sump that also discharged to RVAAP-22 and the spent carbon was stored in RVAAP-07 (Building 1601) until transportation off site for ultimate disposal (Jacobs Engineering 1989).

The site had been operational since 1989 and had an active Ohio NPDES Permit (#3I000000BD). NPDES permitted wastewater with a maximum allowable concentration of 0.14 ppm for RDX, TNT and HMX was permitted for treatment (Jacobs Engineering 1989). The facility ceased operations in 1993.

4.1.31 RVAAP-31 (Ore Pile Retention Pond)

The RVAAP-31 (Ore Pile Retention Pond) is an small, unlined surface impoundment constructed during the 1950s to abate the runoff from the manganese ore piles. During the 1950s, a receiving stream adjacent to the Ore Pile Retention Pond contaminated a farm pond with ore pile runoff. This farm pond is believed to be located southeast from RVAAP-31 adjacent to Griggy's Pond along the installation perimeter fence outside of the facility. All the vegetation in the farm pond turned brown and the cattle refused to drink (Jacobs Engineering 1989).

An investigation conducted by The Mogul Corporation detected RDX and TNT in the soils surrounding the ore piles. RDX, at a concentration of 1.16 μg/ml, was also detected in a water sample from the farm pond. Current sampling of the discharge by the facility has detected no manganese contamination (Jacobs Engineering 1989). The site maintains a current NPDES Permit (#3I000000BD).

4.2 ADDITIONAL UNDOCUMENTED SITES

During interviews with former employees with varying areas of expertise, seven potential new sites were identified. These sites have no available documentation to support their existence in RVAAP files.

4.2.1 RVAAP-32 (40 & 60 mm Firing Range)

This site is due south of RVAAP-16 (Quarry Landfill/Former Fuze and Booster Burning Pits). This site was a firing range where ammunition was tested. The spent shells may pose a heavy metal hazard.

4.2.2 RVAAP-33 (Firestone Test Facility)

This was an area north of Load Line 6, where Firestone Tire and Rubber did classified experimentation on weapons. There was a pond and two small firing chambers at the facility. Due to the classified nature of the research, potential hazards at this area are unknown.

4.2.3 RVAAP-34 (Sand Creek Disposal Road Landfill)

This site was a construction landfill located due south of RVAAP-20 (Sand Creek Sewage Treatment Plant). It has been reported that the site contains concrete, wood, several tons of asbestos, and spent fluorescent light bulbs.

4.2.4 RVAAP-35 (1037 Building - Laundry Wastewater Sump)

The 1037 building provided the laundry facility for the plant. Workers wore scrubs while working on the load lines and each day, the scrubs were laundered. The wastewater from the laundry operation when to a sump behind the 1037 Building. The sump may contain TNT, RDX, or any other explosive residue from the load line. The 1037 Building is currently the Headquarters for the RVAAP.

4.2.5 RVAAP-36 (Pistol Range)

The Pistol Range, due north of RVAAP-05 (Winklepeck Burning Grounds) was used by the installation security force and occasionally other outside agencies for pistol qualification. The qualifier stood on the south side of the creek and shot over the creek at targets on the north side. The north bank, 150 to 200 feet from the edge of the creek, was the stopping point for the bullets.

4.2.6 RVAAP-37 (Pesticide Building S-4452)

This facility was used as the pest control shop from the early 1970s until 1993. Small quantities of pesticide were mixed inside the building and vehicle-mounted sprayers were filled and mixed along the western side of the building. This building is located to the southeast of the 1037 building (Headquarters).

4.2.7 RVAAP-38 (NACA Test Area)

The NACA was trying to develop explosion-proof fuel tanks for aircraft, or explosion-proof fuel. An airplane would land on an old clay runway and taxi to the east (the test facility). The planes were hooked up to a conveyor or catapult and rammed into a wall. The facility is due east of the RVAAP-03 (Demolitions Area #1).

5. PRELIMINARY ASSESSMENT SCORING

As a part of the PA, sites are scored to evaluate the relative threat to human health and the environment and to additionally determine the relative ranking of the sites. The USEPA recommends using the HRS Prioritization Model (USEPA 1991); however, DoD has developed a relative risk site evaluation methodology for scoring sites and determining their relative ranking. The DoD relative risk methodology will be used to score AOCs at RVAAP and prioritize them for additional investigative activities. The DoD methodology is similar to the HRS methodology. Following is a brief discussion of each method.

5.1 PRIORITIZATION SCORING

5.1.1 Description of the HRS Prioritization Model

The HRS is screening tool used by USEPA to assess the relative threat associated with the potential release of hazardous substances from a waste site. The HRS score is the primary criterion EPA uses to determine whether a site should be placed on the USEPA National Priorities List (NPL). The NPL identifies sites that warrant further investigation to determine if they pose risks to public health or the environment.

The HRS, which was revised in 1990, uses a scoring system to evaluate the potential for releases of uncontrolled hazardous substances to cause human health or environmental damage. Environmental and historical data from a suspected site is used during the scoring evaluation The HRS score is the result of an evaluation of four pathways:

1. Ground Water Migration
2. Surface Water Migration
3. Soil Exposure
4. Air Migration

The groundwater and air migration pathways use single threat evaluations, while the surface water migration and soil exposure pathways use multiple threat evaluations. Three threats are evaluated for the surface water migration pathway: drinking water, human food chain, and environmental. These threats are evaluated for two separate migration components - overland/flood migration and groundwater to surface water migration. Two threats are evaluated for the soil exposure pathway: resident population and nearby population. The HRS is structured to provide a parallel evaluation for each of these pathways and threats. HRS scores range from 0 to 100, with sites which score 28.5 and above were eligible for the NPL.

5.1.2 Description of Relative Risk Site Evaluation Model

The DoD RRSE prioritization methodology is outlined in the *Relative Risk Site Evaluation Primer*, DoD, 1994. It is similar to the HRS in that it categorizes sites into relative risk groups based on an evaluation of contaminants, pathways, and human and ecological receptors in groundwater, surface water and sediment, and surface soils. Each of these environmental media are evaluated using three factors:

1. The Contaminant Hazard Factor (a combined measure of contaminant concentrations in a given environmental medium)

2. The Migration Pathway Factor (a measure of the movement or potential movement of contamination away from the original source)

3. The Receptor Factor (an indication of the potential for human or ecological contact with site contaminants)

As a result of relative risk evaluations, site will be placed into High, Medium, or Low relative risk categories during the preliminary assessment phase. Information on the regulatory agreement status of each site, including HRS, will then be combined with the High, Medium, or Low relative risk designation. This dual categorization of sites will serve as the starting point from which to build risk evaluations into the management of the DERP.

5.2 PRIORITIZATION OF SITES

The RRES scoring and prioritization of sites at RVAAP is contained in the annual facility Action Plan.

