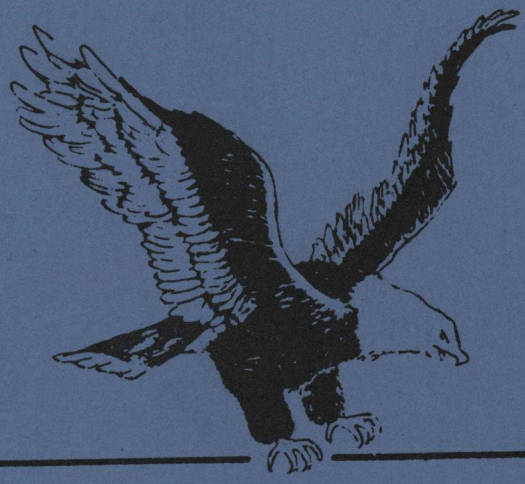
INSTALLATION ASSESSMENT
OF
RAVENNA ARMY AMMUNITION PLANT

REPORT NO. 132

NOVEMBER 1978



US ARMY
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OF

RAVENNA ARMY AMMUNITION PLANT

RECORDS EVALUATION REPORT NO. 132

CONCUR:

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ABSTRACT

A records search was conducted at Ravenna Army Ammunition Plant (RVAAP) to identify past contamination and to assess the potential for contaminant migration beyond the installation boundary, if any.

The review of records identified the major contaminated areas as (1) production areas, (2) burning grounds, (3) test areas, and (4) demolition grounds.

The major contaminants are, (1) TNT, (2) Comp B, (3) sulfates, and (4) nitrates. Residue from loading and storage of lead styphnate and lead azide may also remain. The NPDES outfalls located on drainage ditches exiting the installation are not being monitored for nitrobodies and heavy metals.

The production waste lagoons have been constructed in line with surface drainage ditches. Using this type of construction, the surface routes have been flushed by natural means throughout the years. The soil in the surrounding area is a silty loam over clayey loam and glacial till and is slowly permeable. For these reasons it is believed that waste products would not penetrate into the subsurface and if leaving the plant area would have to be carried by surface waters through natural drainage ditches.

A preliminary survey is not required at this time; however, the Project Manager for Chemical Demilitarization and Installation Restoration (PM CDIR) should monitor the RVAAP water quality program to assure that contaminant migration is not occurring.

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I. GENERAL

A. Purpose

1. To search for, identify, and assess actual or potential toxic or hazardous chemical, biological, or radiological materials contaminant migration at Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio, resulting from military/industrial operations conducted for the Department of Defense.

2. To identify any immediate on-post conditions associated with chemical, biological, or radiological materials, or load, assemble, and pack (LAP) operation contaminants and unexploded ordnance (UXO) which could contribute to a contaminant migration problem.

B. Authority

Department of the Army (DA) charter for the PM CDIR dated 29 April 1977.

C. Introduction

1. In response to a letter from the Office of PM CDIR requesting the identification of potentially contaminated installation, the Commander, US Army Armament Materiel Readiness Command (ARRCOM) recommended RVAAP be included in the Installation Restoration Program.

2. Presurvey instructions were forwarded to RVAAP by letter to outline assessment scope, provide guidelines to RVAAP personnel, and to obtain advanced information for review by the Records Search Team prior to the onsite search. Mr. R. D. Emerson, Commander's Representative, acted as the installation point of contact; and Mr. Al Lawson was assigned as the alternate to assist the Team.

3. Personnel were briefed by PM CDIR on 11 September 1978 concerning the Installation Restoration Program prior to the onsite records search.

4. Prior to the onsite review of local records, various Government agencies were contacted during the period of 14 August through 29 September 1978, for documents pertinent to the records search effort. Agencies contacted included:

a. Department of Defense Explosives Safety Board (DDESB).
b. US Army Environmental Hygiene Agency (USAEHA).
c. US Geological Survey (USGS).
d. Defense Documentation Center (DDC).
e. US Army Engineer Waterways Experiment Station (WES).
f. National Technical Information Service (NTIS).
g. US Army Armament Materiel Readiness Command (ARRCOM).
h. Chemical Systems Laboratory (CSL).

5. The onsite phase of the records search was conducted from 11 September through 15 September 1978. The following personnel from the Installation Restoration Branch, Environmental Technology Division, Chemical Systems Laboratory, Aberdeen Proving Ground, Maryland, were assigned to the team and prepared the report:

a. Mr. Norman Leibel, Team Leader (CSL).
b. Mr. William Collins, Chief, Installation Restoration Branch (CSL).
c. Mr. Steven Kolodzey, Chemical Engineer (CSL).
d. Mr. James Goheen, Chemical Engineer (CSL).
e. Mr. William Ludemann, Chemist (CSL).
f. CPT Jay Abercrombie, Environmentalist (CSL).

The team was also assisted by Messrs. Harry Woods and Jack Lewis, Geologists (WES), who prepared the section on geology, and Mr. Leon Lookingbill, ARRCOM Safety Office, Rock Island, IL.

6. In addition to the review of the records, interviews were conducted with former and present employees (see Appendix A). Many of the employees interviewed had been employed at RVAAP since the plant was constructed. Ground and aerial tours of the installation were also made; photographs taken during the tours are included in the text and in Appendix B.

7. The findings, conclusions, and recommendations are based on the records made available at the time of the search. Where conspicuous discrepancies existed, attempts were made to determine the correct information by interviewing personnel (if available) involved in preparing the original data.

D. Brief History

The RVAAP is located in the northeastern section of Ohio with land in both Portage and Trumball counties. Headquarters lies approximately 56 kilometers southeast of Cleveland, 14.4 kilometers east of Ravenna, and 22.4 kilometers west of Warren.

The installation is surrounded by several local communities of; Windham, which borders the installation to the north; Garrettsville, located 9.6 kilometers to the northwest; Newton Falls, 11.2 kilometers to the east; Charleston, bordering the southwest; and Wayland, 4.8 kilometers to the southeast. The area of the installation is in a tract 5.6 kilometers wide by 17.6 kilometers long and is bounded by the State Road #5; the M. J. Kirwan Reservoir, and the Chesapeake and Ohio Railroad on the south. State Route #534 on the east; Garrettsville and Berry Roads on the west; and the CONRAIL Railroad line on the north. Interchange #14 of the Ohio Turnpike is located on State Route #5, 4 kilometers east of the installation. The total

area of the installation is 8,567.6 hectares of which 73.6 hectares (0.9%) are considered as improved, 753.2 hectares (8.8%) are semi-improved, and 7,740.8 hectares (90.3%) are unimproved.

There were no historical events recorded or historical sites located on the land which became the installation. Before military acquisition, the land was used for farming.

RVAAP was started on 26 August 1940 for the primary purpose of loading medium and major caliber artillery ammunition; bombs, mines, fuze and boosters, primers and percussion elements and the storage of finished ammunition components.

Originally, the installation was divided into two separate units; one was designated the Portage Ordnance Depot with the primary mission of the depot's storage activity, the other as the Ravenna Ordnance Plant with the primary mission of the ammunition loading activities. In August 1943, the installations were designated as the Ravenna Ordnance Center, and in November 1945, the Ravenna Arsenal.

The Atlas Powder Company was the original Government Owned-Contractor Operated (GOCO) manager of the Ravenna Ordnance Depot who operated the plant from 1940 - 1945; the government operated the Portage Ordnance Depot. The last production for World War II was in August 1945. The government assumed operations of both areas from 1945 - 1951 when Ravenna Arsenal Inc. (RAI), a subsidiary of the Firestone Tire and Rubber Co., Akron, Ohio, was contracted to operate the entire facility. RAI has continued operations through 1978.

The peak personnel strength was attained during the World War II period when 16,000 operating-contract personnel, and 450 government employees were employed at RVAAP. During the Korean emergency and the Vietnam conflict, RVAAP was again very active. Production ceased in 1971. Presently, there are four government employees and 166 contractor employees at the plant.

From 1946 - 1949, the Silas Mason Company, Shreveport, LA, leased the ammonium-nitrate lines for the manufacturing of ammonium-nitrate fertilizer.

In 1950, most of the facilities at RVAAP were placed in standby status. During this period, operations consisted primarily of renovation, demilitarization, and maintenance of ammunition and ammunition components.

In July of 1954, the Plum Brook Ordnance Works of Sandusky, Ohio, and the Keystone Ordnance Works of Meadville, Pennsylvania, became satellites of RAI. These ordnance works were used to manufacture explosives during World War II. During the time they were satellited, the entire areas of both

installations were decontaminated to a XXXXX condition. Plum Brook ceased to be under the jurisdiction of Ravenna effective 1 March 1958, and Keystone 31 March 1964.

RVAAP was selected in 1954 for the storage of industrial plant equipment. Storage requirements have increased yearly up to the present time.

Explosive meltout was engineered, fabricated, and installed in Load Line 12 in 1959 and 1960. This facility melted out 250, 500 and 2,000 pounds GP bombs until operations ceased on 31 July 1961.

Other demilitarization operations have been conducted at RVAAP since World War II.

The present mission is the maintenance of load, assemble and pack facilities; the receipt, storage and shipment of ammunition, explosives, equipment, inert and critical materials, and providing the capability to accommodate containerized cargo.[1,2,3]

Major activities presently are receipt of TNT, Comp B, and nitroguanidine; shipment of TNT, Comp B, ammunition and excess materials; and layaway preservation and maintenance of **Plant Equipment Package (PEP)** in buildings under humidity control.

E. Leases

1. Agricultural Leases

Slightly more than 400 hectares at RVAAP were leased for agricultural purposes in 1943. In 1953, 18 agricultural leases were in existence, covering more than 560 hectares. Leases for cropland were phased out in 1956 but grazing leases continued until 1973. There are no current agricultural leases.

2. Industrial Leases

Presently there are no active industrial leases at RVAAP. In the past the Lewis Flight Propulsion Laboratory, National Advisory Committee for Aeronautics (NACA) leased an area west of Greenleaf Road and south of South Patrol Road from approximately 1952 until July 1957. NACA conducted aircraft crash tests during this period.

The Storm Windows of Aluminum Company leased buildings Nos. 5 through 51, 1-F-10, 1-F-11 and 1-F-14 in Load Line 5 from early in 1950 until June 1960.

The Firestone Tire and Rubber Company's Defense Research Division has been using Load Line 6 since 1958; however, they have never had an active lease with RAI. There is a lease presently being prepared.

The Hercules Alcor Company leased a building in Load Line 12 from 1965 through 1967 to produce aluminum chloride.

F. Legal Actions

There are presently no legal actions pending against RVAAP. Available records did indicate that RVAAP had a problem associated with run-off from a strategic ore pile. This problem was corrected and did not result in a legal action. Details on the incident are discussed in Section III. A. 8. e. Spills.

II. ENVIRONMENTAL SETTING

A. Meteorological Data

The climate at RVAAP is continental but the proximity of Lake Erie provides a moderating effect. Average rainfall is 86 centimeters/year and average snowfall is 91 centimeters/year. The mean temperature in the winter is -2.1°C while summer temperatures average 21.4°C. The lowest temperature on record is -28.9°C and the highest recorded temperature is 40.6°C. The average growing season is only 180 days. Killing frosts have occurred as late as 29 May in the spring and as early as 21 September in the autumn. Table I gives the average temperature and precipitation for each month.

B. Geology

1. Physiography-Topography-Drainage

Ravenna Army Ammunition Plant (RVAAP) lies in the glaciated Allegheny Plateau section of the Appalachian Plateau Province. The western and northern portions of the plant display low hills and a dendritic surface drainage pattern. Eastern and southern portions are characterized by an undulating to moderately level surface, reflecting less stream dissection of the original glacial drift surface. Kettles are present throughout the plant. Elevations range from 366 meters in the west to 279 meters in the east.

The surface drainage is controlled by three creeks and their tributaries (see Figure 8). Sand Creek drains the central part of the plant and flows to the northeast. Eagle Creek flows along the northern plant boundary in an easterly direction. Eagle Creek joins Sand Creek just before leaving the plant north of the Smokeless Powder Area. Hinkley Creek enters the plant on the northwestern boundary, flows in a southerly direction and exits the plant just west of the south Charlestown Gate. Several unnamed drainageways drain the extreme eastern, western, and southern portions of the plant.

2. Geology

a. Surface

The surface material of RVAAP and the surrounding area is of glacial origin and consists of boulder clay and sand and gravel. Boulder clay, or glacial till, is an unsorted, unstratified mixture of varying amounts of sand, silt, and clay, containing pebbles, cobbles, and boulders. The United States Geological Survey has identified five surface geological units occurring within the plant. The major part of the central and eastern portion of the plant is blanketed by the Hiram Till, a clayey till commonly called "clay and gravel" having an average thickness of less than 5 meters. The western section of the plant is covered by 6 to 12 meters of Kent Till,

TABLE I

Average monthly temperature and precipitation, RVAAP:

Month	Temperature Average, Degrees C	Precipitation Average Centimeters
January	-2.5	6.53
February	-2.3	6.02
March	2.1	7.32
April	8.3	7.09
May	14.6	7.80
June	19.9	8.18
July	22.4	8.59
August	21.4	7.52
September	18.2	7.77
October	12.1	6.63
November	5.3	6.55
December	-0.4	5.99

a sandy, silty till with pebbles. Data from about 75 wells (drilled within RVAAP) indicate the soil thickness is only a meter at selected locations. The surficial geological units are shown in Figure 1.

In the central part of the plant and oriented in a southwest-northeast direction is a bedrock valley which has been filled with glacial outwash sand and gravel to a depth of 30 to 60 meters capped by the till. The position of the buried valley is shown in Figure 1.

b. Subsurface

Underlying the glacial deposits are sandstone, shale, and conglomerate of Pennsylvanian and Mississippian Age. The aerial distribution of these units is shown in Figure 2 and their thickness and lithology are described in Table II. These rock formations dip very gently to the south at about 2 to 3 meters per kilometer.

3. Soil

a. Surface

RVAAP contains three distinct soil associations; their distribution is depicted in Figure 3 and descriptions are provided below. Most of the installation is mantled by the Mahoning-Ellsworth Soil Association. The till soils (Wadsworth-Rittman Soil Association) in the western quarter of RVAAP contain a cemented subsurface layer (fragipan). The northeastern fringe of RVAAP contains the Sebring-Holly Soil Association.

Mahoning-Ellsworth Soil Association. The topsoil consists of 20 centimeters of friable, dark grayish-brown silt loam; the subsoil consists of 132 centimeters of firm brown silty clay loam. These soils display slow to very slow permeability.

Wadsworth-Rittman Soil Association. The topsoil consists of 20 centimeters of friable, dark grayish-brown silt loam; the subsoil consists of 48 centimeters of yellowish-brown silty clay loam over 53 to 84 centimeters of brown, very firm and brittle cemented, clay loam or silty clay loam (fragipan). These soils display slow permeability.

Sebring-Holly Soil Association. The topsoil consists of 25 centimeters of friable gray silt loam; the subsoil contains 127 centimeters of gray silt loam and the permeability is moderately slow to moderately rapid.

b. Subsurface

The boring logs indicate a clay that varies from 1 to 10 meters overlying rock (see Table III). A more detailed description down to 1 meter was presented in the above paragraph.