6. CONCLUSIONS AND RECOMMENDATIONS

The following conclusive statements are presented with regard to environmental conditions at RVAAP. Based on the information collected during the PA:

- Of the 38 known sites at RVAAP, 24 are regulated under CERCLA, 2 are regulated under RCRA, 2 sites are regulated under CERCLA but and have discrete smaller areas regulated under RCRA, and 10 are regulated under other regulations (TSCA, NPDES, and State of Ohio Solid Waste).
- One site (RVAAP-01) was closed in 1990 under the State of Ohio Solid Waste Regulations
- Five sites (RVAAP-15, 20, 21, 22, and 30) ceased operations in 1993 under NPDES permits.
- Two sites (RVAAP-18 and 31) have active NPDES permits.
- Four sites (RVAAP-04, 05, 07, and 17) are awaiting RCRA closure pending approval of a final closure plan.
- Potential Chemicals of Concern (PCOCs) at RVAAP sites are predominately explosives (TNT, RDX, HMX, RDXX, Composition B, and Lead Azide) and heavy metals (lead and mercury).
- Primary sources of potential contamination at RVAAP are wastewater effluent from munitions assembly and demilitarization process, open burning and detonation of explosives, and landfill operations.
- Primary contaminant release mechanisms from load lines were process effluent discharges to surface water (drainage ditches, settling ponds, and streams) and process building wastewater wash-out on to surface soils. Media of concern are soil, sediment, groundwater, and surface water.
- The greatest potential for release of contaminants to groundwater from load lines likely occurs from wastewater effluent discharge to unlined earthen settling ponds. Concrete settling tanks, open drainage ditches, and storm sewers are also of concern relative to groundwater.
- The primary contaminant release mechanism from open burning and detonation areas resulted from burning and detonation of off-specification explosives on the ground surface. Media of concern are soils, groundwater, surface water, and sediment.
- The primary release mechanism at landfills is a result of potential leaching of contaminants from buried/disposal materials. Media of concern are groundwater and soils.
- Former sewage treatment plant sites do not exhibit a high potential for the release of contaminants because of the primary domestic nature of their operations.
- Known releases of contamination to surface water and soils have occurred from load line (assembly and demilitarization) operations and from open burning and detonation operations.

- Known releases of contamination to groundwater have occurred from quarry landfill operations.
- The potential impact to groundwater from many sites at RVAAP is currently unknown.
- Hydrogeologic conditions underlying sites at RVAAP are not well defined.
- The greatest potential for off-site migration of contaminants during load line operations was via surface water.
- The greatest potential for current off-site migration of contaminants is via groundwater and surface water.
- Few documented records exist for many of the new sites identified at RVAAP.

Based on qualitative assessment of the potential hazards, release mechanisms, and environmental conditions at RVAAP, the candidate sites currently considered to be the highest priority are listed below:

RVAAP-04	Demolition Area #2
RVAAP-05	Winklepeck Burning Grounds
RVAAP-08	Load Line 1 and Dilution/Settling Pond
RVAAP-09	Load Line 2 and Dilution/Settling Pond
RVAAP-10	Load Line 3 and Dilution/Settling Pond
RVAAP-11	Load Line 4 and Dilution/Settling Pond
RVAAP-12	Load Line 12 and Dilution/Settling Pond
RVAAP-13	Building 1200 Dilution/Settling Pond
RVAAP-19	Landfill North of Winklepeck Burning Grounds
RVAAP-29	Upper and Lower Cobbs Ponds

A qualitative assessment of the relative ranking of sites at RVAAP is presented in facility Action Plan which is revised annually based on current information to focus environmental activities at RVAAP on a priority basis.

7. REFERENCES

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APPENDIX A

PRELIMINARY ASSESSMENT DOCUMENT DATABASE

SITE ID NUMBER: RVAAP-01

NAME: Ramsdell Quarry Landfill.
MAP REFERENCE NUMBER: 1.

STATUS: Inactive.
REGULATORY PROGRAM: State of Ohio Solid Waste.

AREA OF THE SITE: 10 acres.

SITE DESCRIPTION: A 10-acre unlined landfill 18 to 20 feet deep, located in the bottom of an abandoned quarry.

SERVICE HISTORY: The site was opened in 1941 as a landfill. From 1946 to 1950, the site was used to thermally treat waste explosives from Load Line 1 and napalm bombs. From 1976 to 1989, the site was used as a nonhazardous solid waste landfill. Site was closed under the State of Ohio Solid Waste Regulations in May, 1990.

WASTE CHARACTERISTICS AND VOLUME: Waste is variable domestic, commercial, industrial, and solid wastes including but not limited to: explosives (TNT, Composition B), napalm, gasoline, acid dip liquor, annealing residue (sulfuric acid), shell casings, sodium ortho-silicate, chromic acid and alkali, aluminum chloride, inert material, and debris from the Quarry Landfill (RVAAP-16). Waste volume is unknown.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: MW-1, MW-2, MW-3, MW-4, MW-5.

CHARACTERIZATION DATA: Groundwater.

REFERENCES:
Documents: Halliburton NUS 1992, Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-02

NAME: Erie Burning Grounds.
MAP REFERENCE NUMBER: 2.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA

AREA OF THE SITE: 35 acres.

SITE DESCRIPTION: An unlimited 35 acre cleared area developed for open burning. Unit believed to be located in a low-lying marshy area.

SERVICE HISTORY: The site was used from 1941 to 1951 to conduct open burning of explosive related items. Previous documentation suggests that this site may have been used for brick manufacturing prior to the purchase of the land by the Army in 1940. Bulk, obsolete, non-specification propellants, and conventional explosives were reported to have been treated at this location. Unspecified large metal items also were treated to remove explosive residue. These items were salvaged and processed as scrap. The ash residue from the burning operations was left on site.

WASTE CHARACTERISTICS AND VOLUME: The ash residues from the burning of explosive waste material containing RDX, TNT, and propellants were left on site. The ash residues can contain small amounts of explosives and some heavy metals.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: 5 soil samples (May 1982), at depth 12-24 inches, indicated no TNT or RDX in surrounding soil. Not certain samples were placed in correct location. No damage to flora or fauna observed on visual inspection: no discolored water or odors observed.

REFERENCES:
Documents:Halliburton NUS 1992, Jacobs Engineering 1989, The Mogul Corp. 1982.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-03

NAME: Demolition Area #1.
MAP REFERENCE NUMBER: 3.

STATUS:
REGULATORY PROGRAM: CERCLA

AREA OF THE SITE: 1.5 acres.

SITE DESCRIPTION: Demolition Area #1 is approximately 1.5 acres in size and was used for the thermal treatment of munitions by burning and detonation. The site now consists of a circular 1- to 1.5 foot tall berm surrounding a grassy area approximately 1 to 1.5 acres in size. Areas of bare ground covering approximately 100 to 150 square feet are evident around the perimeter of the berm. Munitions fragments including scrap metal, small arms primers, and fuzes are present on the ground surface outside of the bermed area. Unit situated in Hiram Till Division; groundwater a depth of 6 feet.

SERVICE HISTORY: The site was used from 1941 to 1949 for the burning and detonation of munitions.

WASTE CHARACTERISTICS AND VOLUME: Waste types include shrapnel and other metallic munitions, and possibly explosive compounds.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: One-half mile northeast of unit.

CHARACTERIZATION DATA: No sampling data available. Stained soil and stressed vegetation noted during visual inspection.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-04

NAME: Demolition Area #2.
MAP REFERENCE NUMBER: 4.

STATUS: Inactive.
REGULATORY PROGRAM: 1.5 acres RCRA, 18.5 acres CERCLA

AREA OF THE SITE: 20 acres.

SITE DESCRIPTION: Demolition Area #2 is an elongate, horseshoe shaped, cleared area approximately 20 acres in size. Five distinct areas are located within the confines of this site:

- Open Detonation Area—a 1.5 acre area in which detonation was accomplished in a backhoe pit with a minimum depth of 4 feet. After demolition, metal parts typically were picked up and removed from the site. The backhoe pit would be backfilled, mulched, and reseeded;
- Open Burning Area—approximately 0.25 acres in size, this area was used to thermally treat sludge from the Load Line 6 Evaporation Unit from 1981 to 1986;
- Prototype Testing Range—an area where projectiles were test-fired into targets;
- Burial Site—an area where scrap bombs may have been buried. This site is approximately 10-feet wide, 200-feet long, and 4-feet deep, and is located along a swale in the northwest corner of the Demolition Area;
- Past Disposal Area—an area which is posted "Off-Limits, Dangerous Material" and is located along a 70 foot long embankment overlooking Sand Creek.

SERVICE HISTORY: Demolition Area #2 was used from 1948 to 1986 to detonate large caliber munitions and "off-spec" bulk explosives that could not be deactivated or demilitarized by any other means. The 1.4 acre open detonation area part of this site had been under RCRA interim status for the treatment of explosives by open detonation; however, the permit application was withdrawn and closure plans were prepared after a 1984 investigation detected explosives in soil samples collected from a trench within this area.

WASTE CHARACTERISTICS AND VOLUME: Waste types present within this site may include bombs, unexploded ordnance, shrapnel, white phosphorous, explosives, and heavy metals. No estimate of waste volume for this site is available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: Four groundwater monitoring wells (DET-1, -2, -3, and -4) associated with the Open Detonation Area are monitored on a quarterly basis.

CHARACTERIZATION DATA: Explosives detected in trench soil samples.

REFERENCES:
Documents: Halliburton NUS 1992, Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-05

NAME: Winklepeck Burning Ground.
MAP REFERENCE NUMBER: 5.

STATUS: Inactive.
REGULATORY PROGRAM: 199 acres are CERCLA, 1 acre is being closed under RCRA.

AREA OF THE SITE: 200 acres.

SITE DESCRIPTION: A 200 acre site used for open burning. Drainage passes through site.

SERVICE HISTORY: The Winklepeck Burning Grounds have been in operation since 1941 and consist of an open area 200 acres in size. Prior to 1980, open burning was carried out in several areas: in 4 pits, on open pads, or on the roads within the burning grounds. The 4 pits were bermed on 3 sides and were approximately 50 feet by 75 feet in size, with Pit #1 being used most frequently. The open pads consisted of 20 foot by 40 foot cleared areas without berms. Burning was conducted on bare ground, with ash residue abandoned on site. Scrap metal was reclaimed and taken to the landfill north of the burning grounds (RVAAP-19). Since 1980, burns have been conducted on pads that consisted of metal, refractory lined trays set on top of slag beds. The trays initially consisted of 0.25 inch thick refractory lined boiler plate and were 4 feet by 60 feet by 10 inches in size. The trays were set on a bed of crushed slag in an area approximately 100 feet by 100 feet in size. Ash residues were collected, drummed, and stored in Building 1601- Hazardous Waste Storage (RVAAP-7) until waste characterization tests could be conducted. The area (one acre) surrounding the burning trays is being closed under RCRA. The remaining 199 acres are being addressed under CERCLA.

WASTE CHARACTERISTICS AND VOLUME: Prior to 1980, wastes disposed at this site included RDX, antimony sulfide, Composition B, lead, TNT, propellant, black powder, sludge from the load lines, and domestic wastes. In addition, small amounts of laboratory chemicals routinely were burned during production periods. Shrapnel and other metallic munitions fragments were allowed to remain on site after detonation as well as possible residual explosives. Waste oil (hydraulic oil from machinery and lubrication oil from vehicles) was burned in the northeast corner of the site until 1973. Ash from these areas was not collected. Estimates of the volume of waste disposed at this site are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: Four groundwater monitoring wells (OBG-1, -2, -3, and -4) are sampled quarterly.

CHARACTERIZATION DATA: Visual inspection indicates stressed vegetation.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989, U.S. Army Toxic and Hazardous Materials Agency 1978
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-06

NAME: C-Block Quarry.
MAP REFERENCE NUMBER: 6.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: 0.3 acres.

SITE DESCRIPTION: An abandoned unlined borrow pit approximately 0.3 acres in size. Currently, the site is heavily wooded.

SERVICE HISTORY: This site was used as a disposal area for annealing process wastes for a short time during the 1950s. Liquid wastes apparently were dumped on the ground surface in the bottom of the pit.

WASTE CHARACTERISTICS AND VOLUME: Wastes disposed at this site include but are not limited to annealing process liquids, spent pickle liquor from a brass finishing operation that contained lead, mercury, chromium, and sulfuric acid. Estimates of waste volumes are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Soil data indicate presence of metals; no metals were detected at levels greater than EP toxic limits; visual inspection revealed no stressed vegetation.

REFERENCES:
Documents: Jacobs Engineering 1989, The Mogul Corp. 1982.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-07

NAME: Building 1601 - Hazardous Waste Storage.
MAP REFERENCE NUMBER: 7.

STATUS: Inactive.
REGULATORY PROGRAM: RCRA.

AREA OF THE SITE: approximately 440 square feet.

SITE DESCRIPTION: Building 1601 consists of a concrete igloo 20 feet by 22 feet by 10 feet tall in size with a 4 to 6 foot thick soil cover.

SERVICE HISTORY: The building has been used since 1980 for the storage of dry hazardous waste. Dry ash and spent carbon waste from demilitarization activities, RVAAP-18 and RVAAP-30, were stored in 55 gallon drums pending ultimate disposal at an approved facility. The drums were located on pallets (4 drums per pallet) and were stacked 3 pallets high. Currently all drums have been removed. This facility operated under an active RCRA Part B permit (#OH5210020736) until April 1994. A RCRA closure plan covering this facility was submitted in May 1994. Administrative Findings and Orders were issued by the OEPA in March 1995. Resolution of closure plan issues is still pending in February 1996.

WASTE CHARACTERISTICS AND VOLUME: Wastes stored in Building 1601 include dry ash from demilitarization activities as well as spent carbon from RVAAP-18 (Load Line 12 Pink Water Treatment Facility) and from RVAAP-30 (Load Line 7 Pink Water Treatment Facility).

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

<u>REFERENCES:</u>
Documents: U.S. Army Environmental Hygiene Agency 1988
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-08

NAME: Load Line 1 and Dilution/Settling Pond
MAP REFERENCE NUMBER: 8.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 1 acre.

SITE DESCRIPTION: The Load Line 1 Dilution/Settling Pond (also known as Griggy's or Charlie's Pond) is an unlined surface impoundment approximately 1 acre in size and receives surface water runoff from the Load Line 1 area.

SERVICE HISTORY: This site was used as a dilution/settling pond for wastewater effluent from Load Line 1 cleaning operations from 1941 to 1971. Wastewater effluent consisted of washdown water periodically used to remove residual explosive material from equipment, and the walls and floors of various Load Line 1 buildings during production operations. The wastewater was collected in concrete sumps located throughout the Load Line 1 facility and then was pumped to a sawdust filtration unit that consisted of 3 concrete settling tanks and 3 filtration tanks for clarification and removal of nitro-compounds. After filtration, effluent was discharged to a drainage ditch that eventually flowed into the pond. In a 1949 report, sulfuric acid and sodium dichromate were disposed at RVAAP-08 and RVAAP-09. The resulting precipitate was lead chromate and hexavalent chromium.