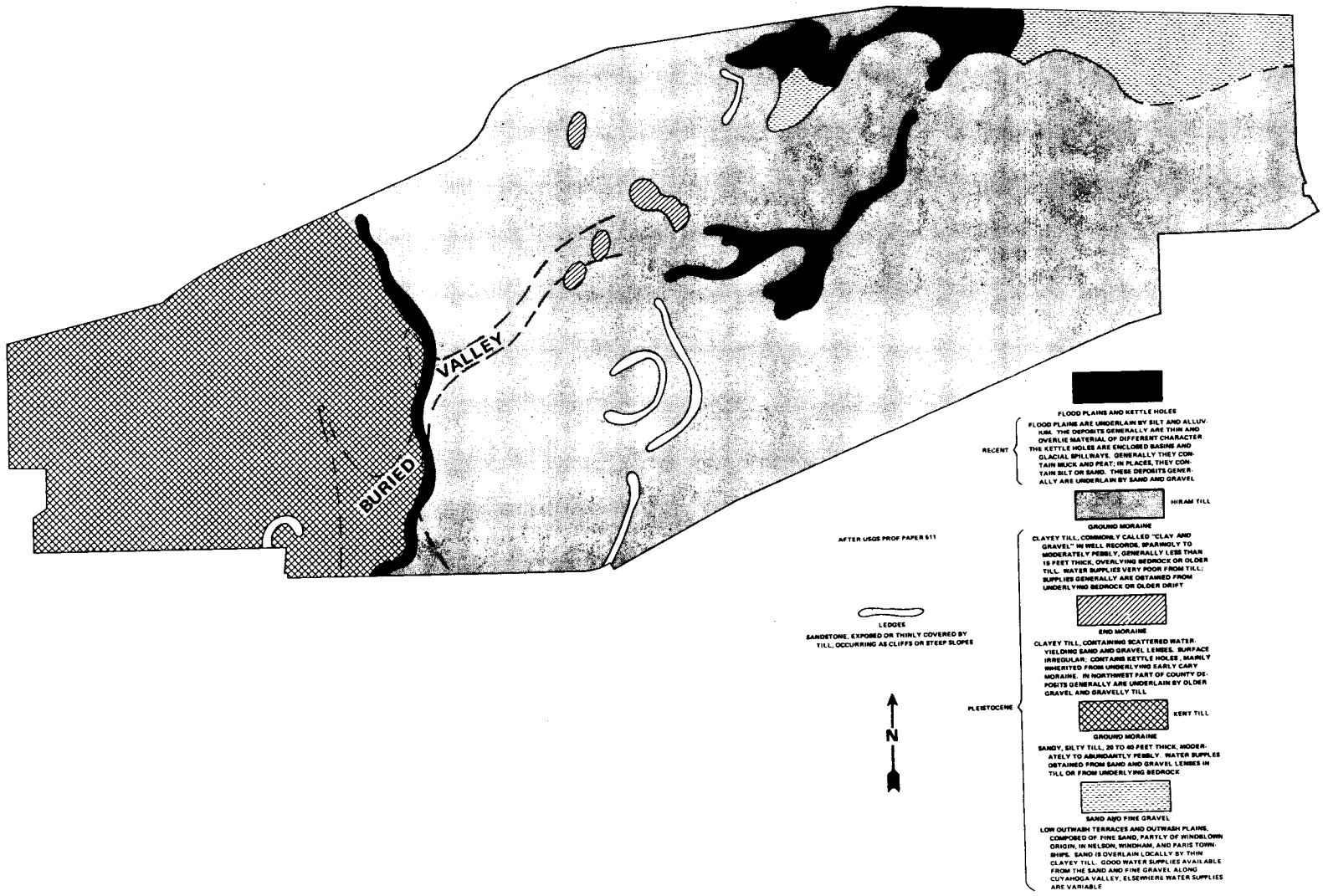

FIGURE 1 SURFICIAL GEOLOGY AT RVAAP

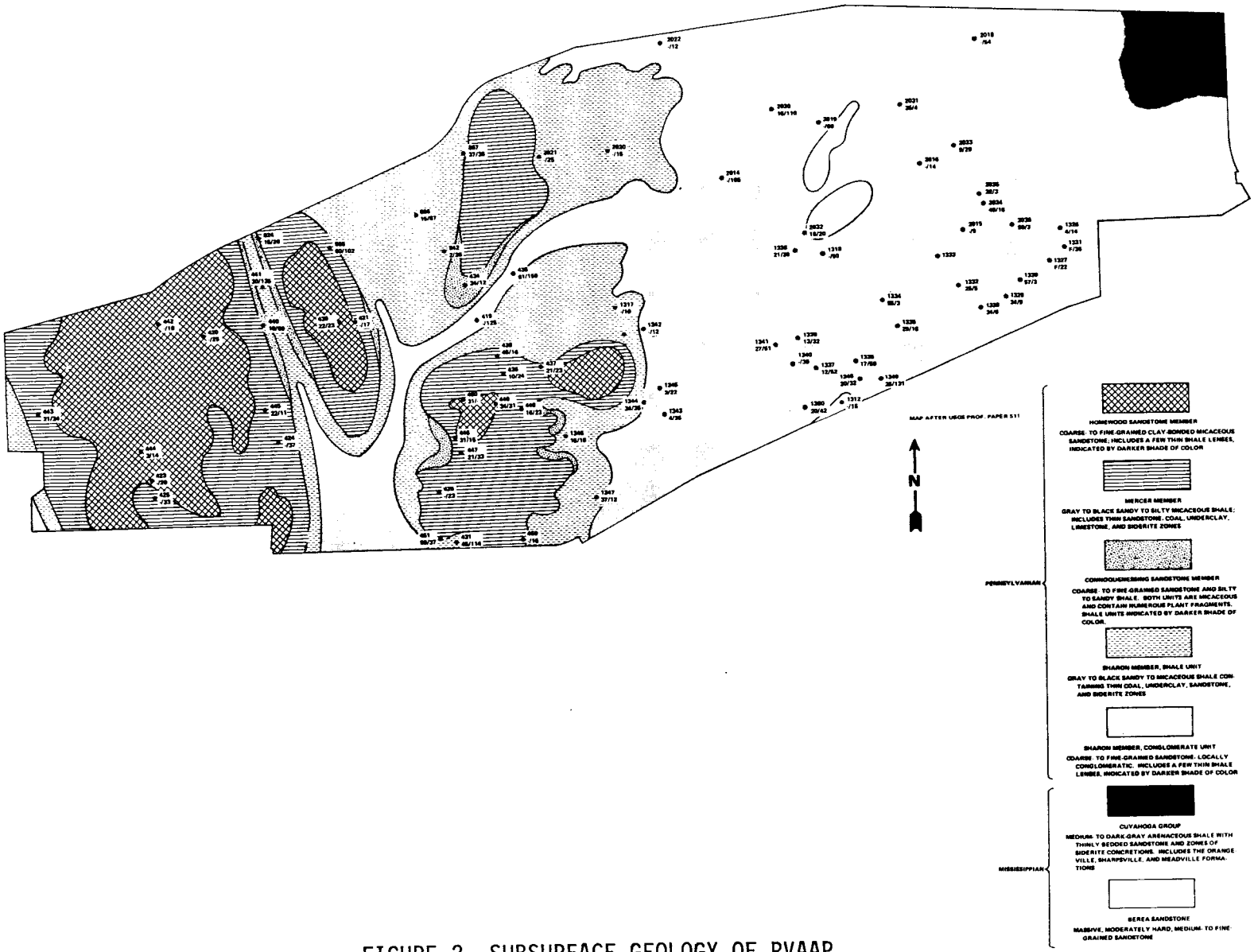

FIGURE 2 SUBSURFACE GEOLOGY OF RVAAP

TABLE II

GENERALIZED STRATIGRAPHIC SECTION

PERIOD	FORMATION	MEMBER	THICKNESS	DESCRIPTION
QUATERNARY	WISCONSIN GLACIAL DRIFT	HIRAM TILL	1.5-4.5 meters	Ground Moraine clay fill, sparingly pebbly
		KENT TILL	6-12 meters	Ground Moraine sandy, silty fill, moderately to abundantly pebbly
PLEISTOCENE EPOCH	ILLINOIAN GLACIAL DRIFT	-- --	0-60 meters	Silt, sand and gravel outwash in burned valleys
------		HOMEWOOD SANDSTONE	0-30 meters	White to tan, coarse to fine-grained, clay-bonded micaceous sandstone
		MERCER	0-27 meters	Gray to black, sandy to silty micaceous shale, includes thin sandstone, coal, underclay, limestone, and siderite zones
		CONNOQUENESSING SANDSTONE	0-42 meters	Coarse to fine-grained sandstone and silty to sandy shale
PENNSYLVANIAN	POTTSVILLE		0-18 meters	Shale Unit: gray to black, sandy to micaceous shale containing thin coal, underclay, sandstone, and siderite zones
		SHARON	0-60 meters	Conglomerate Unit: white to tan, coarse to fine-grained, orthoquartzite sandstone, loosely cemented and locally conglomeratic
MISSISSIPPIAN	CUYAHOGA GROUP	MEADVILLE SHALE	9-30 meters	Blue-gray silty shale alternating with thin beds of sandstone and siltstone
		BEREA SANDSTONE	0-22.5 meters	Massive, moderately hard medium to fine-grained sandstone

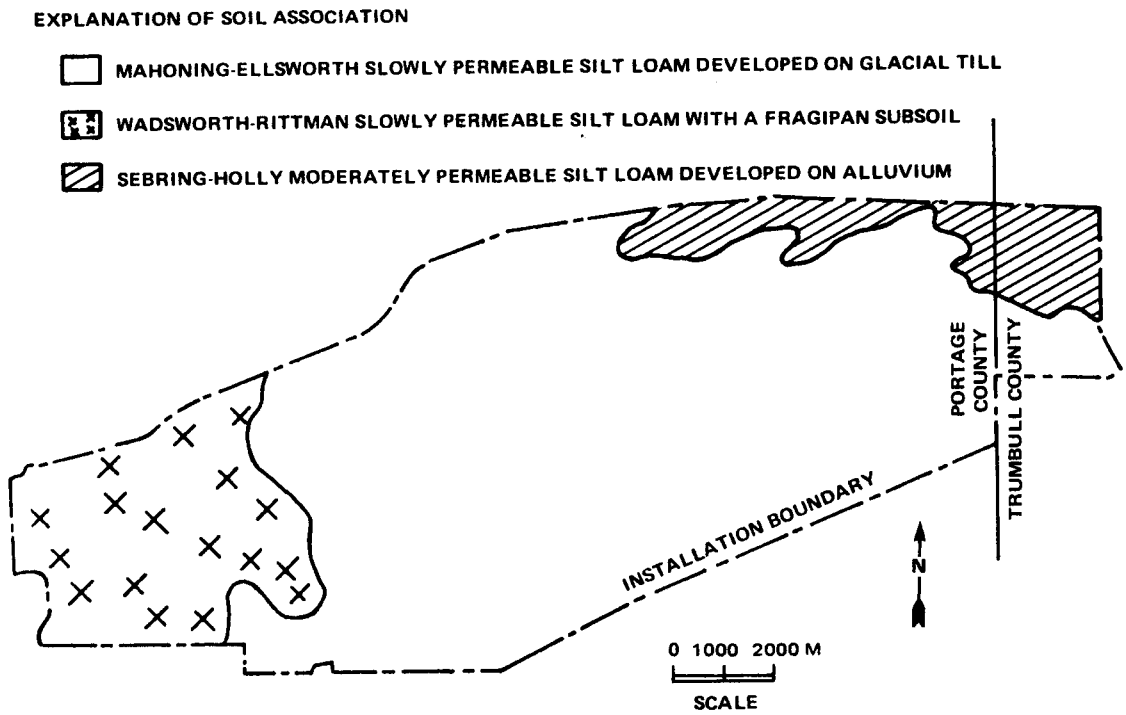

FIGURE 3 SOIL GROUP DISTRIBUTION

TABLE III

WATER WELL BORING LOGS

WELL 25

Meters	
0-2.4	Clay
2.4-37.8	Sandstone
37.8-39	Shale

WELL 27

0-2.1	Clay
2.1-11.4	Shale & Sand
11.4-34.2	Sandstone
34.2-35.4	Shale

WELL 86

0-1.5	Clay
1.5-35.1	Sandstone
35.1-41.4	Shale

WELL 87

0-1.8	Yellow Clay
1.8-3.3	Broken Sandstone
3.3-10.5	Sandstone
10.5-43.5	White Sandstone
43.5-48	Gray Sandstone
48-52.5	White Sandstone
52.5-54.9	Gray Sandstone
54.9-56.4	Shale

WELL 28

0-9	Clay
9-46.5	Sandstone
46.5-47.4	Shale

WELL 29

0-10.2	Clay
10.2-15	Slate & Sand
15-45	Sandstone
45-46.5	Shale

WELL 45

Meters	
0-3.6	Clay
3.6-4.2	Sand & Gravel
4.2-9	Sandstone
9-12.3	Shale
12.3-24	Sandstone
24-24.9	Shale

WELL 47

0-6.9	Clay
6.9-11.7	Shale
11.7-16.5	Sandstone
16.5-53.4	Shale
53.4-64.2	Sandstone
64.2-65.7	Shale

WELL 60

0-9	Clay
9-26.1	Shale
26.1-29.4	Sandstone
29.4-38.7	Shale
38.7-63.3	Sandstone
63.3-64.8	Shale

WELL 61

0-5.4	Clay
5.4-7.2	Fine Sand
7.2-9	Sandstone
9-41.1	Shale
41.1-65.1	Sand & Rock
65.1-66	Shale

WELL 68

0-18	Sandstone
18-28.5	Shale
28.5-39	Sandstone
39-42.6	Shale
42.6-51.6	Sandstone
51.6-66.3	Shale
66.3-66.6	

4. Water Resources

a. Surface

Approximately 45 ponds, varying in size and depths are scattered throughout the plant. Many were built in natural drainageways and incorporated into the plant operations as holding and settling ponds. Others are natural in origin resulting from glacial action. All water bodies support an abundance of aquatic vegetation and are well stocked with fish. No ponds are used as a source for water supply.

b. Subsurface

The depth to the water table in the early 1940's varied from 1 to 18 meters below the surface and in August, 1978, the water level in Well No. 60 was 23 meters, Well No. 29 was 6 meters, and Well No. 45 was flowing. The direction of groundwater movement is to the east at a gradient of approximately 12 meters per kilometer.

Bedrock aquifers are currently the exclusive source of water supply for RVAAP. Little is known about the hydrologic properties of the buried glacial valleys within and adjacent to the plant. The outwash materials within these valleys range from fine- to coarse-grained and well yields are unpredictable. The Homewood Sandstone Unit is generally thin with yields less than 38 liters per minute and a poor recharge within the confines of RVAAP. The shale units underlying the Homewood are aquitards. Where present, these shale units act as upper confining or semi-confining beds for the underlying conglomerate unit of the Sharon formation. The Sharon conglomerate is the primary bedrock aquifer under the plant. Depending on the existence and depth of overburden, it ranges from an unconfined to a leaky artesian aquifer. The thickness of the primary aquifer ranges from 16 meters in Well No. 47 to 44 meters in Well No. 87. Well Nos. 27, 45, and 88 are flowing artesian wells.

Out of approximately 75 test wells drilled onpost, only 15 were considered adequate producers (see Figure 4). These 15 wells are 31 centimeters in diameter, range from 25 to 67 meters deep, and are producing from the Sharon conglomerate aquifer. Presently only five wells (Nos. 28, 29, 45, 60, and 68) (1977) are in continual operation; the Windham Gate and Greenleaf Truck Gate Wells are used only sporadically.

The five principal operating wells collectively produce 8 to 10 million liters of water per month. Well yields range from 114 to 1,520 liters per minute. The wide range in capacity is due to variations in permeability and thickness of the aquifer. It is important to note that each well is used only one or two days per week, yet drawdowns up to 22 meters have resulted in a short period of time. RVAAP personnel have used acid, air surging, and explosives in an attempt to increase the capacity of their

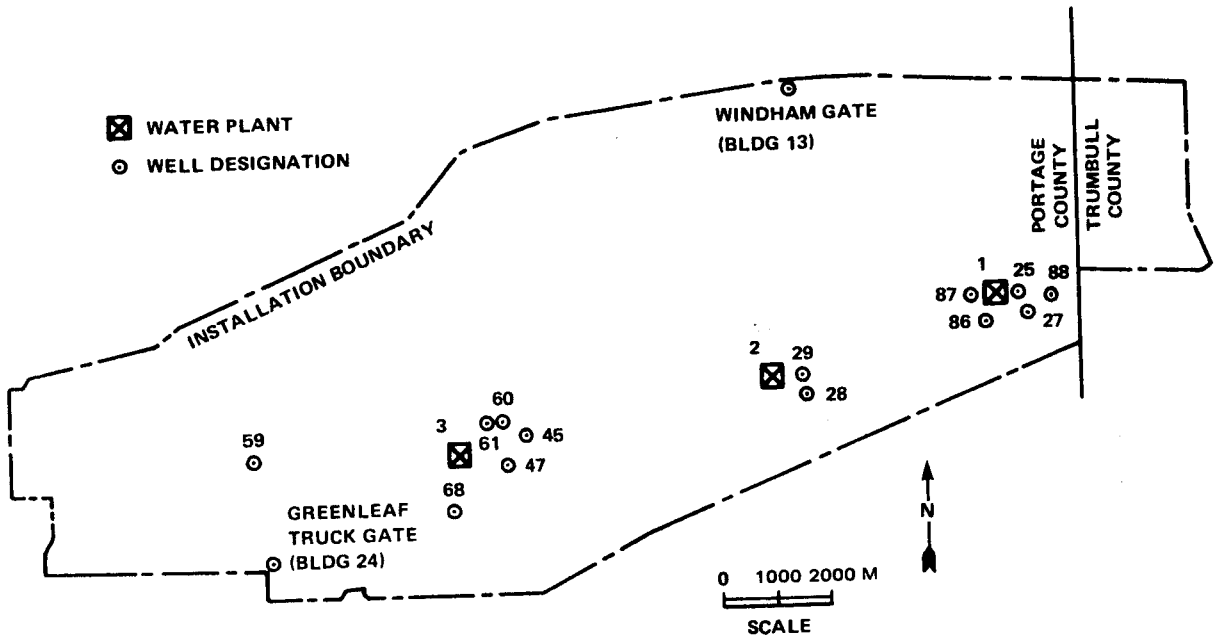

FIGURE 4 WATER TREATMENT PLANTS AND WATER SUPPLY WELLS

wells, without success. According to the Ohio Department of Natural Resources, the long-term dependable (or continuous) yield of a well fully penetrating the Sharon conglomerate unit is typically 133 to 190 liters per minute.

A license has been issued by RVAAP to the Geology Department, Kent State University, Kent, OH, for Kent State to use Water Well 26 (not used by RVAAP) for field demonstrations and training of hydrogeology classes. This well is in the southeastern part of the plant. Because subsurface waters move in an easterly direction, the analysis of water samples collected during geological classes should be requested by RVAAP for future reference.

Three water treatment plants provide treated water for all phases of plant operations and certain water wells are assigned to provide raw water for that plant. A fourth WTP is located in the old Administrative Area on the original Portage Ordnance Depot. This plant is used occasionally by Reserve Training Units.

Raw groundwater is treated by aeration, filtration, softening, and chlorination in one of three water treatment plants which have a combined pumping capacity of 9,120 liters per minute. Water Plant No. 1 is near Load Line 1, Water Plant No. 2 near Load Line 2, and Water Plant No. 3 is near Load Line 6. The treatment plants and associated wells are shown in Figure 4. The storage capacity, totaling 28,701,400 liters consists of six elevated tanks, one covered reservoir, and three clear wells (storage reservoir for potable water at the treatment plants). However, to meet maximum capacity needs of 6 million liters per day, the installation is planning to obtain all its required water from Lake Kerwin south of RVAAP. Utilization of this water source is scheduled to begin in December, 1978, at which time the main installation wells and existing water treatment plants will be reduced to standby status.

The water mains are distributed primarily in the south-central and southeastern portions of the plant serving the administration area, load lines and inert storage areas 6 and 8. The lines are cast iron and range in size from 25 to 30.5 centimeters in diameter. Several galvanized pipes, 3 to 6 centimeters diameter, supply water to isolated buildings from the main distribution lines.

C. Biota

RVAAP consists of 8,567.6 hectares, of which 5,733.2 hectares (66.9%) are forested and 24.4 hectares (0.2%) are water. No natural lakes occur on the installation but small man-made reservoirs and beaver ponds abound. Three major creeks drain RVAAP: Sand Creek arises on the installation and flows generally in a northeasterly direction, draining 3,674.8 hectares. The South Fork of Eagle Creek roughly parallels the northern

installation boundary; its watershed comprises 2,054.4 hectares of government land. Hinkley Creek drains the southwestern 1,956.4 hectares of RVAAP.

The lands surrounding the installation are mainly woodlots and fallow fields. Second and third growth timber and brush constitute the typical vegetation. Rural residences are quite common. Approximately 25% of the surrounding land is in agricultural crops, primarily corn, beans, soybeans, grains (wheat and oats), hay, and alfalfa. Maple sugaring is a common practice in the late winter months.

Hunting is permitted on the installation for deer, squirrels, and ducks. Trapping is allowed for beavers on an occasional basis. Approximately 70 beaver colonies are located at RVAAP. The northeastern corner of the plant consists of an extensive cattail marsh which serves as a feeding, resting, and nesting area for resident and migratory waterfowl. Canada geese and several species of ducks have nested in the marshes for the past several summers.

The installation environmental impact assessment (EIA) has good lists of plants and animals that are found at RVAAP. Thus, the following discussion is limited only to specific members of the biota discovered on the installation during the course of this records search survey.

Due to its location and its relative undisturbed state, RVAAP has a remarkable diversity of ecological habitats. Consequently, it is a haven for several rare or threatened species of plants. Several small, ancient bogs near the northern boundary of the installation indicate the presence of old glacial lakes and support a number of rare and unusual plants. Of particular interest was the discovery of several small bald cypress (Taxodium distichum). These trees are not native to Ohio, being found naturally only in the southern United States. Their occurrence at RVAAP remains unexplained. The bogs harbor several fine specimens of poison sumac (Rhus vernix), a species listed as threatened in Ohio.

Located on the northern edge of RVAAP is a deep gorge carved by the South Fork of Eagle Creek. At places, sandstone cliffs rise an estimated 15 meters above the streambed. Unusual geological formations, such as whirlpool basins and free-standing columns, occur in the gorge. The gorge is unique biologically because it contains an outstanding example of a climax forest comprised of hemlocks, white pine, and northern hardwoods. This forest is a remnant of the great northern forest which once covered much of the northern Appalachians. Its occurrence as far south and west as Portage County, Ohio, is extremely noteworthy. Among the rare or threatened plants found in the gorge are mountain maple (Acer spicatim), hobblebush (Viburnum alnifolium), yellow round-leaved violet (Viola rotundifolia), catchfly (Lonicera canadensis), and broad beech fern (Thelypteris phegopteris). The water flowing through the gorge appeared to be of good quality and supported diverse and large populations of macroinvertebrates and fish.

A small stand of larch (Larix laricina), a northern tree typical of acid bogs, was found on the installation during the course of this survey.

III. DISCUSSION

A. Potential Contamination

1. Installation Operations

a. Industrial Operations

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. (Figure 5, Load Line Layout)

Explosive Melt-Pour Process

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 which 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.

Production Operation Activities

All load lines operated at full capacity during the period of 1941 through 1945. The ammunition items produced in Load Lines 1 through 4 during this period are listed in the following table:

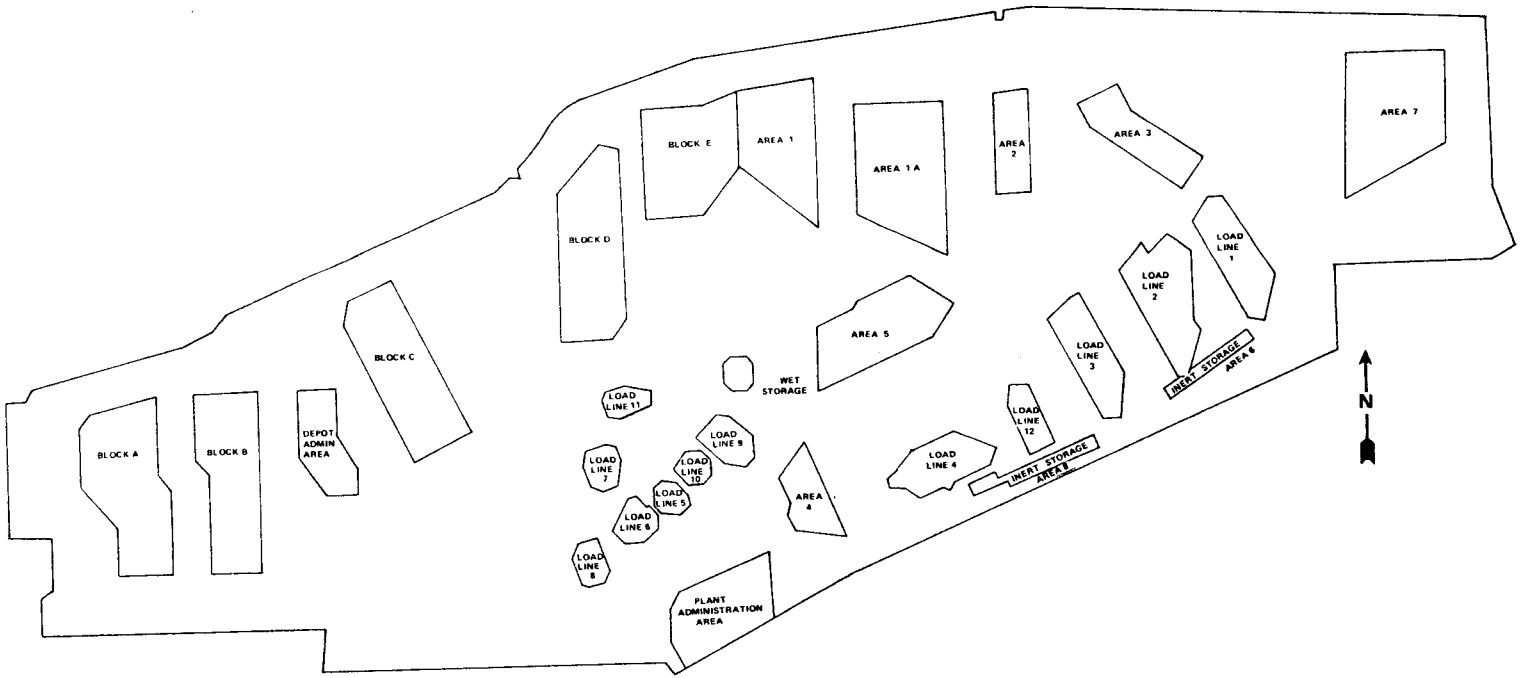

FIGURE 5 LOAD LINE LAYOUT

TABLE IV

PRODUCTION OPERATION ACTIVITIES

Load Line	Ammunition	Total Production Quantities
1	75mm C/R	24,416,749
	76mm C/R	2,354,073
	4.5" Proj	1,463,769
	155mm Proj	1,030,497
	8" M103 Proj	42,684
2	4.5"Proj	65,865
	155mm Proj	5,100,830
	6" Proj	32,879
	8" Proj	665,499
	240mm Proj	109,518
	Bomb, 100 lb	48,415
3	155mm Proj	73,701
	8" Proj	582,586
	240mm Proj	73,100
	Bomb, 100 lb	293,670
	Bomb, 500 lb	131,862
	Bomb, 1000 lb	13,309
	Bomb, 2000 lb	91,536
4	8" Proj	70,168
	Bomb, 500 lb	12,482
	Bomb, 1000 lb	9,320

Operations conducted in Load Lines 5 through 12 are as follows:

Load Lines 5 and 6 produced fuzes until 1945 and were deactivated and the equipment removed. In 1950, Load Line 6 was used by Firestone Tire and Rubber Company to perform research and development efforts on shape charges under DOD contracts.

Load Lines 7 and 8 produced boosters charges until deactivation in 1945. Equipment was removed from the lines.

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 has been deactivated twice.

Load Line 12 (ammonium nitrate plant). 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 US Government's commitment for aid in rehabilitation of occupied foreign countries. A total of 518,264.1 tonnes of ammonium nitrate was produced until the contract was terminated in January 1950.

Ammunition items produced in Lines 5 through 12 are listed in the following table:

TABLE V

PRODUCTION OPERATION ACTIVITIES

Load Line	Ammunition	Total Production Quantities
12	Ammonium Nitrate Grained	39,544,000
	Ammonium Nitrate Reworked	26,818,090
5 through 11	Misc Fuzes	19,257,297
	Misc Boosters	44,297,485
	Misc Primers	50,660,725
	Misc Detonators	79,580,576
	Percussion Elements	226,387,306

RVAAP operated during the period of 1951 to 1957 loading TNT and Composition B into 90mm, 120mm, 155mm, and 8" shells on Load Lines 1, 2, 3, and 4. The production items and quantities are shown in the following table:

TABLE VI

PRODUCTION OPERATION ACTIVITIES

Load Line	Ammunition	Total Production Quantities
1	Shell, HE, Comp B, M71, 90mm	218,747
	Shell, HE, TNT, M71, 90mm	1,573,790
	Cart, HE, M71, Smkls, 90mm	634,795
	Shell, HE, Comp B, M71, 90mm	49,546
	Shell, HE, TNT, M71, 90mm	1,491,982
	Shell, HE, Comp B, M71, 90mm	25,064

TABLE VI (Continued)

Load Line	Ammunition	Total Production Quantities
2 & 3	Shell, HE, M101, 155mm	256,585
2	Shell, HE, M73, 120mm	246,345
	Shell, HE, M73, 120mm	630,602
2 & 3	Shell, HE, M107, 155mm	5,619,243
2	Shell, HE, M101, 155mm	63,502
	Shell, HE, M106, 8"	946,922
1	Chg. Prop, M15, 120mm	1,038,064
	Cart, HE-T, T91, 90mm	592,674
	Cart, HE-T, T91, TNT, 90mm	1,945,659
	Shell, HE, Comp B, T15E, 120mm	34,829
	Cart, HE-T, Comp B, T91, 90mm	14,621
	Cart, HE-T, TNT, T91, 90mm	22,395
4	Mine, AT, HE, Heavy, T27	1,269,262

All load lines were shut down in 1957.

During the 1951 to 1957 time frame, MK2A4 percussion primers were manufactured on Load Lines 10 and 11 as shown in the following table:

TABLE VII

PRODUCTION OPERATION ACTIVITIES

Load Line	Ammunition	Total Production Quantities
11	Primer, Perc, MK2A4	9,927,118
	Primer, MK2A4	24,044,390
	Primer, MK2A4	438,075
	Repack Primer, MK2A4	1,504,935
10	Primer, M36A1	21,716,950
	Primer, M54	56,148,565
	Primer, Perc, M61	43,912,850
	Mfgr Metal Parts, F/Primer, M61	13,484,100
	Perc Element	49,286,628

All load lines were shut down in 1957.

During the period of 1961 to 1971, the facility was again activated in support of the Southeast Asia conflict. The following is a summary of the operations on the load lines.

Load Line 1 - (1961-1967). Removed fuzes, boosters, and primers from 500,000 90mm projectiles. Reconditioned the fuzes to M557 and shipped out.

Load Line 3 - (1967). Derusted and painted 155mm and 8" projectiles.

Load Line 2 - (1969-1971). Loaded TNT into 175mm projectiles. Total production - 372,803.

Load Line 3 - (1969-1971). Loaded Composition B into 155mm projectiles. Total production - 2,275,695.

Load Line 7 - (1969-1970). Production of 40mm projectiles. Total of 16,000,000.

Load Line 11 - (1969-1971). Produced 7,000,000 MR ZA4 fuzes.

Load Line 12 - (1969-1971). Produced 80,000,000 M54 primers.

All load lines were placed on standby in 1971 and have remained in this status to date.

b. Lessee Industrial Operations

Although there are presently no active industrial leases, one past operation and one ongoing operation deserve mentioning.

The Hercules Alcor operation circa 1965/67 has caused damage to the area which is still evident. When Load Line 12 was occupied for the production of aluminum chloride, the operation was environmentally unsafe. A fish kill in Cobb's Pond resulted from processed effluent flowing into the storm drain system. The building originally used for this process has deteriorated to such an extent from corrosion that it has been condemned and is awaiting demolition.

The operations presently being conducted by Firestone Defense Corporation in Load Line 6 involve applied research and development programs on shape charges for the Department of Defense. The amount of explosives (TNT, Composition B, and Octol) involved is minimal, not more than 900 kilograms per year. The explosive scraps and sweepings were burned at the burning grounds until recently when open burning was banned by the state

of Ohio. The scraps and sweepings are now stored in an igloo until an approved disposal facility is available. The cubicle flash water is filtered through sawdust for clarification and removal of residual explosive dusts. The filtered water flows to the storm drains.

c. Laboratory Operations

Building 1039, in the Plant Administration Area, houses the installation's main laboratory. It was used extensively during World War II, and again in the Korean War. There was, however, a limited amount of activity during the Southeast Asia (SEA) conflict. Explosive and hazardous wastes were collected and taken to the burning grounds to be disposed of safely. Other common laboratory wastes either went down the drain or went out with the office waste.

The Photo Lab is also located in this same building. Its activity parallels that of the Analytical Lab. Since the mid 1950's, solutions containing silver were further processed to recover this precious metal, and when a certain quantity had been accumulated, it was sold. With the current standby status of RVAAP, this building has been closed.

It was reported that a lab existed at the end of the Load Line 12 complex, and was associated with the ammonium nitrate production that occurred during World War II and again between 1946-1950. This building has since been torn down.

d. Proof and Surveillance Testing

Seven test areas were identified at this installation.

Firestone Defense Research, a subsidiary of Firestone Tire and Rubber Co., uses Load Line 6 for defense work under contract to Picatinny Arsenal. They are involved in the R&D of various kinds of charges (e.g., shaped, fragmenting disc) for armor penetration. The shaped charges are tested on one of our cubicles at (9), while the fragmenting disc is tested in the present Demolition Area. Three of the ground level cubicles are identical to each other while the fourth has a basement for vertical firing. The latter has sometimes been referred to as an "underground firing range." All tests conducted at this location are static and it has been operational since the early 1960's. Frequency of firing is approximately 1-2 charges per week.

A 40mm firing range (8) was located just north of Load Line 8. It was used between 1969-1971 and has been inactive since then. Each of the approximately 2,500 rounds fired on this range have been accounted for.

The present Demolition Area (2), just north of Load Line 11, is used by Firestone Defense Research. They test armor penetrating devices in which a metal disc (non-explosive) is projected toward a steel plate. Each firing is accounted for and frequency of use is less than once per week.

Building F-15 (12), located west of Block D, was used during World War II, the Korean War, and the Vietnam War to test miscellaneous explosives and propellants.[4] Quantities tested are unknown.

The Ammunition Sectionalizing Area (13), Building 1200, northwest of Load Line 2, was used for testing TNT and Comp B during World War II, the Korean War and the Vietnam War.[5] Information on total quantities was not available.

A Pistol Range (11) for training Security Guards is located north of the Winklepack Burning Grounds. It has been used since 1941.

In early 1975, a one time testing of a 14.5mm cartridge by the National Guard occurred in Training Area B. This location (14) is on the extreme east side of the installation and about 10 rounds were fired. Future testing will take place in two recently approved ranges for Training Areas D and E in the southwest.

e. Training Areas

The installation has two parcels of land which are used by the military for training. In the northeast section 368 hectares are divided into Areas A, B, and C, while the southwest section of 400 hectares contains Areas D, E, F, and G. These areas, shown on Figure 6, are used only on weekends and personnel are not permitted to fire live ammunition. Area B was used in the past by the National Guard for the firing of approximately 10 rounds of 14.5mm ammunition. Future firings of this caliber will take place in the two new approved ranges (which have not yet been developed) in Areas D and E.

Tracked vehicles are presently permitted in all areas and troops are also known to dig fox holes as part of training exercises. This is of particular concern since Areas D and G are the sites of the previous Demolition Grounds which might still contain UXO's. For this reason, it has been recommended that the leases be modified to preclude digging or excavating in Areas D, E, F, and G.

The present Demolition Area (10) is used by the FBI for training students on the use of explosives. Old automobiles are booby trapped and detonated and students then examine the wreckage and try to determine the type of explosive device used. This area has been used annually since 1975.

f. CBR Activities

The most significant radiological source at RVAAP was 1,281,264.3 kilograms of monazite ore stored in two steel tanks at the tank farm between 1947 and 1975. High levels of Thorium 232 concentrations were detected around the storage in mid 1970's. As a result of this high level

1. Demolition Area (Old)
2. Demolition Area (New)
3. Burning Grounds (TRK 49)
4. Burning Grounds (Fuze & Booster)
5. Burning Grounds (Winklepeck)
6. Landfill (Old)
7. Landfill (New) Ramsdell Q
8. Test Sites (40mm)
9. Test Sites (Firestone's 4 cubicles)
10. Test Sites (Firestone's Demolition Area Range)
    Test Sites (FBI Demolition Area Range)
11. Test Sites (Pistol Range)
12. Test Sites (Bldg. F-15)
13. Test Sites (Sectionalizing Area 1200)
14. Test Sites (14.5mm Range, Nat'l Guard)
15. Lead Azide Igloos

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

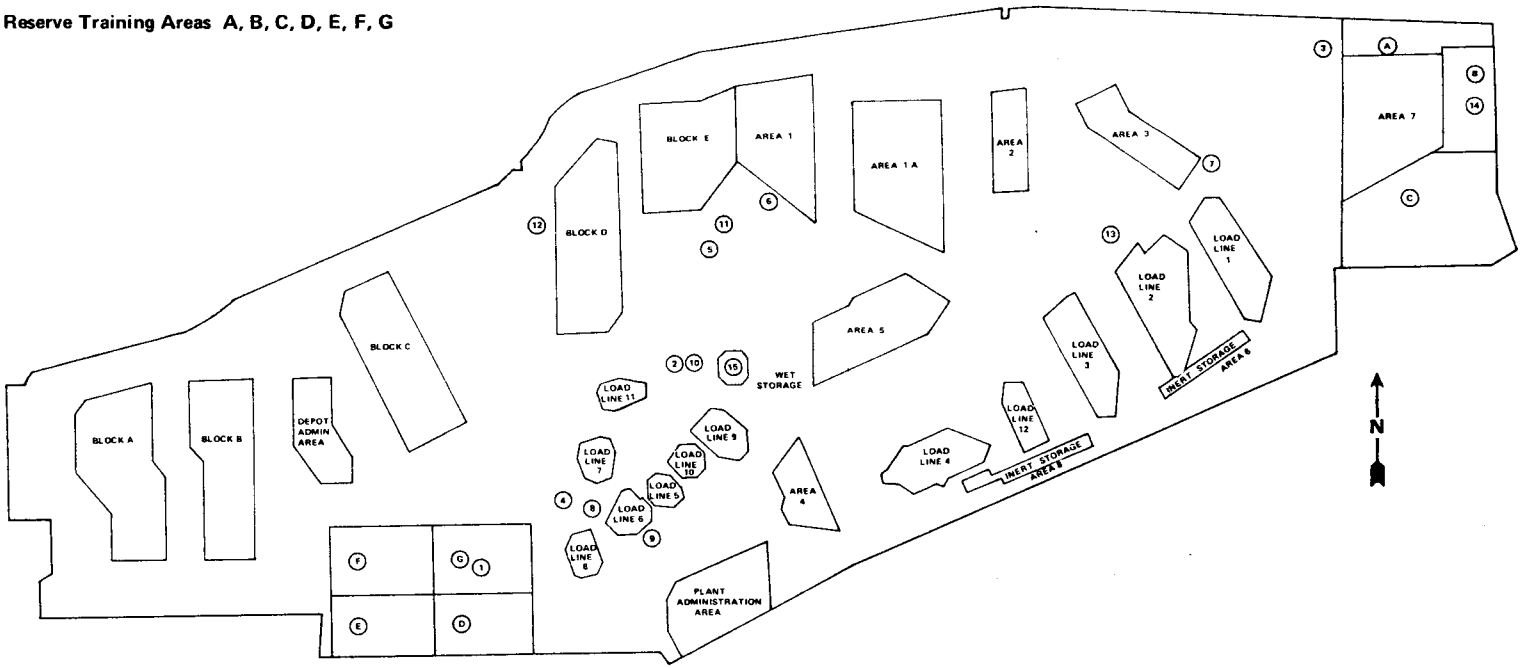

FIGURE 6 POTENTIALLY CONTAMINATED AREAS

concentration, the monazite ore was removed and sold in July, 1974, the storage tanks were tested, certified acceptable and sold to Regis F. Lutz, Warren, OH. Spilled material on the ground was placed in 208 liter (1) drums and landfilled in Sheffield, IL. The area was decontaminated and declared safe by Health Physics Associates, Ltd., a private consulting firm.

Other radiological items at RVAAP are sealed sources. No chemical or biological munitions have been manufactured or stored at RVAAP.

g. Storage of Toxic/Hazardous Materials

About 650 igloos at RVAAP are filled with the following explosives: TNT, Comp B, mines, boosters, nitroguanamine, and 90mm ammunition. Fifteen explosive storage magazines contain 90mm ammunition.

Strategic and critical materials are also stored at RVAAP. Types of materials stored are shown in Table VIII.

h. Pesticide/Herbicide/Fertilizer Usage

About 1,440 kilograms of herbicides are used each year at RVAAP, primarily along fences and rights-of-way and around buildings. Herbicides applied are 2, 4-D, 2, 4, 5-T, and bromacil.

Little insecticide usage occurs at RVAAP. Application is mainly limited to malathion and diazinon used against stinging insects on a request basis.

The pesticide storage-mixing area was well maintained and contained the required safety equipment. Both the pest controller and his supervisor were certified by the Army to handle and apply pesticides.

2. Disposal Operations

a. Waste Disposal

Three sewage treatment plants serve RVAAP: the Depot Plant, the Sand Creek Plant and the George Road Plant. Due to the present layaway status, the George Road Plant processes the bulk of the domestic waste for the installation. The Depot Plant operates on an intermittent basis, usually weekends, when various military reserve units conduct training programs in the area. The Sand Creek Plant is in layaway status.