WASTE CHARACTERISTICS AND VOLUME: Waste constituents associated with this site include but are not limited to: TNT, Composition B, metals, lead, Tritonol, smokeless powder, and chromium. Waste volume estimates are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: In 1981, several groundwater monitoring wells were installed around the perimeter of the load line areas. Arsenic was detected at a concentration of 0.063 mg/l in one of the wells located near Load Line 1; however, frost heaving has since destroyed this well. In addition to groundwater, sediment samples also have been taken in the past in the drainage ditch leading from the sawdust filtration unit. TNT and RDX were detected in 2 separate sampling locations along the ditch at concentrations of 0.30 μg/ml and 1.60 μg/ml, respectively. No observed stress to vegetation; however, no data available on aquatic biota.

<u>REFERENCES:</u>
Documents: Halliburton NUS 1992, Jacobs Engineering 1989, The Mogul Corp. 1982.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-09

NAME: Load Line 2 and Dilution/Settling Pond.
MAP REFERENCE NUMBER: 9.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: 2 acres.

SITE DESCRIPTION: The Load Line 2 Dilution/Settling Pond (also known as Kelly's Pond) is an unlined surface impoundment approximately 2 acres in size and 6 to 8 feet deep, that receives surface water runoff from the Load Line 2 area.

SERVICE HISTORY: Load Line 2 operated from 1941 to 1971, and the pond was used as a dilution/settling pond for wastewater effluent from Load Line 2 cleaning operations. Wastewater effluent consisted of washdown water periodically used to remove residual explosive material from equipment, and the walls and floors of Building DB-4 during production operations. The wastewater was collected in 2 concrete sumps located adjacent to the building and then was pumped to a sawdust filtration unit that consisted of 2 concrete settling tanks and 3 filtration tanks for clarification and removal of nitro-compounds. After filtration, effluent was discharged to the dilution/settling pond. Discharge from the pond flowed to the Sand Creek, which eventually exits the RVAAP facility. In addition, chromic acid waste (625 ppm hexavalent chromium) was discharged from Building 802 into a drainage ditch that flowed into the West Branch of the Mahoning River.

WASTE CHARACTERISTICS AND VOLUME: Waste constituents associated with this site include but are not limited to: TNT, Composition B, smokeless powder, chromic acid, and lead. Waste volume estimates include: approximately 9,211 kilograms of Composition B and 3,192,000 liters of pink water generated monthly during full capacity operation, and approximately 5,166,000 cubic meters of scrap, sludge, and dust.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Sediment samples from the drainage ditch into which the sawdust filtration unit discharged indicated the presence of explosives (TNT at .60 μg/ml and RDX at 1.75 μg/ml). No observed stress to vegetation; however, no data available on aquatic biota.

<u>REFERENCES:</u>
Documents: Halliburton NUS 1992; U.S. Army Environmental Hygiene Agency 1988; APCO, Ohio 1951, The Mogul Corp. 1982.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-10

NAME: Load Line 3 and Dilution/Settling Pond.
MAP REFERENCE NUMBER: 10.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE:

SITE DESCRIPTION: The Load Line 3 Dilution/Settling Pond is an unlined surface impoundment that receives surface water runoff from the Load Line 3 area.

SERVICE HISTORY: Load Line 3 operated from 1941 to 1971, and the pond was used as a dilution/settling pond for wastewater effluent from Load Line 3 cleaning operations. Wastewater effluent consisted of washdown water periodically used to remove residual explosive material from equipment, and the walls and floors of various Load Line 3 buildings during production operations. The wastewater was collected in concrete sumps located throughout the Load Line 3 area and then was pumped to a sawdust filtration unit that consisted of 3 concrete settling tanks and 3 filtration tanks for clarification and removal of nitro-compounds. After filtration, the filtrant was burned and the effluent was discharged to Upper and Lower Cobbs Ponds.

WASTE CHARACTERISTICS AND VOLUME: Waste constituents associated with this site include but are not limited to: TNT, Composition B, and smokeless powder. Waste volume estimates include approximately 9,173 kilograms of scrap and sludge and 304,800 liters of pink water generated monthly during full capacity operation.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: RDX was detected at a concentration of 1.16 μg/ml in a sediment sample collected from Upper Cobbs Pond in 1982. However, since Load Line 12 also discharged effluent to Upper Cobbs Pond, it is unclear from where the RDX originated. No observed stress to vegetation; however, no data on aquatic biota available.

REFERENCES:
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-11

NAME: Load Line 4 and Dilution/Settling Pond.
MAP REFERENCE NUMBER: 11.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 2 acres.

SITE DESCRIPTION: The Load Line 4 Dilution/Settling Pond is an unlined surface impoundment approximately 2 acres in size that receives surface water runoff from the Load Line 4 area.

SERVICE HISTORY: Load Line 4 operated from 1941 to 1971, and the pond was used as a dilution/settling pond for wastewater effluent from Load Line 4 cleaning operations. Wastewater effluent consisted of washdown water periodically used to remove residual explosive material from equipment, and the walls and floors of various Load Line 4 buildings during production operations. The wastewater was collected in concrete sumps located throughout the Load Line 4 area and then was pumped to a sawdust filtration unit that consisted of 3 concrete settling tanks and 3 filtration tanks for clarification and removal of nitro-compounds. After filtration, the filtrant was burned and the effluent was discharged to the dilution/settling pond.

WASTE CHARACTERISTICS AND VOLUME: Waste constituents associated with this site include but are not limited to: TNT, RDX, Composition B, chromium, lead, mercury, other unknown constituents, scrap, sludge, and dust. Waste volume estimates include: approximately 11,930 kilograms of scrap, sludge and dust, and 3,390,000 liters of pink water generated monthly during full capacity operation.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Explosives have been detected in sediments from the drainage ditch that received effluent from the sawdust filtration tanks at Load Line 4. RDX was detected in sediment samples at a concentration of 0.54 μg/ml and TNT was detected at a concentration of 0.06 μg/ml.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989, The Mogul Corp. 1982.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-12

NAME: Load Line 12 and Dilution/Settling Pond.
MAP REFERENCE NUMBER: 12.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE:

SITE DESCRIPTION: The Load Line 12 Dilution/Settling Pond is an unlined surface impoundment that receives surface water runoff from the Load Line 4 area. The Load Line 12 pond also received effluent from the Pink Waste Water Treatment Plant (RVAAP-18).

SERVICE HISTORY: Load Line 12 operated periodically for 40 years until 1989 as a bomb melt-out facility, and the pond was used as a dilution/settling pond for wastewater effluent from Load Line 12 cleaning operations. Wastewater effluent consisted of washdown water periodically used to remove residual explosive material from equipment, and the walls and floors of various Load Line 12 buildings during production operations. The wastewater was collected in 2 stainless steel tanks, one used for settling and one used for filtration. Prior to 1981, effluent from the filtration tanks was discharged from Building FJ-904 to a drainage ditch that flowed directly to the dilution/settling pond. After 1981, effluent from Load Line 12 runoff was treated by the Pink Waste Water Treatment Plant (RVAAP-18) before being discharged to the pond. Load Line 12 was also involved with reclaiming cartridge bases for re-use. In the annealing process, sulfuric acid, sodium orthosilicate, chromic acid, and alkali were used, which precipitated heavy metals.