All the sewage plants provide secondary treatment utilizing Imhoff tanks, trickling filters and post chlorination as the principal treatment operations. The Depot Plant has a design capacity of 190,000 liters per day and serves the Depot administration area. The Sand Creek Plant has a design capacity of 1,330,000 liters per day and serves Load Lines 1, 2, 3, 4,

TABLE VIII

RAVENNA ARMY AMMUNITION PLANT

STRATEGIC & CRITICAL MATERIAL			GENERAL SERVICES ADMINISTRATION		
DESCRIPTION	CLASS	TYPE	KGS SHIPPED	KGS ON HAND	TONNES
1. Antimony	SCM	Tank		3,050,479.8	3050.4798
2. Asbestos	SCM	Tank		2,759,111.5	2759.1115
3. Beryllium	US Supp	Whse		914,678.6	914.6786
4. Bismuth	SCM	Whse		135,010.8	135.0108
5. Chrome, Chemical	SCM	Unimproved		21,985,015	21985.0150
6. Chrome, Metallurgical	SCM	Unimproved		132,884,725	132884.7250
7. Chrome, Refractory	SCM	Unimproved		5,956,717.5	5956.7175
8. Cobalt	SCM	Igloo		347,164.2	347.1642
9. Cobalt	SCM	Whse		1,710,490	1710.4900
10. Ferrochrome	US Supp	Improved		44,139,741	44139.7420
11. Ferrochrome, Low Carbon	US Supp	Whse		10,287,841	10287.8410
12. Ferrochrome, Low Carbon	SCM	Whse		4,931,392.9	4931.3929
13. Ferrochrome, Silicon	US Supp	Whse		10,964,117	10964.1160
14. Ferromanganese, Medium Carbon	SCM	Improved		1,372,086	1372.0860
15. Lead	SCM	Whse		74,635.2	74.6352
16. Manganese, Battery Grade	SCM	Unimproved		25,720,832	25720.8310
17. Manganese, Metallurgical	SCM	Unimproved	20,595,550	181,890,122	181890.1219
18. Manganese, Metallurgical	D	Unimproved		26,861,823	26861.8230
19. Nickel Cathodes	SCM	Tank		5,641,934.8	5641.9348
20. Rutile	SCM	Tank		4,926,250.3	4926.2503
21. Talc	SCM	Whse		1,729,876.5	1729.8765
22. Titanium	D	Whse		1,714,044.6	1714.0446
			Total KGS	489,998,091	
			Total Tonnes	489,998	

and 12. The George Road Plant is identical to the Sand Creek Plant and serves Load Lines 5 through 11 and the administration area.

Infiltration of groundwater into the sewer lines has been recognized as a major problem for a number of years(2). A comparison of the flow rates reported for three months of 1978 for the water treatment plant and the George Road Sewage Treatment Plant indicates that the problem still exists (see Appendix C). Treatment efficiency is presently good, in spite of the high hydraulic load, due to the low waste load. However, in the event of mobilization, increased demands on the sewage treatment plants will cause a reduction in the effluent quality.

Secondary treatment plants are designed to reduce Biochemical Oxygen Demand and suspended solids by at least 90 per cent. However, current standards call for greater efficiencies of these parameters as well as ammonia and nitrate nitrogen limitations. Secondary treatment plants are not adequate to produce the required effluent quality and will require additional treatment steps if the RVAAP is to meet effluent limitations (3).

During the melt-pour and assembly operation in Load Lines 1, 2, 3, and 4, explosive dust, particles, spills and vapors collected on the floor and walls. The floors and walls were washed down with water and the wash liquid collected in settling tanks located throughout the building of each load line. The solids settled in the tank and the wash water overflowed and was pumped to concrete filter sumps filled with sawdust. The water was clarified by the sawdust then overflowed from the filter sump to a settling pond. The settled solids in the settling tanks and the sawdust in the filter sumps were cleaned out periodically and disposed of by burning.

The lines transporting the wastewater and suspected explosive solids flowed into either underground piping or open ditches to holding ponds. Over the years explosive wastes have accumulated in piping sections. During 1951, the load lines were rehabilitated, including the removal of explosive accumulations. The soil was removed to a depth where chemical analysis indicated no explosive contamination. All the contaminated lines that could be reached were removed and replaced. In spite of the renovation effort, many contaminated lines remain in each load line.

The potential contaminants in Lines 5 through 11 include lead azide, lead styphnate, black powder, TNT and Composition B. The lead azide and lead styphnate residues were destroyed chemically and the black powder was destroyed by leaching of the potassium nitrate using water before releasing to the storm drainage system. The TNT and Composition B residues were collected and burned. These load lines were rehabilitated in 1951 and the lines that were deactivated were decontaminated to the XX condition.*

* ARRCOM Regulation 385.5 - Contamination, Decontamination, and Disposal.

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

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

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

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

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

taken on the contaminated waste incinerator. These two projects should eliminate open field burning of any waste materials from future production.

Pink water has resulted largely from washdown and steam decontamination of equipment and building interiors. Each building usually has one or more interior settling tanks where large solid particles settle out. The effluent goes to an outside filter sump which consists of an inground concrete tank filled half way with sawdust. The sawdust acts as a filtering medium to remove finer particles as the water moves through the tank. Sludge from these two tanks is periodically cleaned out and disposed of by burning. The overflow is then directed to a settling pond for additional clarification and holding before emptying into a stream that eventually exits the installation. By this time enough filtering and dilution has occurred so that there have been no problems with pink water leaving post.

The laundry operation uses modified soda, low phosphate detergent, bleach and calgon to wash clothing. Wash and rinse water empties into the sanitary sewer system.

Used crank case oil from the automotive and locomotive repair shops is mixed with fuel oil and burned in Powerhouse 6.

There is an acid dip tank (approximately 190 liters), located in the Pipe Shop, Building 1035. Although it has not been used in the past few years, it did get some use during times of plant activity. When spent (2-3 times per year), the less than 190 liters of liquor was taken to Ramsdell Quarry and dumped.

b. Landfills and Burial Sites

Since World War II, both the Burning Ground Landfill, located east of George Road and south of Area 1 (6) and Ramsdell Quarry (7) have been used as a sanitary landfill. Although records for past activities are nonexistent, current operations are well documented and defined. Both sites are regulated by an Ohio EPA Solid Waste Disposal License issued in August, 1978. Presently, only Ramsdell Quarry is active with the other site in a standby status. In a typical week, approximately 675 kilograms of trash and 2,700 kilograms of demolition debris are dumped, with 15 centimeters of dirt covering the fresh material each day. The quarry also receives solid waste from the installation's sewage treatment plant. During the onsite visit, standing water was present in the quarry. Due to the location of the two sites and the type of ground conditions that exist in the immediate area, there have been no anticipated problems due to leaching and none have been reported.

Following World War II, napalm bombs were burned in the Ramsdell Quarry. In the early 1950's, residue from annealing operations was poured into the quarry. These operations are discussed later in the report under para III.A.8.d.

Two other documented operations of the quarry were as follows: The first involved the dumping and subsequent burning of some inert material in 1973 in support of the demilitarization operations of the M-71, 90mm cartridge at Load Line 1.[7] The second, also in 1973, concerned the demolition of Load Line 12 (originally the ammonium nitrate line and later leased by Hercules Alcor for the manufacturing of aluminum chloride). In the cleanup of this abandoned area, the remaining piles of aluminum chloride, suspected contaminated earth and building rubble were taken to the quarry and dumped.[8]

A report by USAEHA, dated September 1977,[9] stated that a portion of the "Burning Grounds" (5) was used as a landfill. The trash and garbage were deposited in trenches approximately one meter deep and covered with earth. The report also said that this area was not currently used for landfilling.

One site where mustard agent was reported to have been buried before 1950 was found at RVAAP.[10] This area was located within the old demolition grounds, now known as Training Areas D and G. The information obtained by interviews and old files was quite sketchy and incomplete. Personnel contacted knew nothing more than a general story which was that the 68th EOD Detachment excavated the site in August, 1969. At this time the Detachment recovered one 189 l drum and 7 small cans in rusty condition. All 8 items were empty and no evidence of contamination was found. This story was supported by available documentation but was further confused by subsequent correspondence during the next two years. On 30 June 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 17 July 1970 and stated that they would comply with the request. There was no further action until 11 June 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 gas 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 X 6 X 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 in regards to details on this burial site. Personnel were not familiar with this subject and stated that records would no longer be available.

c. Holding/Settling Ponds

Each of the Load Lines 1, 2, 3, and 4 had a settling pond to collect the clarified water effluent from the LAP operations. The settling ponds are naturally formed ponds, and are thus unlined. The settling ponds are in the storm drainage system of the installation and collect drainage water from the area adjacent to the local lines as well as load line effluent.

The load line effluent to the settling ponds passes through settling tanks to remove solids and filtered through sawdust for chlorification and removal of nitro-compounds prior to discharge into the storm drainage system.

d. Demilitarization

Beginning late in 1945 the demilitarization of ammunition considered unsafe, obsolete or unserviceable became a major project at RVAAP. Initially the shells and mines were defuzed and the TNT and smokeless powder from them burned at the ammunition burning grounds. During the first six months of 1946 approximately 920,353.5 kilograms of TNT, 1,956,699 kilograms of smokeless powder, 674,193 fuzes, 14,233 mines, 15,012 British Bomb Throwers and 7,338 signals were burned or demilitarized.

18,810 - 500 pound incendiary or napalm bombs were burned in the Ramsdell Quarry.

In 1946, the major demilitarization projects generated the quantity of scrap metal which was sold to industry as shown in Table IX below:

TABLE IX

SCRAP METAL SOLD TO INDUSTRY

	Scrap Metal in Metric Tons - 1946
Debanded 4.5" shells	2,106
Disassembled 75mm shells	3,452
Debanded 240mm shells	280
Burned Land Mines	245
Debanded 76mm and 3" shells	3,255
Burned Napalm Bombs	1,440
Demiled 105mm shells	99
TOTAL	10,877

The number of demilitarization projects increased during the period of 1947 through 1949. The load line building began to be utilized for the projects. Disassembly equipment, including a debanding machine was installed in Load Line 2. A TNT washout plant was installed in Load Line 2 for removal and recovery of explosives. Approximately 1,800,000 kilograms of TNT were salvaged in this period and sold to American Industry.

In order to perform anticipated major projectile renovation work on the load lines, the TNT washout plant and the debanding equipment were moved from Load Line 1 to Load Line 12 in late 1949.

The TNT washout plant in Load Line 12 was converted in 1950 to a melt out process to recover and upgrade the quality of TNT and Composition B for sale.

The demilitarization programs continued from 1951 through 1957. Table X presents type and quantities of ammunition demilitarized during this period.

Between 1950 and 1952, Load Lines 1, 2, and 12 were involved with reclaiming cartridge bases for reuse. In the annealing process used for reclaiming, sulfuric acid, sodium ortho silicate, chromic acid and alkali were used. The residue from the annealing process was poured into Ramsdell Quarry.

In 1961, demilitarization operations started for the disposal of bombs stored at the depot. The TNT and Composition B were removed by melting in Load Line 12 melt process system. The bombs were then taken to the burning grounds and fired to remove residual explosive and certify them XXXXX* condition. The salvaged explosive was sold to America Explosive Industry and the burned out bomb cases sold as scrap metal to bidders.

During 1962, the demilitarization of bombs was stopped. The bombs were needed for the Southeast Asia Conflict. The remaining bombs in the depot were renovated and shipped.

The number of bombs demilitarized during this period is as follows:

500 pound bombs	13,951
1000 pound bombs	20
2000 pound bombs	227

The roll-off operation in inert 120mm projectiles was performed as a Scrap and Salvage operation in 1963. Demilitarization of 120mm propellant charges and the 90mm cartridge was run on Load Line 1 during 1965 and 1966. The 90mm cartridge cases were generated for reuse; projectiles were burned out and sold as scrap; the M557 fuzes were reboostered, packed and stored for future use.

Demilitarization operations on 90mm cartridges (455,475) started in June, 1973, and were completed in March, 1974, on Load Line 1. Meltout operation was conducted on Load Line 12.

* AARCOM Regulation 385-5, Contamination, Decontamination, and Disposal.

TABLE X

AMMUNITION DEMILITARIZED 1951-1957

Line No.		Quantity
3	Shot, AP-T, M74, 37mm	219,773
3	Shot, AP-T, M80, 37mm	360
F-15 & Demo. Gr.	Shot, APC-T, M51, 37mm	80
2-B-6	Shell, HE, M65A1, 4.5"	214,879
3 & 12	Shell, HE, M41A1, 75mm	6
F-16	Shell, HE, M48, 75mm	302,304
F-16	Shell, WP, M64, 75mm	127
F-16	Shell, HE, M66, 75mm	599
3 & 12	Shell, HE, M41A1, 75mm	6
2-B-6 & Demo. Gr.	Cluster, Frag. Bomb, M1	2,481
3	Shell, HE, M1, 105mm	8,015
3 & 12	Shell, HE, M1, 105mm	1,270
Depot	Shell, HE, M101, 155mm	1,456
12	Shell, HE, MK3, 155mm	2,321
2-B-6	Shell, AP, M112, 155mm	15,377
Nitrate	Rocket, HE, 45, M8A3	16,990
B. G.	Mine, AT, HE, M1A1	46,179
F-16	Fuze, PD, M51A5	20,028
F-15	Fuze, PD, M46	120,130
Demo. Gr.	Fuze, PD, M52	244,182
B. G.	Fuze, Grenade, Hand, M6A4C	600
Demo. Gr.	Fuze, MF, M43A5	11,965
Demo. Gr.	Fuze, PD, M48	4,831
F-16	Fuze, T8Q, M54A1	11,345
F-16	Fuze, M55 & M54	185,483
B. G.	Fuze, Grenade, Hand, M6A4C	362,059
Demo. Gr.	Fuze, M53	97,111
Demo. Gr.	Fuze, PD, M58	24,601
Demo. Gr.	Fuze, TSQ, M77	11,293
F-16	Fuze, M61A2	3,759
F-16	Fuze Body, M55A3	1,500
Demo. Gr.	Booster, M20A1 & M21A1	30,840
B. G.	Primer, Perc., M32	128,309
B. G.	Primer, Perc., M22A2	5,000
Depot	Primer, Perc., M28B2	262,956
B. G.	Primer, M49	22,923
B. G.	Detonator Ass'y, F/M46 & M47 Fuze	403,367
2-B-21	Case, Cart., M18, W/Loaded Primer, 75mm	19,998
20-X-3	Flare, AC, Para. AN-M26A1	7,853
B. G.	Demil Primer, MK2A4	195,220
B. G.	Demil Primer, M28B2	2,191

e. Spills

In July of 1957, wastes from manganese ore piles contaminated a farm pond located east of RVAAP. All vegetation in the pond turned brown and cattle refused to drink the water.[11]

Surface water from rainfall carried waste from at least two ore piles to a swamp adjacent to the pond and thence to the pond. Additionally, large quantities of the waste were precipitated on the ground. Analysis indicated a high sulfate content and a pH between 10.0 and 11.0.

To eliminate the problem, the direction of the waste flow was changed and a small impounding pond was constructed to control the flow of wastes reaching the receiving stream and eventually the Mahoning River.

Dilution water was pumped into the farm pond continuously for a period of time. In approximately six months, natural vegetation returned and water analyses indicated no adverse conditions.

On 15 November 1966, there was a large fish kill at North Cobb's Pond. The cause was attributed to improper handling of materials (aluminum chloride) during manufacturing operations which were conducted in Building FF19 (Load Line 12).[12] The bulk of the aluminum chloride was scooped up and trucked to the Ramsdell Quarry landfill, where it was allowed to decompose by weathering.[13]

The contaminated pond, receiving the contaminating waste from drainage ditches, was permitted to settle, then drained, and the contaminants removed to Ramsdell Quarry by truck. Contaminated metals involved were flashed at a burning ground to a 5x condition, then sold as scrap.

At the time, Building FF19 had been outleased to Hercules Alcor, Inc., for a five year period (21 December 1964 to 20 December 1969). The lease was terminated on 8 November 1967.

B. Water Quality

At RVAAP over one hundred test wells have been drilled at various times in an attempt to obtain sufficient potable water for the needs of the installation during production periods. Of these, fifteen[14] wells have been considered producing wells and have been used on a rotating basis. (See Figure 7). Continuous use of a single well for up to sixteen hours can exhaust the water supply temporarily. A recovery period of twenty-four hours then becomes necessary.[15] At the time of the team's survey, five wells were in active use. Well Nos. 45, 60 and 68 were used regularly. Well Nos. 28 and 29 were used periodically to help maintain pressure and test water treatment plant number two (on standby).

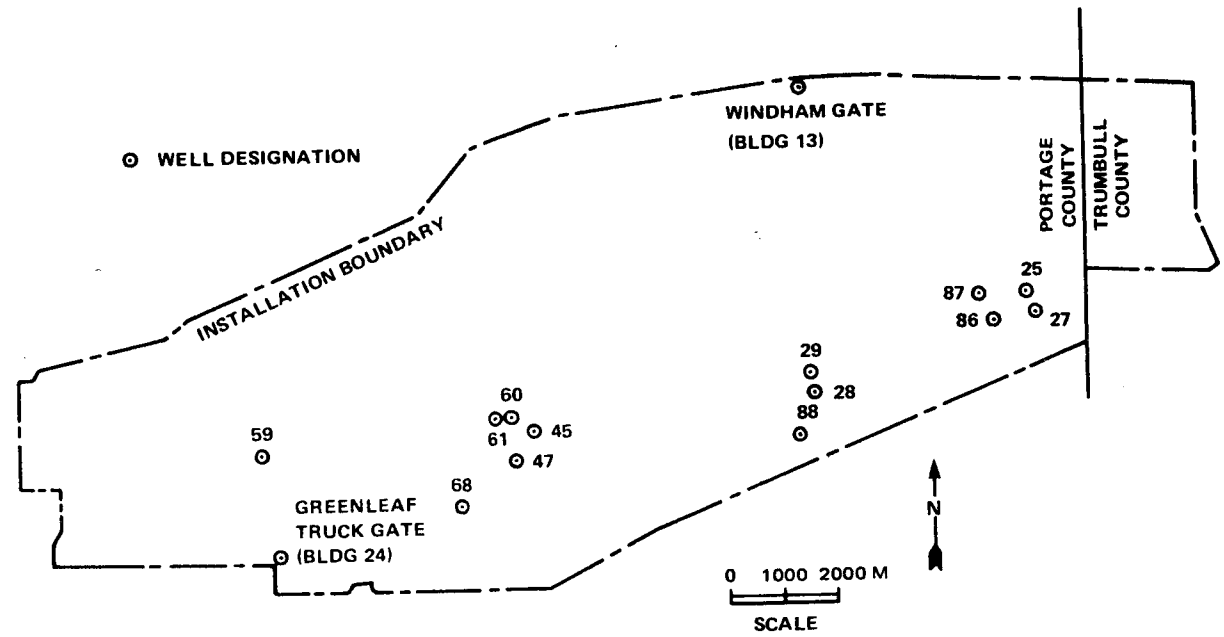

FIGURE 7 LOCATION OF PRODUCTION WELLS

The well water is treated at one of three water treatment plants by means of aeration, filtration, softening and chlorination and then distributed (throughout the installation) by a single distribution system. Number one plant is located at the southern end of Load Line 1. Number two plant is located at the southern end of Load Line 12 and number three plant is located immediately south of Load Line 7. A fourth plant is located in the depot area and provides chlorination only on an intermittent basis, usually weekends for reserve training units.

Recently, a new water treatment plant was constructed adjacent to water works number three and placed in service in the summer of 1978. It is planned that, beginning in December, 1978, RVAAP will obtain its water supply from the Michael J. Kirwan Dam and Reservoir (formerly West Branch Reservoir) immediately south of the installation. It is anticipated that the Kirwan Reservoir and the new water treatment plant will provide the 5.7 million liters per day needed to meet the estimated maximum mobilization requirements.[16] The three older water treatment plants have been placed in a standby status. At the time of conversion, the wells will also be placed on standby.

The new water treatment plant has as its only waste stream the salt brine and rinse water used to regenerate the zeolite softeners. This waste is discharged to a series of three settling ponds, with the decant discharging to Hinkley Creek. At the present time, this plant is the only water treatment plant in operation.

RVAAP has a treated water storage capacity of approximately 28 million liters, consisting of six elevated steel water tanks, three underground concrete clearwells and an open reservoir.

Analysis of the water from eleven wells[14] indicates potable quality, though very hard and high in iron and manganese content (table XI). Trace amounts of 2, 4, 6 - TNT were detected by the Gas Liquid Chromatograph (GLC) in most of these wells, but no isomers or other nitrotoluenes were detected. No increase in the amounts of TNT is expected, since the installation has been on layaway status since 1971.[14] The projected installation of activated charcoal filters on the load lines, if mobilization occurs, should preclude any further TNT contamination of groundwater.

A water monitoring program has been in existence at RVAAP since 1945.[17] Information as to the extent of the early stages of this program was not available at the time of the team's visit. At the present time, due to the layaway status, only two outfalls are required to be monitored. One (HC-11 or 004) is just inside the southern boundary where Hinkley Creek exits the installation. This point monitors the effluent from the water treatment plant. The second (D-22 or 002) is also located on the southern boundary and monitors the effluent from the George Road sewage treatment plant. In the event that mobilization occurs, eighteen additional monitoring points have

TABLE XI

RVAAP GROUNDWATER QUALITY (ALL VALUES REPORTED IN TERMS OF MG/L UNLESS OTHERWISE SPECIFIED)

	Installation Wells										
Parameters	(Windham Gate) 13	(Greenleaf Truck Gate) 24	25	27	28	29	45	59	60	68	86
Alkalinity (as $CaCO_3$)	180	212	148	130	235	233	120	256	266	156	205
Chloride	1.8	177	12.7	114	0.5	0.3	27.9	1.3	1.0	18.3	15.6
Fluoride	0.19	0.26	0.18	0.24	0.11	0.11	0.14	0.16	0.17	<0.10	0.19
Hardness (as $CaCO_3$)	259	562	276	202	349	354	245	345	374	321	414
Nitrate/Nitrite (as N)	<0.04	0.83	<0.04	<0.04	0.04	0.09	<0.04	<0.04	<0.04	<0.04	<0.04
pH (pH units)	7.1	6.8	6.8	6.8	7.0	7.1	6.7	7.1	7.2	6.9	6.9
Specific Conductance (μmhos/cm)	445	1350	860	800	680	650	480	660	700	630	700
Sulfate	38	230	250	108	95	88	74	75	78	130	145
Total Dissolved Solids	283	902	613	470	448	428	333	421	450	444	540
Total Organic Carbon	3	2	2	1	1	2	1	2	2	2	3
2,4,6-TNT	0.001	0.001	0.002	0.001	<0.001	0.007	0.002	<0.001	0.001	0.004	0.001
Gross Alpha (pC/ℓ)	2.8	3.2	<1.1	<1.1	3.0	3.1	1.8	<1.1	<1.1	<1.1	<1.1
Gross Beta (pC/ℓ)	1.2	5.2	2.7	2.6	3.7	3.3	2.0	4.2	3.1	3.7	4.4
Arsenic	<0.010	<0.010	<0.010	<0.010	0.033	0.020	<0.010	<0.010	<0.010	<0.010	<0.010
Barium	<0.30	<0.30	<0.30	<0.030	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium	64.5	15.4	50.1	50.1	97.2	93.0	56.6	94.1	99.5	78.0	97.4
Copper	<0.025	0.072	0.246	<0.025	0.128	<0.025	<0.025	<0.025	<0.025	<0.025	0.164
Chromium	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Iron	2.57	1.96	8.70	8.30	1.99	1.96	5.80	25.0	1.57	25.3	1.57
Lead	<0.005	0.012	0.023	0.006	<0.005	<0.005	<0.005	0.007	0.006	0.010	0.008
Magnesium	18.2	38.0	21.6	18.5	29.0	28.7	20.5	27.8	30.3	24.0	31.0
Manganese	0.144	<0.030	0.218	0.825	0.240	0.060	0.434	0.548	0.196	0.749	0.486
Mercury	<0.0002	0.0002	<0.0002	0.0003	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	0.0002	<0.0002
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Silver	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025	<0.025
Sodium	6.2	96.1	102.2	94.1	12.7	11.4	10.0	8.6	10.5	15.0	2.9
Zinc	0.505	2.40	0.214	<0.015	0.019	<0.015	<0.015	<0.015	<0.015	0.080	0.170

been recommended (figure 8). An analytical schedule has also been proposed for the twenty monitoring sites.[19]

RVAAP has an NPDES permit, Number OH 0010936, in effect since August 1973 (Appendix D). While oil and grease limits have been exceeded on occasion, only one formal violation of the permit has been issued by the USEPA, Region V. This violation was due to a failure to file a quarterly report for the October through December 1977 period. Since that time, effluent analyses have been performed by a private laboratory. Analyses required by the NPDES permit are: Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), fecal coliform, suspended solids, dissolved solids, ammonia, nitrate, chlorine residual, oil and grease, pH and water flow.

All the drainage and waste waters from RVAAP flow to either the West Branch of the Mahoning River, Kirwan Reservoir, Hinkley Creek, or Eagle Creek. The State of Ohio EPA has classified all of these waters for "Primary Contact Recreation," "Public Water Supply," "Well-Balanced Warm Water Fishery," "Industrial Water Supply," and "Agricultural Use and Stock Watering".[18]

The West Branch Mahoning River is the major surface stream in the area of RVAAP. It flows by the west end of the plant generally in a north to south direction before flowing into the Kirwan Reservoir on the south side of the plant. It then flows out of the reservoir along the south side of the plant before joining the Mahoning River on the east side of the plant. Virtually all of the wastewater from the load lines flows into this stream.

Hinkley Creek flows through the western portion of the plant. It flows from north to south and empties into Kirwan Reservoir outside the plant boundary. The major discharges into the creek are from the depot sewage treatment plant and the wastewaters from the new water treatment plant. The old water treatment plant (#3) has in the past years, also discharged into this creek.

Eagle Creek is a tributary of the Mahoning River. It enters the plant boundary on the north and flows east for three to five kilometers before leaving the north side of the plant. The only wastewater that flows into Eagle Creek comes from Sand Creek, which empties into Eagle Creek just prior to leaving the plant. Sand Creek flows through the center of the installation including the demolition and burning ground and is the principal recipient of surface drainage from the plant. Sand Creek also received discharges from Sand Creek sewage treatment plant, water treatment plants, numbers 1 and 2, and boiler plant blowdown and discharges from the load lines when the plant was operational.

When the plant was in production, small volumes of industrial wastes were generated at various areas within the installation.[18] The major source of wastewater at the explosive loading operations conducted in load lines one through four and twelve (wash-out operations) consisted primarily

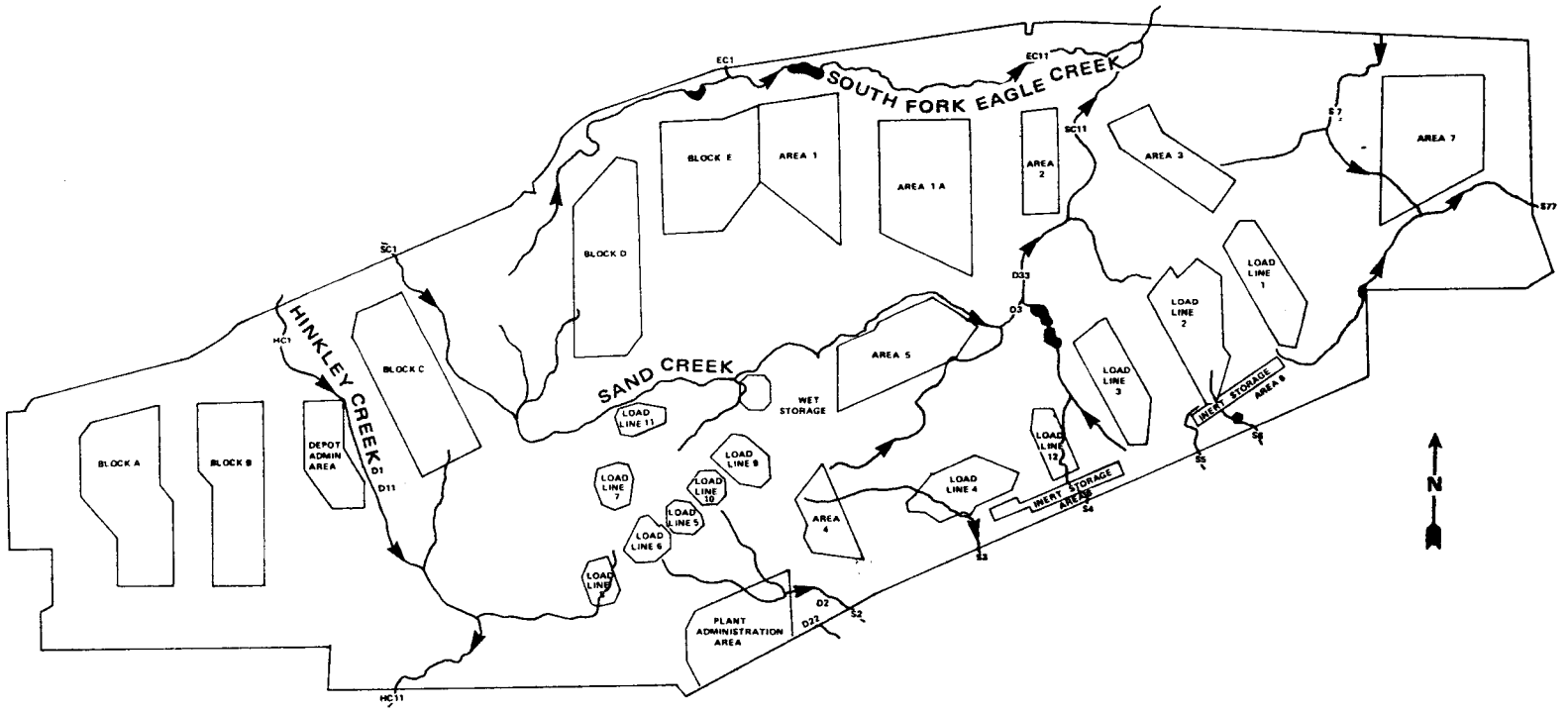

FIGURE 8 MONITORING POINTS

of TNT and RDX formulations. Treatment of the condensed steam and washdown water consisted of sawdust filters, settling and cooling by detention ponds before discharge to streams on the installation.

There are seven steam plants on the installation, only one of which is presently operational. All seven plants utilize deionizers which are regenerated with sulfuric acid. The backwash and rinsewaters from the deionizers are discharged to the various surface streams throughout the installation. All fuel oil storage areas are diked.

Laundry wastes at RVAAP pass through filters and are discharged to the sewer system for treatment at the George Road Sewage Treatment Plant. Presently, the laundry is not operating.

Wastes from the motor pool and maintenance shops go to oil separators in floor drains. The wastewater from washing operations flows to the sewer system for treatment at the sewage treatment plants. Waste oils are filtered and recycled by burning with fuel oil at the steam plants. Excessive flows to the oil separators are the cause of the occasional high levels of oil and grease found in the sewage treatment plant effluent (appendix C).

All storm water runoff is carried by open ditches and creeks to points off the installation.

Records of effluent analyses during production years were not available.

Table XII lists the various contaminants produced on some of the load lines during production based on 63 shifts per month.[19-24]

In August, 1949, the ammonium nitrate fertilizer graining and bagging operations (Load Line 12) were investigated to determine whether any health hazard existed due to waste disposal procedures.[25] At that time the city of Warren, Ohio (40 kilometers downstream from the ammonium nitrate plant) was using the Mahoning River as the source of its water supply. In November and December, 1948, the nitrate level of the raw water at Warren was found to average 4.1 ppm expressed as nitrogen, with a low of 1.2 and a high of 15 ppm. Improvements in the operations and housekeeping at RVAAP during early 1949 reduced nitrate to an acceptable level (<10 ppm) to an average of 0.8 ppm, with a low of 0.3 and a high of 1.5 ppm. These improvements also resulted in a reduction of the ammonia levels at Warren.

C. Migration Potential

During the past operations at RVAAP, especially in times of peak production, large quantities of contaminated waste were generated and every effort was made to retard its migration off post by surface routes. The procedures used to stop or retard the migration (sawdust filters, settling/

TABLE XII

LOAD LINE CONTAMINANTS/MONTH

	Material	Kilograms	Cu. Meters	Liters
Load Line 2	Comp B	9,211.5		
2,040,000# Comp B/month	scrap, sludge, dust			
	fumes and dust		5,166,000	
19	red water			3,192,000
Load Line 3	TNT			
2,550,000# TNT/month	scrap, sludge, dust	11,930		
	fumes and dust		14,923,776	
20	red water			3,393,400
Load Line 4	TNT			
3,885,000# TNT/month	scrap, sludge	9,173.25		
	fumes and dust		14,333,760	
21	red water			304,836
Load Line 10	No. 70 mix			
No. 7 Primer Mix 9,369#/month	sludge	114.75		15,200
	TNT	4.5		
22	Antimony	22.5		
	Lead thiocyanate	11.25		
Load Line 11	Black powder			
Black Powder 8,100#/month	sludge	70.2		12,160
23	scrap primers	4.5		
Load Line 12				
154,600# TNT	TNT, Comp B			
250,900# Comp B	Fumes		4,309,200	
(Non-concurrent operation)	Red Water			324,000
24	Scrap	684		

retention ponds in line with natural drainageways, resulting in flushing action) should reduce the concentration of contamination to a permitted level according to documents reviewed. Top soil around some of the load lines has been removed, flashed and replaced with noncontaminated soil. The holding/retention ponds are unlined and retain their water level even during dry periods which indicates the underlying clay till prevents any significant percolation.

IV. FINDINGS

A. CONTAMINATION POTENTIAL

1. Installation Industrial Operations

a. Of 12 load lines, 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, primers, and boosters were manufactured on Load Lines 5 through 11. Load Line 12 housed the ammonium nitrate plat from 1941 to 1950.

2. Lessee Industrial Operations

a. There are presently no active industrial leases.

b. Hercules Alcor produced aluminum chloride during the period 1965 to 1967. Dumping of effluent into the storm drain system resulted in a fish kill in Cobb's Pond during this time frame.

c. Firestone Defense Corporation has operated Load Line 6 since 1950, conducting applied research on shaped charges. Until recently, explosive scraps and sweepings were burned at the burning grounds.

d. Kent State is licensed to use one water well for geology class instruction.

3. Training Areas

a. Two parcels of land are used by the military for training. No live ammunition firing is permitted. Tracked vehicles presently operate in areas which are suspected to contain UXO's.

b. The FBI uses the Demolition Area for training students on the use of explosives.

4. Proof and Surveillance Testing

a. Seven test areas were identified.

(1) Firestone Defense Research conducts tests involving R&D of various kinds of charges using Load Line 6.

(2) A 40mm firing range was used between 1969 and 1971.

(3) A demolition area is used by Firestone Defense Research to test armor penetrating devices.

(4) Building F-15 was used during World War II, the Korean conflict, and the Vietnam War to test miscellaneous explosives and propellants.

(5) The Ammunition Sectionalizing Area, Building 1200, was used for testing TNT and Composition B during the past three wars.

(6) Since 1941 a pistol range has been used for training security guards.

(7) In early 1975 a one-time testing of a 14.5mm cartridge by the National Guard occurred in Training Area B.

5. Laboratory Operations

a. The main laboratory, in Building 1039, was used extensively during World War II and the Korean War but little during the Vietnam War. Explosive and hazardous wastes were collected and taken to the burning grounds.

b. The Photo Lab processed solutions to effect silver recovery from mid 1950's until RVAAP was placed on standby in 1971.

c. A lab once associated with the ammonium nitrate production has been torn down.

6. CBR Activities

a. Monazite ore, containing Thorium 232 and other rare earths, was stored in two steel tanks between 1947 and 1975. Due to high levels of radiation, the ore was removed, the area was scraped, residue was packaged in 208 l drums, and sold. The area was decontaminated and subsequently declared safe by a private consulting firm in 1975.

b. No chemical or biological munitions have been manufactured or stored at RVAAP, although mustard agent is reported buried at RVAAP.

7. Storage of Toxic/Hazardous Materials

a. Approximately 650 igloos at RVAAP are filled with explosive materials.

b. Strategic and critical materials are also stored on the installation.

8. Disposal Operations

a. Waste Disposal

(1) Three sewage treatment plants serve RVAAP when in a production status; only one is now operating.

(2) A long standing problem involves infiltration of groundwater into the sewer lines. The low waste load due to present status limits the problem; increased demands in event of mobilization will cause a reduction in effluent quality.

Washdown of explosive dusts and particles was collected in settling tanks to allow solids to settle. Overflow was filtered through sawdust. Periodically, settled solids and sawdust were burned.

Underground piping used for transporting wastewater and explosive solids has become contaminated. A renovation project in 1951 removed many lines but many still exist. Potential contaminants in Lines 5 through 11 include lead azide, lead styphnate, black powder, TNT, and Composition B.

All residues, dusts, and spills occurring in the Line 12 operation (ammonium nitrate) were washed into the storm drainage system.

Three burning grounds and two demolition areas were used for destruction of explosive wastes and devices as well as for demilitarization operations.

Pink water has been collected, filtered in sawdust, and further settled. Sludge from these collecting systems was removed periodically and disposed of by burning. Overflow from these collection systems empties into streams exiting the installation.

Effluent from the laundry operation including detergent, bleach, low phosphates, etc., empties into the sanitary sewer system.

b. Landfills and Burial Sites

Two areas have been identified as being used as sanitary landfills since 1941. Until 1978, when EPA regulations were imposed, records on disposal practices were non-existent.

The present sanitary landfill, known as Ramsdell Quarry, has been used in the past to burn napalm bombs, dispose of aluminum chloride and spent liquor waste, and to dump and burn inert material from demilitarization operations.

V. CONCLUSIONS

A. Areas of RVAAP, including the production areas, burning grounds, test areas, and demolition areas, are contaminated with explosive waste to include: TNT, Composition B, lead azide, lead styphnate, and black powder.

B. Surface waters exiting the installation are not presently required to be monitored for nitrobodies and heavy metals.

C. The current analysis of the well water indicates potable quality.

D. UXO's are in the demolition area.

E. There is no environmental stress at RVAAP.

F. The chemical agent mustard may be buried within the old demolition grounds.

G. The Ramsdell Quarry site landfill as it has been and is presently being used could constitute a potential leaching problem.

H. Although the subsurface soil structure prevents any quick percolation, the finding of trace quantities of 2, 4, 6 - TNT in the wells indicates that some leaching has occurred.

I. A potential radiological problem (monazite ore) was removed, clearance of the area was obtained, and that portion of the NRC license was properly handled.

VI. RECOMMENDATIONS

A. That no preliminary survey be conducted at the present time.

B. That the installation augment its water quality program to monitor surface waters and subsurface well waters to include analysis for nitrobodies and heavy metals as well as normal parameters. Specifically, wells to the east of Ramsdell Quarry (Nos. 25, 27, 86, 87, and 88) should be monitored annually to determine if leachate (nitrobodies and heavy metals) is moving from the quarry.

C. That digging or excavating within the demolition area (located in Training Areas D and G) be prohibited by RVAAP until the area has been certified safe by an EOD team.