WASTE CHARACTERISTICS AND VOLUME: Waste constituents associated with this site include but are not limited to: TNT, HMX, Composition B, chromium, lead, mercury, other explosives, and Ammatol. Waste volume estimates include 324,000 liters of pink water generated monthly during full capacity operation.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: RDX was detected at a concentration of 1.16 μg/ml and TNT was detected at a concentration of 0.17 μg/ml in a sediment sample collected from Upper Cobbs Pond in 1980. However, since Load Line 3 (RVAAP-10) also discharged effluent to Upper Cobbs Pond, it is unclear from where the contaminants originated. Stressed vegetation and red soil stains noted during visual inspection.

<u>REFERENCES:</u>
Documents: Halliburton NUS 1992, Jacobs Engineering 1989, The Mogul Corp. 1982.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-13

NAME: Building 1200 and Dilution/Settling Pond.
MAP REFERENCE NUMBER: 13.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: 0.5 acre.

SITE DESCRIPTION: The Building 1200 Dilution/Settling Pond covers approximately 0.5 acre and received wastewater effluent from Building 1200 ammunition sectionalizing operations.

SERVICE HISTORY: Building 1200 (also known as Ammunition Sectionalizing) operated from 1941 to 1971. Wastewater effluent from sectionalizing operations was piped through a crushed slag gravel bed which then discharged into a drainage ditch that flowed to the pond. Effluent from the pond then flowed into Eagle Creek.

WASTE CHARACTERISTICS AND VOLUME: Effluent from Building 1200 contained explosive contaminated wastewater. The water may have contained small amounts of TNT, HMX, Composition B, other explosives, as well as heavy metals such as lead, chromium, and mercury. Estimates of waste volumes are not available.

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-14

NAME: Load Line 6 Evaporation Unit.
MAP REFERENCE NUMBER: 14.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: 1008 cubic feet.

SITE DESCRIPTION: The evaporation unit consists of a 2-compartment 18 foot by 14 foot by 4 foot concrete tank enclosed in a 400 square foot prefabricated metal building.

SERVICE HISTORY: The Load Line 6 Evaporation Unit was operated from 1981 to 1987 by Physics International and was used to collect wastewater from Load Line 6 generated during research and development experiments. Explosive wastewater from washdown was evaporated in the larger of the two concrete compartments. In 1985, an inspector from the Ohio EPA noted hairline cracks in the tank, and the tank was lined with PVC. In 1989, the tank was emptied, cleaned of explosive residues, and was issued a RCRA Closure Plan. Under the provisions of the closure plans, a soil investigation was performed. Characterization data are presented below. No information currently exists indicating that any cleanup has occurred.

WASTE CHARACTERISTICS AND VOLUME: Explosive wastewater from building washdown operations was the primary waste stream associated with this facility. Tank residuals were transported to Demolition Area #2 (RVAAP-4) where they were thermally destroyed. Waste volume estimates for this site are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Surface soil samples (depths to 2 feet) collected from the outside perimeter of the evaporation unit indicated the presence of TNT and RDX at concentrations of up to 200 ppm. Soil samples collected from beneath the unit indicated the presence of explosives at concentrations of up to 100 ppm.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989, U.S. Army Environmental Hygiene Agency 1988
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-15

NAME: Load Line 6 Treatment Plant.
MAP REFERENCE NUMBER: 15.

STATUS: Inactive.
REGULATORY PROGRAM: NPDES (former).

AREA OF THE SITE: 400 square feet.

SITE DESCRIPTION: The Load Line 6 Treatment Plant consisted of a 400 square foot metal sided building that enclosed 2 activated carbon filtration units and a 900 gallon stainless steel influent holding tank.

SERVICE HISTORY: This facility was used from 1987 to 1993 and was used for the treatment of pink waste water effluent using activated carbon filtration. Treated water was sampled and discharged (if adequately treated) at the George Road Sewage Treatment Plant (RVAAP-7). Discharge from the Load Line 6 Treatment Plant was regulated by an NPDES permit.

WASTE CHARACTERISTICS AND VOLUME: The NPDES permit that regulated discharge from this site specified a maximum allowable concentration of 0.14 ppm each for TNT, RDX, and HMX. Estimates of waste volumes are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Soil.

REFERENCES:
Documents: Halliburton NUS 1992, Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-16

NAME: Quarry Landfill/Former Fuze and Booster Burning Pits.
MAP REFERENCE NUMBER: 16.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 1 acre.

SITE DESCRIPTION: The Quarry Landfill/Former Fuze and Booster Burning Pits currently consist of 3 elongate ponds separated by earthen dikes and are located in an abandoned quarry. The total combined area of the 3 ponds is approximately 1 acre.

SERVICE HISTORY: From 1945 to 1949, the quarry was used as an open burning area for sawdust waste (some of which may have originated from Load Line filtration tanks). Then the site was used as a landfill, where fuze and booster assemblies, projectiles, residual ash, and sanitary waste all have been disposed. In 1976, existing debris was removed and disposed of in either the Ramsdell Quarry Landfill (RVAAP-1) or one or more of the burning grounds. The current ponds received NPDES-permitted effluent (filter backwash) from the potable water system (groundwater pumped from a well and treated at Water Works 3). The facility ceased operations in 1993.

WASTE CHARACTERISTICS AND VOLUME: Waste types associated with this site include but are not limited to: spent brine regenerant, sand filtration backwash from groundwater treatment, fuze and booster assemblies, projectiles, residual ash, sanitary waste, and groundwater treatment effluent. The only available waste volume estimates are for the NPDES-permitted effluent discharged to the ponds (approximately 3000 to 5000 gallons per day during operation) with a maximum allowable concentration of 0.14 ppm for each TNT, RDX, and HMX.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989, U.S. Army Environmental Hygiene Agency 1988
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-17

NAME: Deactivation Furnace.
MAP REFERENCE NUMBER: 17.

STATUS: Inactive.
REGULATORY PROGRAM: RCRA.

AREA OF THE SITE: 192 square feet.

SITE DESCRIPTION: The Deactivation Furnace consisted of an oil-fired, horizontal, rotary retort furnace and was used to deactivate fuzes, boosters, and munitions. The charging side of the conveyor was housed in an 8 foot by 24 foot metal sided building, while the retort was enclosed by a wooden earth-filled barricade.

SERVICE HISTORY: Built during the 1960s, the furnace was designed to destroy explosives of up to 400 grains. The furnace was last used in 1983.

WASTE CHARACTERISTICS AND VOLUME: Waste types associated with this site include but are not limited to: munitions, fuzes, boosters, scrap metal, and various explosives. Waste volume estimates are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

REFERENCES:
Documents: Jacobs Engineering 1989, U.S. Army Environmental Hygiene Agency 1988
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-18

NAME: Load Line 12 Pink Waste Water Treatment Plant.
MAP REFERENCE NUMBER: 18.

STATUS: Active.
REGULATORY PROGRAM: NPDES.

AREA OF THE SITE: 800 square feet.

SITE DESCRIPTION: This unit consists of dual mode activated carbon filtration of Pink Water. Twin 2,000-pound carbon units are enclosed in a 20 by 40-foot steel girder metal-sided building set on a concrete floor. The spent carbon is stored in Building 1601 (SWMU-7) until transported off site for disposal.