D. That RVAAP investigate the area where mustard agent is suspected, to insure survey by an EOD team and, if required, excavation, monitoring, and decontamination of the area be performed.

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U. S. Army Environmental Hygiene Agency, "Report of General Sanitary Engineering Survey", Survey No. 24-005-70, Ravenna Army Ammunition Plant, 7-12 September 1969.

_____, "Geohydrologic Consultation", No. 24-0061-78, Ravenna Army Ammunition Plant, 12-16 September 1977.

Winslow, J. D. and White, G. W., "Geology and Goundwater Resources of Portage County Ohio", U. S. G. S. Professional Paper 511, 1966.

APPENDIX A

LIST OF KEY PERSONNEL INTERVIEWED

LIST OF KEY PERSONNEL INTERVIEWED

NAME	POSITION
Benton, R. E.	Inspector
Bungard, R.	Locksmith
Di Mauro, Joseph N.	Manager, Stores and Transportation
Duer, John	Plant Engineer
Emerson, Dave	Commander's Representative
Everhart, Willis R.	Pest Controller
Kirsch, Kenneth P.	Roads and Ground Supervisor
Riesterer, Oscar D.	Safety Manager for GOCO, retired
Swaebly, Lyle R.	Manager, Engineering Section
Talkowski, John P.	Industrial Relations and Operations Manager
Walters, Robert B.	Chief, Plant Protection

APPENDIX B

Photographs

of

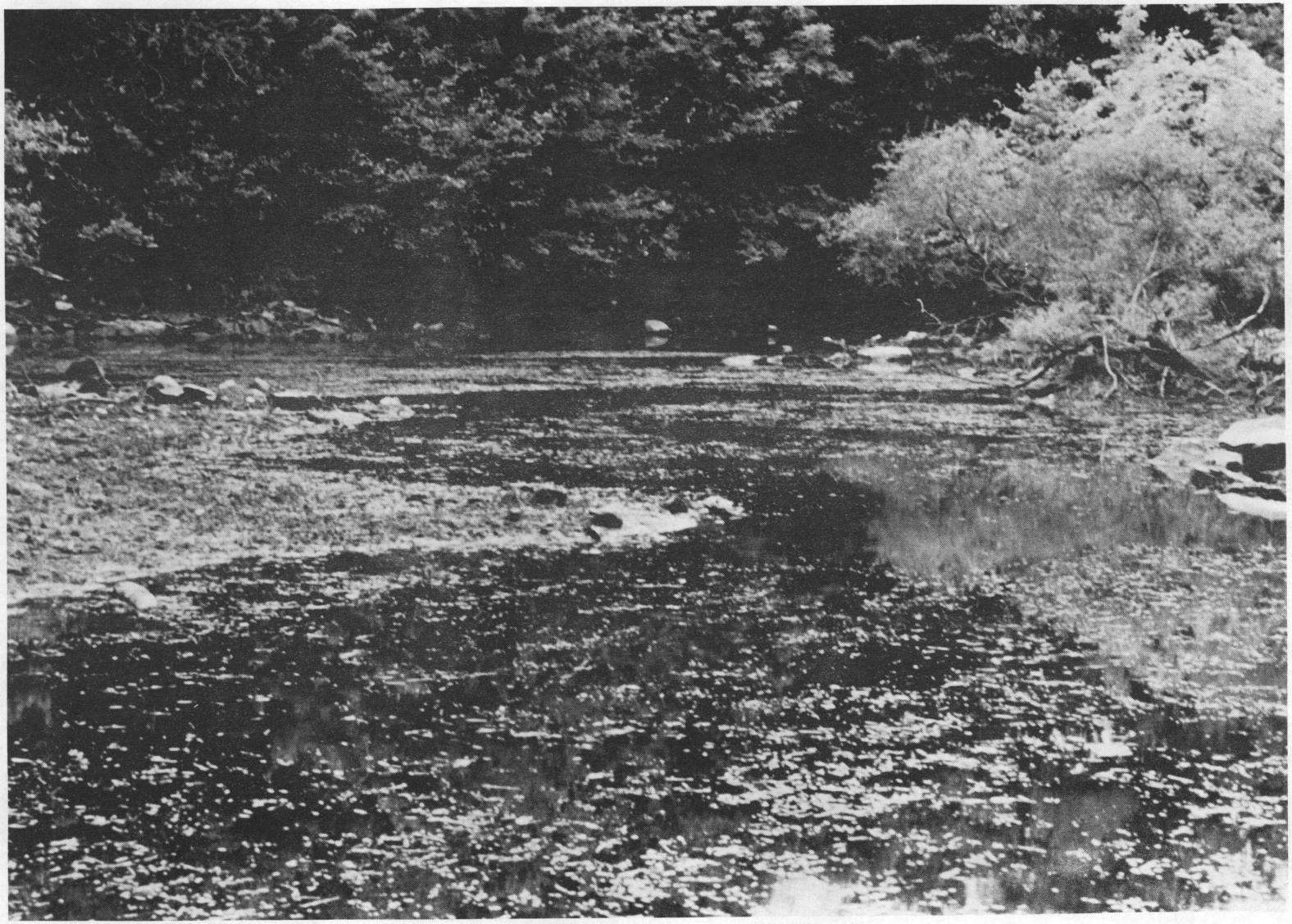
Ravenna Army Ammunition Plant

NOTE: Numbers in circles are keyed to Figure 6.

ERIE BURNING GROUND (3)

WINKLEPECK BURNING GROUND (5)

QUARRIES IN BLOCK A



QUARRY IN BLOCK A

SWAMP AND MARSH AREA, ERIE BURNING GROUND (3)

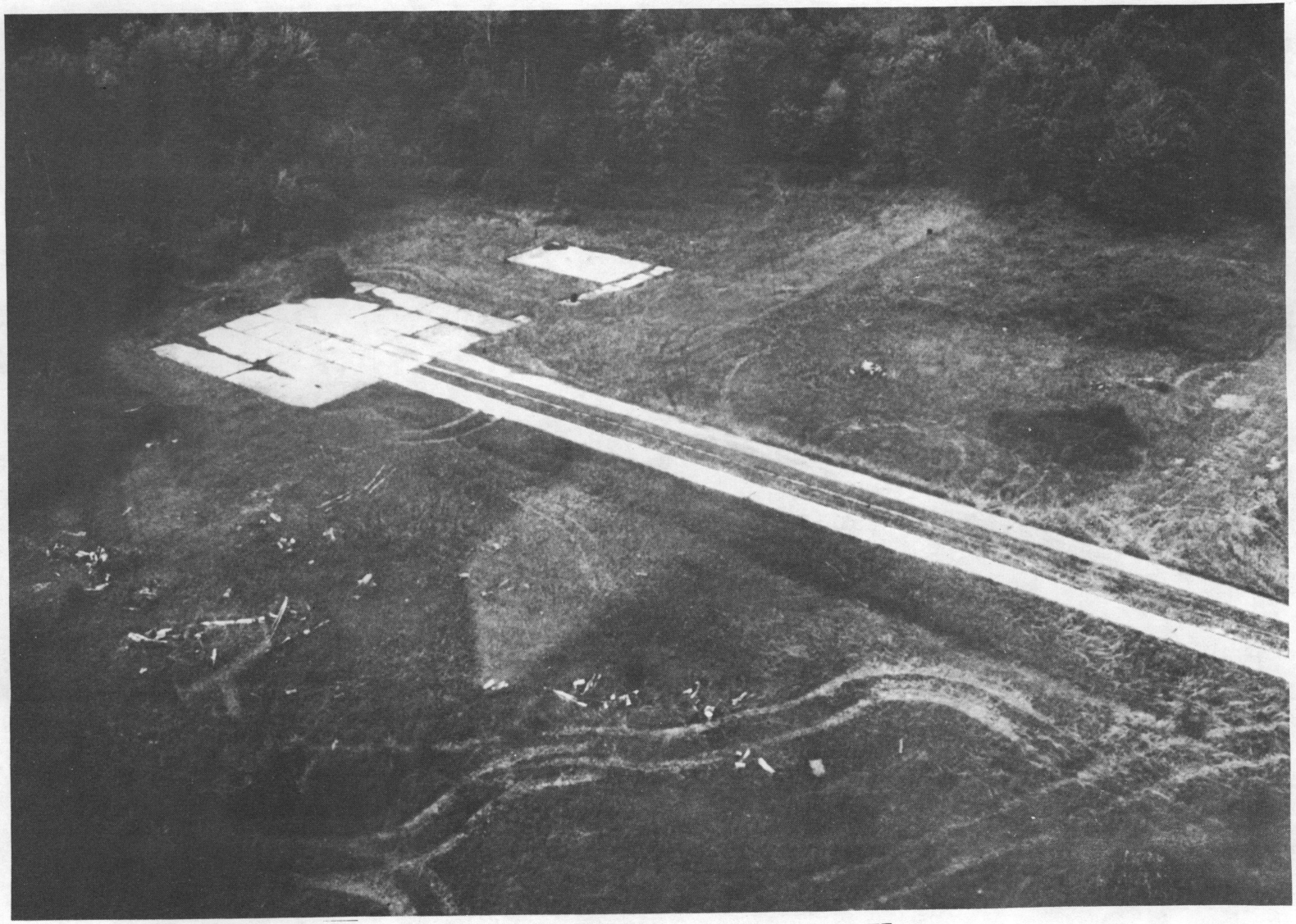
SWAMP AND MARSH AREA, ERIE BURNING GROUND (3)

KELLYS POND

WEST BRANCH RESERVOIR DAM

SAND CREEK SEWAGE TREATMENT PLANT

SILT RETENTION POND FOR WATER TREATMENT PLANT



AIRCRAFT CRASH FACILITY TEST SITE (1)

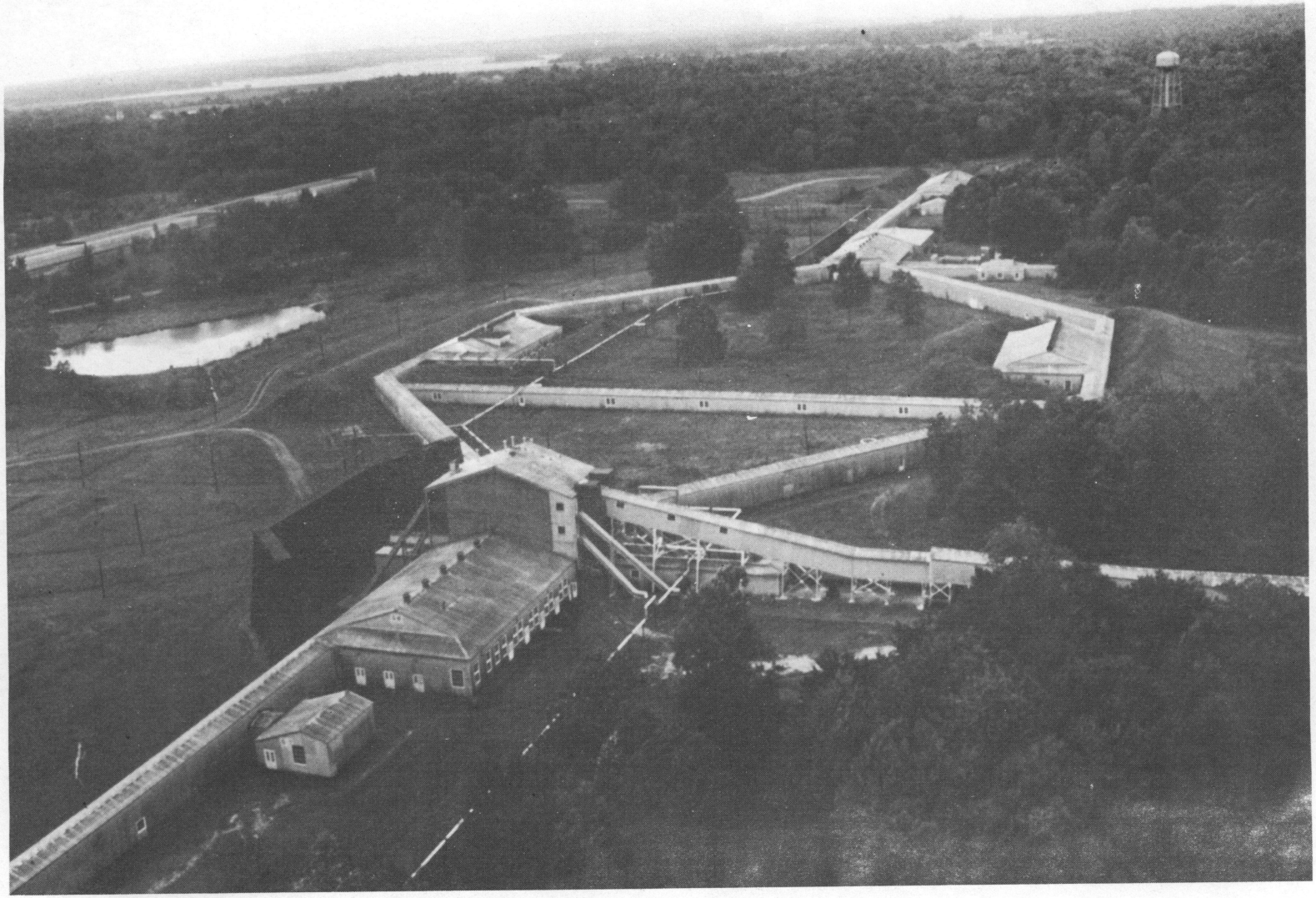
COUNTY SANITARY LANDFILL NORTH OF PLANT BOUNDARY

FORMER SANITARY LANDFILL (6)

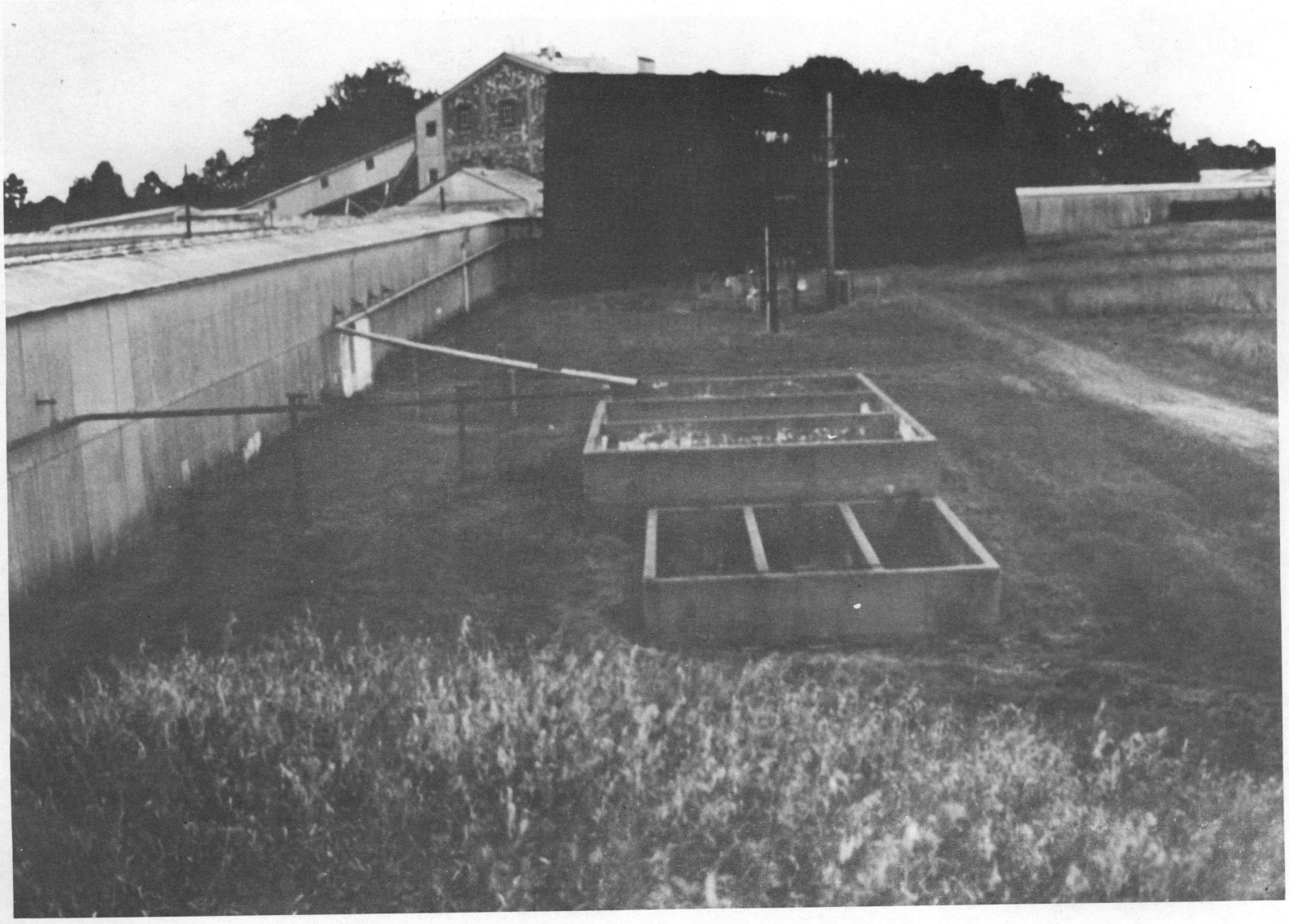
DEMOLITION GROUND AND FIRESTONE TEST
SITE (10)

DEMOLITION GROUND AREA ②

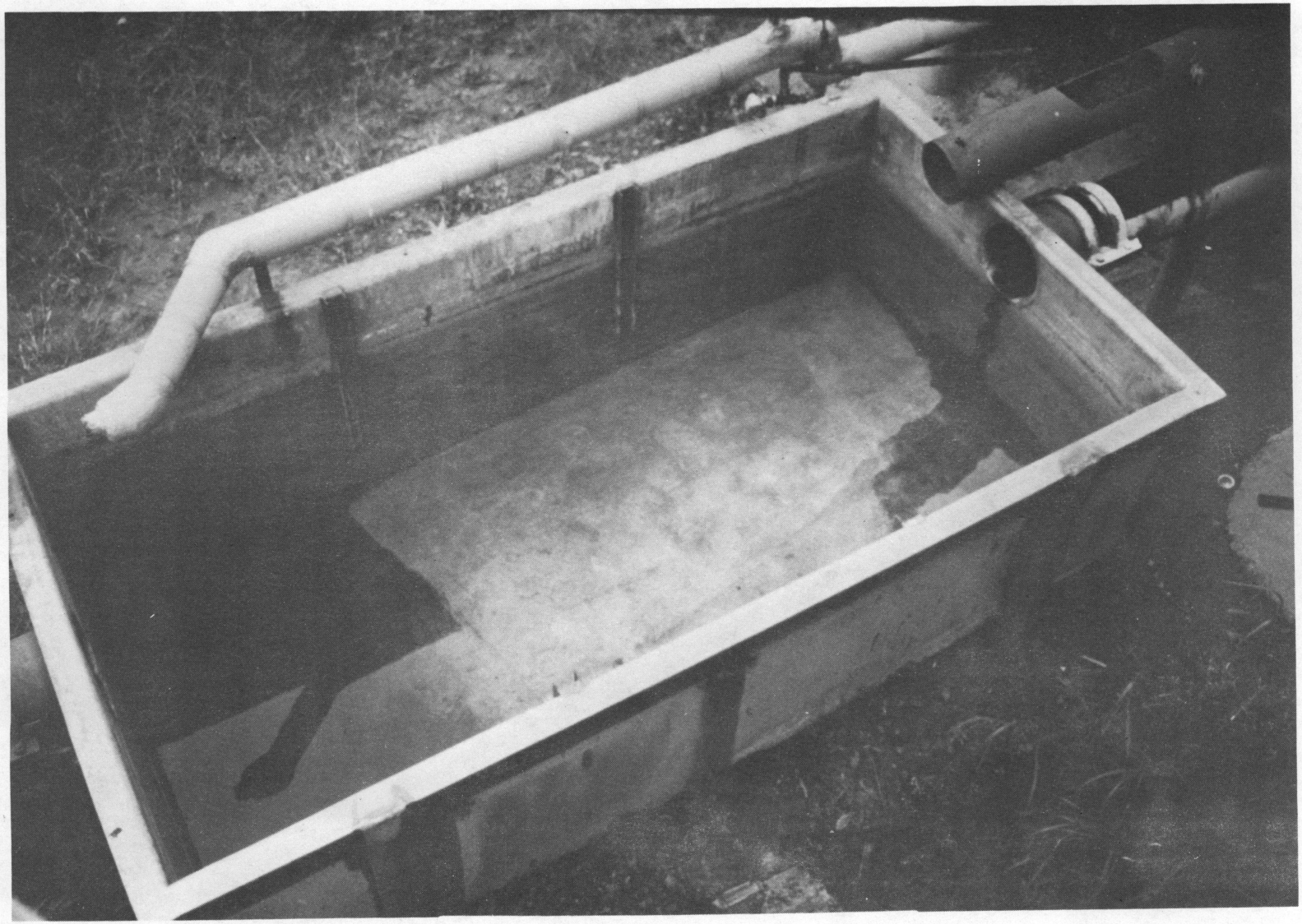
MAGAZINES USED IN EARLY 1940's TO STORE
LEAD AZIDE (15)