SERVICE HISTORY: This facility was built in 1981 and was used for the treatment of pink waste water in effluent from Load Line 12 operations using activated carbon filtration. Influent is pumped through a bag prefilter that removes particulate matter. After the prefilter, the influent is pumped through a series of two activated carbon units and to a holding tank. Approximately 30 minutes of carbon bed contact time is maintained during the treatment process. Treated water was discharged to a drainage ditch that flowed directly into the Load Line 12 Dilution/Settling Pond. The site has an active NPDES Permit No. 3I000000BD.

WASTE CHARACTERISTICS AND VOLUME: The primary waste stream associated with the site is TNT waste water. The NPDES permit allows discharge of effluent with a maximum allowable TNT concentration of 0.14 ppm. The system is designed to treat 20 gallons of waste water per minute and averaged 5,000 gallons per day during operation. Plant influent is stored in a 10,000-gallon underground concrete holding tank.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Routine NPDES sampling.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-19

NAME: Landfill North of Winklepeck Burning Ground.
MAP REFERENCE NUMBER: 19.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 10 acres.

SITE DESCRIPTION: This site consists of an unlined landfill used for general refuse.

SERVICE HISTORY: The landfill operated from 1969 to 1976. The general appearance of the site suggests that a trench and fill method of operation was used for waste disposal.

WASTE CHARACTERISTICS AND VOLUME: Waste types possibly associated with this landfill include: booster cups, aluminum liners, sanitary waste, explosive and munitions waste and ash, and scrap metal from the Winklepeck Burning Grounds (RVAAP-5). Estimates of the volume of waste landfilled at this site are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-20

NAME: Sand Creek Sewage Treatment Plant.
MAP REFERENCE NUMBER: 20.

STATUS: Inactive.
REGULATORY PROGRAM: NPDES (former).

AREA OF THE SITE:

SITE DESCRIPTION: The Sand Creek Sewage Treatment Plant consisted of 2 Imhoff tanks, 2 trickling filters, and a final clarifier.

SERVICE HISTORY: This site was intermittently operational from 1969 to 1978, 1981 to 1983, and 1983 to 1993. Sludge resulting from treatment was dried inside a glass-enclosed drying bed and was then spread over the ground surface (location unknown). Treated effluent was discharged under NPDES Permit No. 3I000000BD until 1993.

WASTE CHARACTERISTICS AND VOLUME: Domestic sewage was the only type of waste treated at this site. There is no record of analytical testing of the sludge from this facility. Design flow capacity was 350,000 gallons per day with actual flows ranging between 150,000 to 250,000 gallons per day.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Routine NPDES monitoring.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989, U.S. Army Environmental Hygiene Agency 1988
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-21

NAME: Depot Sewage Treatment Plant.
MAP REFERENCE NUMBER: 21.

STATUS: Inactive.
REGULATORY PROGRAM: NPDES (former).

AREA OF THE SITE:

SITE DESCRIPTION: The Depot Sewage Treatment Plant consisted of 2 Imhoff tanks, 2 trickling filters, and a chlorinator.

SERVICE HISTORY: This site operated from 1941 to 1993. Sludge resulting from treatment was hauled to the George Road Sewage Treatment Plant (RVAAP-22) for disposal. Treated effluent was discharged under NPDES Permit No. 3I000000BD until 1993.

WASTE CHARACTERISTICS AND VOLUME: Domestic sewage was the only type of waste treated at this site. Design flow capacity was 65,000 gallons per day with actual flows ranging between 10,000 to 20,000 gallons per day.

WASTE CHARACTERISTICS AND VOLUME: NPDES-regulated waste water was the only type of waste treated at this site.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Routine NPDES monitoring.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-22

NAME: George Road Sewage Treatment Plant.
MAP REFERENCE NUMBER: 22.

STATUS: Inactive.
REGULATORY PROGRAM: NPDES (former).

AREA OF THE SITE:

SITE DESCRIPTION: The George Road Sewage Treatment Plant consisted of 2 Imhoff tanks, 2 trickling filters, and a final clarifier.

SERVICE HISTORY: This site operated until 1993 when it was closed. Sludge resulting from treatment was dried inside a glass-enclosed drying bed and was then spread over the ground surface. The location where the sludge was spread is not known. Treated effluent was discharged under NPDES Permit No. 3I000000BD.

WASTE CHARACTERISTICS AND VOLUME: Domestic sewage was the primary type of waste treated at this site, however treated effluent from the Load Line 6 Treatment Plant (RVAAP-15) and the Load Line 7 Pink Water Treatment Plant (RVAAP-30) also was discharged to this site. Design flow capacity was 350,000 gallons per day with actual flows ranging between 150,000 to 200,000 gallons per day. Approximately 1,200 cubic feet of sludge was spread over the ground surface every 3 years. This site also received sludge from the Depot Sewage Treatment Plant (RVAAP-21).

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Routine NPDES monitoring.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-23

NAME: Unit Training Equipment Site Waste Oil Tank.
MAP REFERENCE NUMBER: 23.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE:

SITE DESCRIPTION: The Unit Training Equipment Site Waste Oil Tank was a 1,000 gallon underground storage tank.

SERVICE HISTORY: The exact age of the tank is unknown, but is estimated to be at least 20 years old. The tank was used until December 1988 but never had been precision tested. The tank and an adjacent fuel oil tank were removed in 1989. No information is available regarding the removal and closure of that tank.

WASTE CHARACTERISTICS AND VOLUME: Waste types associated with this site originated from maintenance shop operations and include: crankcase and transmission oil, gear lubricants, and hydraulic and brake fluids. Estimates of the total volume of waste oil stored in the tank during its operation are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-24

NAME: Reserve Unit Maintenance Area Waste Oil Tank.
MAP REFERENCE NUMBER: 24.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 100 square feet.

SITE DESCRIPTION: The Reserve Unit Maintenance Area Waste Oil Tank is a 400 gallon above ground storage tank located near Building U4 in the Depot Area. The steel storage tank is set on a bed of crushed slag and was used for storing waste lubricating oil.

SERVICE HISTORY: The tank was used from 1983 to 1993. Waste oil was stored in the tank until removed by an oil reclaimer. The contents of the tank were emptied in 1993 and the site has remained inactive.

WASTE CHARACTERISTICS AND VOLUME: Waste types associated with this site are limited to waste lubricating oil from the motor pool area including: crankcase and transmission oil, gear lubricants, and hydraulic and brake fluids. Estimates of the total volume of waste oil stored in the tank during its operation are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

<u>REFERENCES:</u>
Documents: U.S. Army Environmental Hygiene Agency 1988
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-25

NAME: Building 1034 Motor Pool Waste Oil Tank.
MAP REFERENCE NUMBER: 25.

STATUS: Active.
REGULATORY PROGRAM: Undefined.

AREA OF THE SITE: Approximately 100 square feet.

SITE DESCRIPTION: The Building 1034 Motor Pool Waste Oil Tank is a 500 gallon above ground storage tank set on a four-wheeled chassis.

SERVICE HISTORY: The tank has been used 1974 to store waste oil from shop maintenance. Waste oil is stored in the tank until removed by an oil reclaimer on an as-needed basis.

WASTE CHARACTERISTICS AND VOLUME: Waste types associated with this site are limited to waste lubricating oil from the motor pool area including: crankcase and transmission oil, gear lubricants, and hydraulic and brake fluids. Approximately 300 gallons of waste oil is stored in the tank per year.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

REFERENCES:
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-26

NAME: Fuze and Booster Area Settling Tanks.
MAP REFERENCE NUMBER: 26.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: N/A.