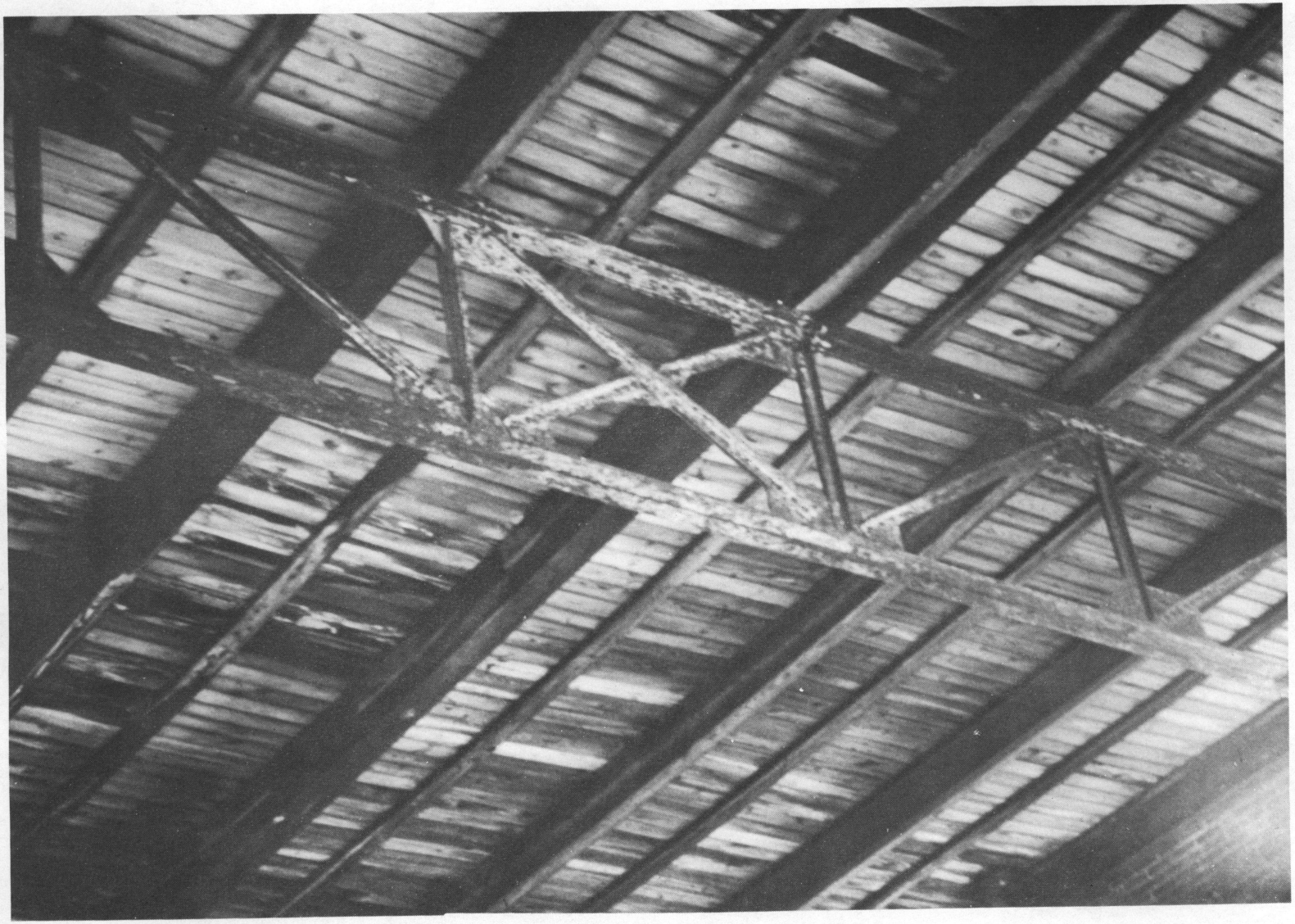
LOAD LINE 4 - SHOWING SETTLING POND



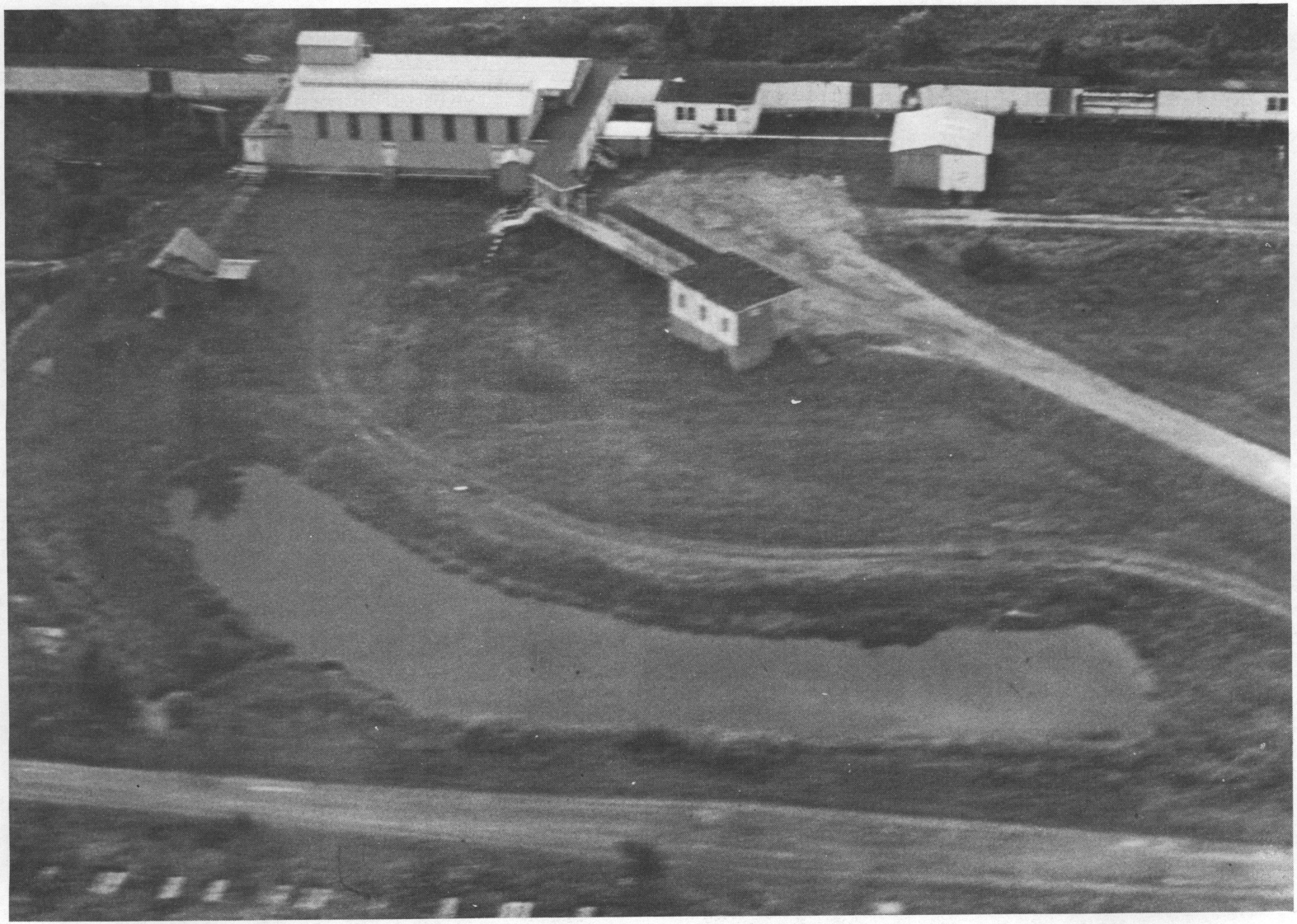
SUMPS FOR LOAD LINE 4



SUMP AT WASHOUT FACILITY - LOAD LINE 12



INTERIOR OF BUILDING DAMAGED FROM
ALUMINUM CHLORIDE OPERATIONS



WASHOUT FACILITY LOAD LINE 12 AND HOLDING POND

LOAD LINE 12

CONDEMNED BUILDING LOAD LINE 12

STRATEGIC ORE PILES

RAMSDELL QUARRY SANITARY LANDFILL (7)

RAMSDELL QUARRY SANITARY LANDFILL (7)

RAMSDELL QUARRY SANITARY LANDFILL (7)

APPENDIX C

DISCHARGE MONITORING REPORT

FOR

1 APRIL THROUGH 30 JUNE 1978

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM COMMENTS

DISCHARGE MONITORING REPORT

PERMITTEE NAME: RAVENNA ARMY AMMUNITION PLANT

ADDRESS: RAVENNA, OHIO 44266

PHONE: (216) 358-7111 (OUTFALL FROM WATER WORKS NO. 3)

(2 3) OH ST — (4-16) 0010936 PERMIT NUMBER — (17-19) 004 DIS — SIC — LATITUDE (20-21) (22-23) (24-25) — LONGITUDE (26-27) (28-29) (30-31)

REPORTING PERIOD: FROM 7 8 0 4 0 1 (YEAR MO DAY) TO 7 8 0 4 3 0 (YEAR MO DAY) (32-37)

COMMENTS

OIL & GREASE, COD AND SUSPENDED SOLIDS WERE EXCEEDED DUE TO STORM RUN OFF INTO SAMPLE POINT.

OIL & GREASE WERE EXCEEDED DUE TO VEGETABLE OILS IN SOLUTION WHICH THIS PLANT IS NOT ABLE TO REMOVE. VEGETABLE OIL ORIGINATES WITH PLANT VEGETATION.

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
BOD	REPORTED		.03	.08	KG/DAY	0		1.0	1.5	MG/L	0	1/7	GRAB
00310	PERMIT CONDITION		0.2	0.5				5	10			1/7	GRAB
FLOW	REPORTED		.0068		MGD							CONT	CONT
50050	PERMIT CONDITION											CONT	CONT
OIL & GREASE	REPORTED		1.73	5.1	KG/DAY	3		67	92	MG/L	3	1/7	GRAB
00550	PERMIT CONDITION		0.5	0.7				10	15			2/30	GRAB
COD	REPORTED		0.8	1.1	KG/DAY	2		32	60	MG/L	2	1/7	GRAB
00335	PERMIT CONDITION		0.5	0.9				10	20			1/7	GRAB
FECAL COLIFORM	REPORTED								16	N/100 ML	0	1/7	GRAB
74055	PERMIT CONDITION								200			1/7	GRAB

(32-37) PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
DISSOLVED SOLIDS	REPORTED		8.4	21.2	KG/DAY	0		325	484	MG/L	0	1/7	GRAB
00515	PERMIT CONDITION		18.9	28.4				400	600			1/7	GRAB
SUSPENDED SOLIDS	REPORTED		0.8	2.2	KG/DAY	1		31	116	MG/L	1	1/7	GRAB
00530	PERMIT CONDITION		0.9	1.4				20	30			1/7	GRAB
DISSOLVED OXYGEN	REPORTED									MG/L	0	1/7	GRAB
00300	PERMIT CONDITION							9.0		MG/L		1/7	GRAB

NAME OF PRINCIPAL EXECUTIVE OFFICER: EMERSON, R. D. (LAST FIRST MI)

TITLE OF THE OFFICER: COMMANDER'S REP. (TITLE)

DATE: 7 8 0 7 1 2 (YEAR MO DAY)

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief such information is true, complete, and accurate.

R. D. Emerson

SIGNATURE OF PRINCIPLE EXECUTIVE OFFICER OR AUTHORIZED AGENT

RV 3560.5 (3-76)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM COMMENTS

DISCHARGE MONITORING REPORT

PERMITTEE NAME: RAVENNA ARMY AMMUNITION PLANT

ADDRESS: RAVENNA, OHIO 44266

PHONE: (216) 358-7111 (GEORGE ROAD SEWAGE PLANT EFFLUENT)

COMMENTS

COD WAS EXCEEDED DUE TO HIGH FLOWS.

(2 3) OH ST — (4-16) 0010936 PERMIT NUMBER — (17-19) 002 DIS — SIC (20-21) (22-23) — LATITUDE (24-25) — LONGITUDE (26-27) (28-29) (30-31)

REPORTING PERIOD: FROM 7 8 0 4 0 1 (YEAR MO DAY) TO 7 8 0 4 3 0 (YEAR MO DAY)

(32-37)

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
FLOW	REPORTED		.400		MGD	0						CONT	N/A
50050	PERMIT CONDITION		.460									CONT	N/A
BOD	REPORTED		1.8	2.25	KG/DAY	0		1.2	1.4		0	1/7	GRAB
00310	PERMIT CONDITION		17	26				10	15			1/7	GRAB
SUSPENDED SOLIDS	REPORTED		9	20	KG/DAY	0		6	18	MG/L	0	1/7	GRAB
00530	PERMIT CONDITION		35	52				20	30			1/7	GRAB
FECAL COLIFORM	REPORTED								10	N/100 ML	0	1/7	GRAB
74005	PERMIT CONDITION								200			1/7	GRAB
DISSOLVED SOLIDS	REPORTED		572	660	KG/DAY	0		377	474	MG/L	0	1/7	GRAB
00515	PERMIT CONDITION		872	1308				500	750			1/7	GRAB

(32-37)

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
CHLORINE RESIDUAL	REPORTED								0.5	MG/L	0	CONT	CONT
50060	PERMIT CONDITION								0.5			1/7	GRAB
COD	REPORTED	38	67			1		25	30		0	1/7	GRAB
00335	PERMIT CONDITION	35	52					20	30			1/7	GRAB
NITRATE	REPORTED	0.9	2.0	KG/DAY		0		0.6	0.9	MG/L	0	1/7	GRAB
00620	PERMIT CONDITION	4.7	7.1					2.7	4.1	MG/L		1/7	GRAB

NAME OF PRINCIPAL EXECUTIVE OFFICER			TITLE OF THE OFFICER	DATE		
EMERSON,	R.	D.	COMMANDER'S REP.	7 8	0 7	1 2
LAST	FIRST	MI	TITLE	YEAR	MO	DAY

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief such information is true, complete, and accurate.

R. D. Emerson

SIGNATURE OF PRINCIPLE EXECUTIVE OFFICER OR AUTHORIZED AGENT

RV 3560.5 (3-76)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM COMMENTS

DISCHARGE MONITORING REPORT

PERMITTEE NAME: RAVENNA ARMY AMMUNITION PLANT

ADDRESS: RAVENNA, OHIO 44266

PHONE: (216) 358-7111 (GEORGE ROAD SEWAGE PLANT EFFLUENT)

COMMENTS

OIL & GREASE EXCEEDED LIMITS DUE TO THE VEGETABLE OIL IN SOLUTION WHICH THIS PLANT IS NOT ABLE TO REMOVE. VEGETABLE OIL ORIGINATES WITH PLANT VEGETATION.

(2 3)	(4-16)	(17-19)				
OH ST	0010936 PERMIT NUMBER	002 DIS	SIC	LATITUDE	LONGITUDE	
		(20-21)	(22-23)	(24-25)	(26-27)	(28-29) (30-31)

REPORTING PERIOD: FROM 7 8 0 4 0 1 (YEAR MO DAY) TO 7 8 0 4 3 0 (YEAR MO DAY)

(32-37)

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
AMMONIA	REPORTED		0.2	.32	KG/DAY	0		0.16	.20	MG/L	0	1/7	GRAB
00610	PERMIT CONDITION		0.9	1.3				0.5	.75			1/7	GRAB
OIL & GREASE	REPORTED			3005	KG/DAY	3			188	MG/L	3	1/7	GRAB
00550	PERMIT CONDITION			17					10			2/30	GRAB
PH	REPORTED	7.7		8.3	STANDARD UNITS	0							
00400	PERMIT CONDITION	6.5		8.5									

NAME OF PRINCIPAL EXECUTIVE OFFICER			TITLE OF THE OFFICER	DATE
EMERSON,	R.	D.	COMMANDER'S REP.	7 8 0 7 1 2
LAST	FIRST	MI	TITLE	YEAR MO DAY

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief such information is true, complete, and accurate.

R. D. Emerson

SIGNATURE OF PRINCIPLE EXECUTIVE OFFICER OR AUTHORIZED AGENT

RV 3560.5 (3-76)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM COMMENTS

DISCHARGE MONITORING REPORT

PERMITTEE NAME: RAVENNA ARMY AMMUNITION PLANT

ADDRESS: RAVENNA, OHIO 44266

PHONE: (216) 358-7111 (OUTFALL FROM WATER WORKS NO. 3)

(2 3) OH ST

(4-16) 0010936 PERMIT NUMBER

(17-19) 004 DIS

SIC (20-21) (22-23)

LATITUDE (24-25)

LONGITUDE (26-27) (28-29) (30-31)

REPORTING PERIOD: FROM 7 8 0 5 0 1 (32-37) YEAR MO DAY TO 7 8 0 5 3 1 YEAR MO DAY

COMMENTS

OIL & GREASE, COD AND DISSOLVED SOLIDS WERE EXCEEDED DUE TO STORM RUN OFF INTO SAMPLE POINT.

OIL & GREASE WERE EXCEEDED DUE TO VEGETABLE OILS IN SOLUTION WHICH THIS PLANT IS NOT ABLE TO REMOVE. VEGT. OIL ORIGINATES WITH PLANT VEGETATION.