SITE DESCRIPTION: There were a total of 16 concrete Fuze and Booster Area Settling Tanks located throughout Load Lines 5, 7, 9, 10, and 11. One of the tanks, an underground 1,350 gallon tank located at Load Line 7, was removed in 1988. The remaining 15 tanks are in the following locations:

- Load Line 5- one tank (3,840 gallon capacity);
- Load Line 9- two tanks (4,800 gallon and 2,880 gallon capacities);
- Load Line 10- nine tanks [3,480 gallon capacities (7 tanks), 405 gallon capacity (1 tank), and one above ground tank with unknown capacity];
- Load Line 11- three tanks (3,480 gallon capacities each).

SERVICE HISTORY: The Fuze and Booster area covers approximately 450 acres and includes Load Lines 5,7, 9, 10, and 11. These areas were used for the manufacture of miscellaneous fuzes, boosters, primers, detonators, and percussion elements. Load Line 5 produced fuzes until 1945 and was then deactivated and the equipment removed. Load Line 7 produced booster charges until deactivation in 1945. Equipment was removed from the line. Load Line 9 produced fuze component parts and was deactivated in 1945. Equipment was removed from the line. Load Line 10 produced M36 percussion elements until 1945 and was placed on standby. Load Line 11 produced primers and was deactivated twice.

All of these tanks were used as settling basins for the explosive contaminated waste water produced from 1941 to 1971. Settled sludge was periodically collected and taken to one of the burning grounds [probably Winklepeck (RVAAP-05] for disposal. The disposition of the wastes from the tanks is not positively known. It may have been pumped onto the ground or into the sewer system. All of the tanks were emptied, cleaned, and covered in 1971 and have remained inactive. The soils surrounding the process buildings sourcing the effluent to the settling tanks may also be of concern because building washout operations historically resulted in the release of waste water on the ground adjacent to the building exits.

WASTE CHARACTERISTICS AND VOLUME: Potential waste types associated with the settling tanks include but are not limited to: TNT, RDX, black powder, lead, lead azide, mercury, lead styphnate and other unknown compounds. Estimates regarding the volume of sludge removed from the settling tanks throughout their operation are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

REFERENCES:
Documents: Halliburton NUS 1992, Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-27

NAME: Building 854, PCB Storage.
MAP REFERENCE NUMBER: 27.

STATUS: Inactive.
REGULATORY PROGRAM: TSCA.

AREA OF THE SITE: Approximately 12,500 square feet.

SITE DESCRIPTION: Building 854 is a wooden frame structure with a pitched roof and concrete floor. PCBs were stored in a 250 foot by 50 foot section of the building.

SERVICE HISTORY: Building 854 was used for PCB storage until 1992 by the Defense Reutilization Material Office. PCB-laden material was stored inside the building on wood pallets or metal trays. All PCB-laden material was removed in 1992.

WASTE CHARACTERISTICS AND VOLUME: Waste types stored at this site include PCB-laden transformers and capacitors, and other material. Estimates regarding the total volume of PCBs or PCB-laden material stored at this site are not available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

<u>REFERENCES:</u>
Documents: U.S. Army Environmental Hygiene Agency 1988
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-28

NAME: Mustard Agent Burial Site.
MAP REFERENCE NUMBER: 28.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 324 square feet.

SITE DESCRIPTION: A reported burial site for an unknown amount of Mustard Agent within the old demolition grounds now known as Training Areas D and G.

SERVICE HISTORY: The undocumented and unconfirmed burial supposedly took place prior to 1950. This information was obtained through interviews with former employees. Old files are very sketchy and incomplete. Personnel contacted reported nothing more than a general story that indicated that the 68th EOD Detachment excavated the site in August 1969. At this time, the Detachment recovered one 55-gallon drum and 7 small cans in rusty condition. All 8 items were empty and no evidence of contamination was found. Documentation available in 1969 conflicted with further documentation gathered during the next two years. On June 30, 1970, RVAAP sent a letter to Fort Meade requesting "the assistance of the 68th EOD to perform chemical tests of a small area in the old demolition and burning ground." Fort Meade responded on July 17, 1970 and stated that they would comply with the request. There was no further action until June 11, 1971 when a letter from the Chief, Safety Office, RVAAP, to the head of the Safety Office, Ravenna Arsenal Inc. stated that "there is a reported base burial site located approximately 90 to 135 meters south of the previous site that was excavated." A cyclone fence surrounds the triangular shaped area that measures 4.5 by 6 by 6 meters and the 68th was to have checked the area for contamination when being cleared by a bulldozer. Fort Meade (549th EOD) was contacted regarding the details on this burial site. Personnel were not familiar with this subject and stated that records would no longer be available.

WASTE CHARACTERISTICS AND VOLUME: The waste type of concern is Mustard Agent (dichlorodiethyl sulfide and thiodiglycol). No estimate of the volume of waste buried is available.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None available.

<u>REFERENCES:</u>
Documents: Halliburton NUS 1992, U.S. Army Toxic and Hazardous Materials Agency 1978, Facilities Contamination Report, January 14, 1978.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-29

NAME: Upper and Lower Cobbs Ponds.
MAP REFERENCE NUMBER: 29.

STATUS:
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 5 acres (Upper Cobbs Pond) and 4 acres (Lower Cobbs Pond).

SITE DESCRIPTION: The Upper and Lower Cobbs Ponds are unlined ponds currently used for recreational purposes and contain abundant fish and wildlife. A ponded area known as the "backwater area" is located south of Upper Cobbs Pond. This area, approximately 1 acre in size, was created by beaver activity and was not present during operations.

SERVICE HISTORY: The Upper and Lower Cobbs Ponds were used as sedimentation basins for Load Line waste water effluent and stormwater runoff from 1941 to 1971. The Cobbs Pond complex received waste water effluent from several areas including Load Line 3 (RVAAP-10) and Load Line 12 (RVAAP-12).

WASTE CHARACTERISTICS AND VOLUME: Waste types associated with this site include but are not limited to: TNT, RDX, HMX, Composition B, lead, chromium, mercury, and aluminum chloride. Estimates of the total volume of waste water received by the Cobbs Pond complex is not available.

UNPLANNED RELEASE DATA: A large fish kill occurred in 1966 and was attributed to the mishandling of aluminum chloride at Load Line 12 (RVAAP-12).

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Sediment sampling conducted in 1982 indicated the presence of RDX in sediment from Upper Cobbs Pond at a concentration of 1.16 μg/ml. Explosive compounds were not detected in Lower Cobbs Pond.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989, The Mogul Corp. 1982.
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-30

NAME: Load Line 7 Pink Water Treatment Plant.
MAP REFERENCE NUMBER: 30.

STATUS: Inactive.
REGULATORY PROGRAM: NPDES (former).

AREA OF THE SITE:

SITE DESCRIPTION: The Load Line 7 Pink Water Treatment Plant consists of a metal sided building that encloses 2 activated carbon filtration units and a 900 gallon stainless steel influent holding tank.

SERVICE HISTORY: This facility was used from 1989 to 1993 and was used for the treatment of pink waste water effluent using activated carbon filtration. Treated water was discharged to the George Road Sewage Treatment Plant (RVAAP-22). The site had an active NPDES permit.

WASTE CHARACTERISTICS AND VOLUME: The primary waste stream associated with site was TNT waste water. The NPDES permit allowed discharge of effluent with maximum allowable TNT, RDX, and HMX concentrations of 0.14 ppm each. The system is designed to treat 20 gallons of waste water per minute and averaged 5,000 gallons per day during operation.

UNPLANNED RELEASE DATA: None available.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: Routine NPDES monitoring.

REFERENCES:
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-31

NAME: Ore Pile Retention Pond.
MAP REFERENCE NUMBER: 31.

STATUS: Active.
REGULATORY PROGRAM: NPDES.

AREA OF THE SITE: Approximately 1 acre.

SITE DESCRIPTION: The Ore Pile Retention Pond is an unlined surface impoundment used as a settling basin for runoff from the manganese ore piles.

SERVICE HISTORY: The pond was constructed in the 1950s and is still active at present.

WASTE CHARACTERISTICS AND VOLUME: Waste types associated with this site include but are not limited to: manganese, RDX, and TNT. Estimates regarding the volume of wastes associated with this pond are not available.

UNPLANNED RELEASE DATA: Some time during the 1950s, a stream (adjacent to the Ore Pile Retention Pond) that receives effluent from the Ore Pile Retention Pond contaminated a farm pond off of the RVAAP property, affecting vegetation in the farm pond.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: During an investigation in 1982, RDX and TNT were detected in the soil surrounding the ore piles, and RDX was detected in a water sample from the retention pond at a concentration of 1.16 μg/ml. Subsequent sampling of the pond discharge did not indicate the presence of manganese contamination.

<u>REFERENCES:</u>
Documents: Jacobs Engineering 1989
Photographs:
Drawings: 1200.13

SITE ID NUMBER: RVAAP-32

NAME: 40 and 60 mm Firing Range.
MAP REFERENCE NUMBER: 32.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 12 acres.

SITE DESCRIPTION: This site encompassed two distinct areas. One area approximately 6 acres is south east of the RVAAP-16. Another area to the south is approximately 6 acres.

SERVICE HISTORY: This site was used as a test firing range for 40 mm and 60 mm projectiles during the 1940s and 1950s.

WASTE CHARACTERISTICS AND VOLUME: Heavy metals. Volume unknown.

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: None.
Photographs: None.
Drawings: None.

SITE ID NUMBER: RVAAP-33

NAME: Firestone Test Facility
MAP REFERENCE NUMBER: 33.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 41.1 acres (land), 84,426 square feet (buildings).

SITE DESCRIPTION: This area (also known as Load Line 6) consists of a pond and several buildings that housed a melt-pour operation, an above ground test chamber.

SERVICE HISTORY: This site was used as a security classified experimental test facility for munitions. Shape charges were constructed and tested for the Department of Defense.

WASTE CHARACTERISTICS AND VOLUME: Lead azide, black powder, TNT, Comp B, Octol, PBX-N5, Tetryl, LX-14.

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: Facilities Contamination Report, January 14, 1974.
Photographs: None.
Drawings: None.

SITE ID NUMBER: RVAAP-34

NAME: Sand Creek Disposal Road Landfill
MAP REFERENCE NUMBER: 34.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: 7500 square feet.

SITE DESCRIPTION: A 150 foot by 50 foot stretch of creek bank site is unlined.

SERVICE HISTORY: This facility was used as a construction landfill for concrete, wood, asbestos debris, and fluorescent light tubes that may contain mercury.

WASTE CHARACTERISTICS AND VOLUME: Asbestos, heavy metals (mercury).

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: None.
Photographs: None.
Drawings: None.

SITE ID NUMBER: RVAAP-35

NAME: Building 1037-Laundry Waste Water Sump
MAP REFERENCE NUMBER: 35.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: 100 square feet.

SITE DESCRIPTION: A concrete sump below ground approximately 5,765 gallons.

SERVICE HISTORY: Treatment consisted of one settling tank operating on a two-hour detonation period between discharging of rinse water. Wash water is emptied approximately 12 times during 8 hours of operation and rinsing 3 times each 8 hours. The wash water entering the tank prior to the rinse water discharge had sufficient settling time so that the increase in rate from the rinse water did not disturb the settled matter on the tank bottom. The rinse water was sent to the RVAAP-22.

WASTE CHARACTERISTICS AND VOLUME: TNT. Volume unknown.

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: Laundry - Bldg. 1037, Waste Water Treatment 8/24/51.
Photographs: None.
Drawings: None.

SITE ID NUMBER: RVAAP-36

NAME: Pistol Range
MAP REFERENCE NUMBER: 36.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: 1.3 acres.

SITE DESCRIPTION: A 350 foot x 150 foot area. An unnamed small tributary of Sand Creek runs west to east through the middle of the site. There is a bank approximately 150 feet to 200 feet from the creek on the north side which was the stopping point for the ammunition.

SERVICE HISTORY: The site was used by the installation security force, and occasionally other outside agencies for pistol qualification. The qualifier stood on the south side of the creek and shot over the creek at targets on the north side of the creek. The bank, 150 to 200 feet from the creek, was the stopping point for the bullets.

WASTE CHARACTERISTICS AND VOLUME: Lead is the primary contaminant of concern.

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: None.
Photographs: None.
Drawings: None.

SITE ID NUMBER: RVAAP-37

NAME: Pesticide Bldg. S-4452
MAP REFERENCE NUMBER: 37.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Building 800 square feet, mixing area 240 square feet.

SITE DESCRIPTION: A 40 foot by 20 foot wooden building that houses the pest controller office and the pesticide storage and mixing facilities. There is a crawl space underneath the structure. The storage area consists of a galvanized steel curbed area on a wooden floor and metal cabinets. The mixing area is a 20 foot by 12 foot gravel area outside the building.

SERVICE HISTORY: This building was used as the pest control shop from the early 1970s until 1993. Small quantities of pesticide were mixed inside the building and vehicle. Mounted sprayers were filled and mixed along the western side of the building. No large spills are known to have occurred at the site, but in 1990 an empty (residue present) 1-gallon chlordane container and a 2-gallon hand sprayer were found in the crawl space.

WASTE CHARACTERISTICS AND VOLUME: Synthetic organic compounds are of primary concern. No volume estimate is available.

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: None.
Photographs: None.
Drawings: None.

SITE ID NUMBER: RVAAP-38

NAME: NACA Test Area
MAP REFERENCE NUMBER: 38.

STATUS: Inactive.
REGULATORY PROGRAM: CERCLA.

AREA OF THE SITE: Approximately 12.4 acres.

SITE DESCRIPTION: The clay "runway" is approximately 1800 feet by 50 feet and associated cleared area at the eastern end which is 900 feet by 500 feet. The runway spans the southern end of Greenleaf Road at Post 5 to the east.

SERVICE HISTORY: Not much is known regarding this facility. Supposedly NACA was developing explosion-proof fuel tanks for airplanes, or explosion-proof fuel. An aircraft would land on the old clay runway and taxi to the east (to the test site). The planes were hooked up to a conveyor or catapult and rammed into a wall at the eastern end. The crashes were filmed for later use.

WASTE CHARACTERISTICS AND VOLUME: The contaminant of concern is petroleum hydrocarbon and other unknown contaminants.

UNPLANNED RELEASE DATA: None.

ASSOCIATED MONITORING WELLS: None.

CHARACTERIZATION DATA: None.

REFERENCES:
Documents: None.
Photographs: None.
Drawings: None.

APPENDIX B

USGS MAPS FOR
NEWTON FALLS, OHIO
RAVENNA, OHIO
WINDHAM, OHIO