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
BOD	REPORTED		.04	.04	KG/DAY	0		1.025	1.5	MG/L	0	1/7	GRAB
00310	PERMIT CONDITION		0.2	0.5				5	10			1/7	GRAB
FLOW	REPORTED		.0102		MGD							CONT	CONT
50050	PERMIT CONDITION											CONT	CONT
OIL & GREASE	REPORTED		5.7	18.4	KG/DAY	3		147	336	MG/L	4	1/7	GRAB
00550	PERMIT CONDITION		0.5	0.7				10	15			2/30	GRAB
COD	REPORTED		.97	1.4	KG/DAY	1		25	25	MG/L	4	1/7	GRAB
00335	PERMIT CONDITION		0.5	0.9				10	20			1/7	GRAB
FECAL COLIFORM	REPORTED								696	N/100 ML	1	1/7	GRAB
74055	PERMIT CONDITION								200			1/7	GRAB

C-7

(32-37) (64-68) (68-70)

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	FREQUENCY OF ANALYSIS	SAMPLE TYPE
DISSOLVED SOLIDS	REPORTED		18.2	30.4	KG/DAY	1		472	554	MG/L	0	1/7	GRAB
00515	PERMIT CONDITION		18.9	28.4				400	600			1/7	GRAB
SUSPENDED SOLIDS	REPORTED		0.8	1.0	KG/DAY	0		20	28	MG/L	0	1/7	GRAB
00530	PERMIT CONDITION		0.9	1.4				20	30			1/7	GRAB
DISSOLVED OXYGEN	REPORTED									MG/L	0	1/7	GRAB
00300	PERMIT CONDITION							9.0		MG/L		1/7	GRAB

NAME OF PRINCIPAL EXECUTIVE OFFICER: EMERSON, R. D. (LAST FIRST MI)

TITLE OF THE OFFICER: COMMANDER'S REP. (TITLE)

DATE: 7 8 0 7 1 2 (YEAR MO DAY)

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief such information is true, complete, and accurate.

R. D. Emerson

SIGNATURE OF PRINCIPLE EXECUTIVE OFFICER OR AUTHORIZED AGENT

RV 3560.5 (3-76)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM COMMENTS

DISCHARGE MONITORING REPORT

PERMITTEE NAME: RAVENNA ARMY AMMUNITION PLANT

ADDRESS: RAVENNA, OHIO 44266

PHONE: (216) 358-7111 (GEORGE ROAD SEWAGE PLANT EFFLUENT)

COMMENTS

(THE COD WAS EXCEEDED DUE TO HIGH FLOWS)

(2 3) OH ST — (4-16) 0010936 PERMIT NUMBER — (17-19) 002 DIS — SIC — LATITUDE — LONGITUDE (20-21) (22-23) (24-25) (26-27) (28-29) (30-31)

REPORTING PERIOD: FROM 7 8 0 5 0 1 (YEAR MO DAY) TO 7 8 0 5 3 1 (YEAR MO DAY) (32-37)

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	FREQUENCY OF ANALYSIS (64-68)	SAMPLE TYPE (68-70)
FLOW	REPORTED		.373		MGD							CONT	N/A
50050	PERMIT CONDITION		.460									CONT	N/A
BOD	REPORTED		1.7	1.7	KG/DAY	0		1.2	1.7		0	1/7	GRAB
00310	PERMIT CONDITION		17	26				10	15			1/7	GRAB
SUSPENDED SOLIDS	REPORTED		14.	15.	KG/DAY	0		10	12	MG/L	0	1/7	GRAB
00530	PERMIT CONDITION		35	52				20	30			1/7	GRAB
FECAL COLIFORM	REPORTED								20	N/100 ML	0	1/7	GRAB
74055	PERMIT CONDITION								200			1/7	GRAB
DISSOLVED SOLIDS	REPORTED		663	1170	KG/DAY	0		469	620	MG/L	0	1/7	GRAB
00515	PERMIT CONDITION		872	1308				500	750			1/7	GRAB

(32-37) PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
CHLORINE RESIDUAL	REPORTED								0.5	MG/L	0	CONT	CONT
50060	PERMIT CONDITION								0.5			1/7	GRAB
COD	REPORTED		28	57		1		20	30		0	1/7	GRAB
00335	PERMIT CONDITION		35	52				20	30			1/7	GRAB
NITRATE	REPORTED		0.64	0.72	KG/DAY	0		0.45	0.60	MG/L	0	1/7	GRAB
00620	PERMIT CONDITION		4.7	7.1				2.7	4.1	MG/L		1/7	GRAB

NAME OF PRINCIPAL EXECUTIVE OFFICER: EMERSON, R. D. (LAST FIRST MI)

TITLE OF THE OFFICER: COMMANDER'S REP. (TITLE)

DATE: 7 8 0 7 1 2 (YEAR MO DAY)

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief such information is true, complete, and accurate.

R. D. Emerson

SIGNATURE OF PRINCIPLE EXECUTIVE OFFICER OR AUTHORIZED AGENT

RV 3560.5 (3-76)

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM COMMENTS

DISCHARGE MONITORING REPORT

PERMITTEE NAME: RAVENNA ARMY AMMUNITION PLANT

ADDRESS: RAVENNA, OHIO 44266

PHONE: (216) 358-7111 (GEORGE ROAD SEWAGE PLANT EFFLUENT)

(2 3) OH ST

(4-16) 0010936 PERMIT NUMBER

(17-19) 002 DIS

SIC (20-21) (22-23)

LATITUDE (24-25)

LONGITUDE (26-27) (28-29) (30-31)

REPORTING PERIOD: FROM 7 8 0 5 0 1 (YEAR MO DAY) TO 7 8 0 5 3 1 (YEAR MO DAY)

(32-37)

COMMENTS

OIL & GREASE EXCEEDED DUE TO VEGETABLE OIL IN SOLUTION WHICH AT THIS PLANT WE ARE NOT ABLE TO REMOVE. VEGETABLE OIL ORIGINATES WITH PLANT VEGETATION

PARAMETER		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
AMMONIA	REPORTED		.24	.45	KG/DAY	0		0.17	.24	MG/L	0	1/7	GRAB
00610	PERMIT CONDITION		0.9	1.3				0.5	.75			1/7	GRAB
OIL & GREASE	REPORTED			65	KG/DAY	1			54	MG/L	2	1/7	GRAB
00550	PERMIT CONDITION			17					10			2/30	GRAB
PH	REPORTED	7.7		8.2	STANDARD UNITS	0							
00400	PERMIT CONDITION	6.5		8.5									

NAME OF PRINCIPAL EXECUTIVE OFFICER: EMERSON, R. D. (LAST FIRST MI)

TITLE OF THE OFFICER: COMMANDER'S REP. (TITLE)

DATE: 7 8 0 7 1 2 (YEAR MO DAY)

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief such information is true, complete, and accurate.

R. D. Emerson

SIGNATURE OF PRINCIPLE EXECUTIVE OFFICER OR AUTHORIZED AGENT

RV 3560.5 (3-76)

(32-37)		(3 card only) QUANTITY (38-45) MINIMUM	(46-53) AVERAGE	(54-61) MAXIMUM	UNITS	(62-83) NO EX	(4 card only) CONCENTRATION (38-45) MINIMUM	(46-53) AVERAGE	(43-61) MAXIMUM	UNITS	(62-83) NO EX	(64-68) FREQUENCY OF ANALYSIS	(68-70) SAMPLE TYPE
PARAMETER													
CHLORINE RESIDUAL	REPORTED								0.5	MG/L	0	CONT	CONT
50060	PERMIT CONDITION								0.5			1/7	GRAB
COD	REPORTED		10.3	12		0		13.4	20		0	1/7	GRAB
00335	PERMIT CONDITION		35	52				20	30			1/7	GRAB
NITRATE	REPORTED		.46	.58	KG/DAY	0		.6	.9	MG/L	0	1/7	GRAB
00620	PERMIT CONDITION		4.7	7.1				2.7	4.1	MG/L		1/7	GRAB

NAME OF PRINCIPAL EXECUTIVE OFFICER			TITLE OF THE OFFICER	DATE	
EMERSON,	R.	D.	COMMANDER'S REP.	7 8 0 7 1 2	
LAST	FIRST	MI	TITLE	YEAR MO DAY	

I certify that I am familiar with the information contained in this report and that to the best of my knowledge and belief such information is true, complete, and accurate.

R. D. Emerson

SIGNATURE OF PRINCIPLE EXECUTIVE OFFICER OR AUTHORIZED AGENT

RV 3560.5 (3-76)

APPENDIX D

NPDES PERMIT NO. OH 0010936

FOR

RAVENNA ARMY AMMUNITION PLANT

Permit No. OH 0010936

Application No. OH 0010936

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et seq; the "Act"),

RAVENNA ARMY AMMUNITION PLANT

is authorized by the United States Environmental Protection Agency, Region V,

to discharge from a facility located at Ravenna Army Ammunition Plant, Ravenna, Ohio 44266

to receiving waters named Hinkley Creek, ditch to West Branch of Mahoning River, ditch to Sand Creek, and Hinkley Creek Boundary

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit and the authorization to discharge shall expire at midnight, August 28, 1978. Permittee shall not discharge after the above date of expiration. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit such information, forms, and fees as are required by the Agency authorized to issue NPDES permits no later than 180 days prior to the above date of expiration.

This permit, modified in accordance with 40 CFR 125, shall become effective 30 days from this date of signature and supersedes NPDES Permit number OH 0010936 dated August 31, 1973.

Signed this

FEB 28 1977

James MacDonald

Director, Enforcement Division

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning August 31, 1973, and lasting until June 30, 1977, the permittee is authorized to discharge from outfall serial number 001.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS kg/day Daily Avg	(lbs/day)*** Daily Max	Other Units Daily Avg	(mg/l) Daily Max	MONITORING REQUIREMENTS (1) Measurement Frequency	Sample Type
Flow (MGD)					Continuous	-
Oil & Grease		1.4 (3.2)	-	10	Twice/Month	Grab
BOD	1.4 (3.2)	2.2 (4.8)	10	15	Weekly	Grab
COD or TOC *	3.0 (6.5)	4.4 (9.7)	20	30	Weekly	Grab
Fecal Coliform Bacteria (1/100 ml)				200	Weekly	Grab
Residual Chlorine				0.5	Weekly	Grab
Dissolved Solids	74 (162)	111 (244)	500	750	Weekly	24-hr. Composite
Suspended Solids	3.0 (6.5)	4.4 (9.7)	20	30	Weekly	24-hr. Composite
Ammonia	0.07 (0.16)	0.11 (0.24)	0.5	0.75	Weekly	24-hr. Composite
TNT**	0.13 (0.3)	0.23 (0.5)	1.0	1.5	Weekly	24-hr. Composite

(1) during plant layaway, monitoring is not required for zero flow conditions
* when equipment is available
** when added to liquidwaste from Operations or Cleanup
*** quantities based on a flow of 0.039 MGD

The pH shall not be less than 6.5 nor greater than 8.5 and shall be monitored.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: at a point representative of the discharge but prior to entering Hinkley Creek.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning July 1, 1977, and lasting until August 28, 1978, the permittee is authorized to discharge from outfall serial number 001.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS kg/day (lbs/day)*** Daily Avg	kg/day (lbs/day)*** Daily Max	Other Units (mg/l) Daily Avg	Other Units (mg/l) Daily Max	MONITORING REQUIREMENTS (1) Measurement Frequency	Sample Type
Flow (MGD)					Continuous	-
Oil & Grease		1.4 (3.2)		10	2/Month	Grab
BOD	1.4 (3.2)	2.2 (4.8)	10	15	Weekly	Grab
COD or TOC *	3.0 (6.5)	4.4 (9.7)	20	30	Weekly	Grab
Fecal Coliform Bacteria (1/100 ml)			-	200	Weekly	Grab
Residual Chlorine			-	0.5	Weekly	Grab
Dissolved Solids	74 (162)	111 (244)	500	750	Weekly	24-hr. Composite
Suspended Solids	3.0 (6.5)	4.4 (9.7)	20	30	Weekly	24-hr. Composite
Ammonia	0.07 (0.16)	0.11 (0.24)	0.5	0.75	Weekly	24-hr. Composite
TNT**	0.07 (0.16)	0.11 (0.24)	0.5	0.75	Weekly	24-hr. Composite

(1) during plant layaway, monitoring is not required for zero flow conditions
* when equipment is available
** when added to Waste Stream from Operations or Cleanup
*** quantities based on a flow of 0.039 MGD

The pH shall not be less than 6.5 nor greater than 8.5 and shall be monitored.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: at a point representative of the discharge but prior to entering Hinkley Creek.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning August 31, 1973, and lasting until June 30, 1977, the permittee is authorized to discharge from outfall serial number 002.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS kg/day (lbs/day)*** Daily Avg	kg/day (lbs/day)*** Daily Max	Other Units (mg/l) Daily Avg	Other Units (mg/l) Daily Max	MONITORING REQUIREMENTS (1) Measurement Frequency	Sample Type
Flow (MGD)					Continuous	-
Oil & Grease		17 (38)	-	10	2/month	Grab
BOD	17 (77)	26 (58)	10	15	Weekly	Grab
COD or TOC *	35 (77)	52 (115)	20	30	Weekly	Grab
Fecal Coliform Bacteria (1/100 ml)			-	200	Weekly	Grab
Residual Chlorine				0.5	Weekly	Grab
Dissolved Solids	872 (1920)	1308 (2880)	500	750	Weekly	24-hr. Composite
Suspended Solids	35 (77)	52 (115)	20	30	Weekly	24-hr. Composite
Ammonia	0.9 (1.9)	1.3 (2.9)	0.5	0.75	Weekly	24-hr. Composite
TNT**	1.7 (3.8)	2.6 (5.8)	1.0	1.5	Weekly	24-hr. Composite
Nitrate	4.7 (10.4)	7.1 (15.7)	2.7	4.1	Weekly	24-hr. Composite

(1) during plant layaway, monitoring is not required for zero flow conditions
* when equipment is available
** when added to Waste Stream from Operations or Cleanup
*** quantities based on a flow rate of 0.46 MGD

The pH shall not be less than 6.5 nor greater than 8.5 and shall be monitored weekly on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: at a point representative of the discharge, but prior to entering the unnamed ditch to the West Branch of the Mahoning River.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning July 1, 1977, and lasting until August 28, 1978, the permittee is authorized to discharge from outfall serial number 002.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS kg/day (lbs/day)*** Daily Avg	kg/day (lbs/day)*** Daily Max	Other Units (mg/l) Daily Avg	Other Units (mg/l) Daily Max	MONITORING REQUIREMENTS (1) Measurement Frequency	Sample Type
Flow (MGD)					Continuous	-
Oil & Grease		17 (38)	-	10	2/month	Grab
BOD	17 (77)	26 (58)	10	15	Weekly	Grab
COD or TOC *	35 (77)	52 (115)	20	30	Weekly	Grab
Fecal Coliform Bacteria (1/100 ml)			-	200	Weekly	Grab
Residual Chlorine				0.5	Weekly	Grab
Dissolved Solids	872 (1920)	1308 (2880)	500	750	Weekly	Grab
Suspended Solids	35 (77)	52 (115)	20	30	Weekly	Grab
Ammonia	0.9 (1.9)	1.3 (2.9)	0.5	0.75	Weekly	Grab
TNT**	0.9 (1.9)	1.3 (2.9)	0.5	0.75	Weekly	Grab
Nitrate	4.7 (10.4)	7.1 (15.7)	2.7	4.1	Weekly	Grab

(1) during plant layaway, monitoring is not required for zero flow conditions
* when equipment is available
** when added to Waste Stream from Operations or Cleanup
*** quantities based on a flow rate of 0.46 MGD

The pH shall not be less than 6.5 nor greater than 8.5 and shall be monitored weekly on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: at a point representative of the discharge, but prior to entering the unnamed ditch to the West Branch of the Mahoning River.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning August 31, 1973, and lasting until June 30, 1977, the permittee is authorized to discharge from outfall serial number 003.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS kg/day Daily Avg	(lbs/day)*** Daily Max	Other Units Daily Avg	(mg/l) Daily Max	MONITORING REQUIREMENTS (1) Measurement Frequency	Sample Type
Flow (MGD)					Continuous	-
Oil & Grease		11 (25)	-	10	2/month	Grab
BOD	11 (25)	17 (38)	10	15	Weekly	Grab
COD or TOC *	23 (50)	34 (75)	20	30	Weekly	Grab
Fecal Coliform Bacteria (1/100 ml)			-	200	Weekly	Grab
Residual Chlorine				0.5	Weekly	Grab
Dissolved Solids	568 (1250)	851 (1875)	500	750	Weekly	24-hr. Composite
Suspended Solids	23 (50)	34 (75)	20	30	Weekly	24-hr. Composite
Ammonia	0.59 (1.3)	0.86 (1.9)	0.5	0.75	Weekly	24-hr. Composite
TNT**	1.1 (2.5)	1.7 (3.7)	1.0	1.5	Weekly	24-hr. Composite
Nitrate	2.4 (5.3)	3.6 (8)	2.1	3.2	Weekly	24-hr. Composite

(1) during plant layaway, monitoring is not required for zero flow conditions
* when equipment is available
** when added to Waste Stream from Operations or Cleanup
*** quantities based on a flow rate of 0.3 MGD

The pH shall not be less than 6.5 nor greater than 8.5 and shall be monitored weekly on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: at a point representative of the discharge, but prior to entering the unnamed stream to Sand Creek.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning July 1, 1977, and lasting until August 28, 1978, the permittee is authorized to discharge from outfall serial number 003.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS kg/day (lbs/day)*** Daily Avg	kg/day (lbs/day)*** Daily Max	Other Units (mg/l) Daily Avg	Other Units (mg/l) Daily Max	MONITORING REQUIREMENTS (1) Measurement Frequency	Sample Type
Flow (MGD)					Continuous	-
Oil & Grease		11 (25)	-	10	2/month	Grab
BOD	11 (25)	17 (38)	10	15	Weekly	Grab
COD or TOC *	23 (50)	34 (75)	20	30	Weekly	Grab
Fecal Coliform Bacteria (1/100 ml)			-	200	Weekly	Grab
Residual Chlorine			-	0.5	Weekly	Grab
Dissolved Solids	568 (1250)	851 (1875)	500	750	Weekly	24-hr. Composite
Suspended Solids	23 (50)	34 (75)	20	30	Weekly	24-hr. Composite
Ammonia	0.59 (1.3)	0.86 (1.9)	0.5	0.75	Weekly	24-hr. Composite
TNT**	0.59 (1.3)	0.86 (1.9)	0.5	0.75	Weekly	24-hr. Composite
Nitrate	2.4 (5.3)	3.6 (8)	2.1	3.2	Weekly	24-hr. Composite

(1) during plant layaway, monitoring is not required for zero flow conditions
* when equipment is available
** when added to Waste Stream from Operations or Cleanup
*** quantities based on a flow rate of 0.3 MGD

The pH shall not be less than 6.5 nor greater than 8.5 and shall be monitored weekly on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: at a point representative of the discharge, but prior to entering the unnamed stream to Sand Creek.

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this modified permit and lasting until August 28, 1978, the permittee is authorized to discharge from outfall serial number 004.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS kg/day (lbs/day) (1)		Other Units (mg/l)		MONITORING REQUIREMENTS Measurement Frequency	Sample Type
	Daily Avg	Daily Max	Daily Avg	Daily Max		
Flow (MGD)					Continuous	-
Oil & Grease	0.5 (1.0)	0.7 (1.5)	10	15	2/month	Grab
BOD	0.2 (0.5)	0.5 (1.0)	5	10	Weekly	Grab
COD or TOC *	0.5 (1.0)	0.9 (2.1)	10	20	Weekly	Grab
Fecal Coliform Bacteria (1/100 ml)			-	200	Weekly	Grab
Residual Chlorine ***			-	0.5	Weekly	Grab
Dissolved Solids	18.9 (41.6)	28.4 (62.4)	400	600	Weekly	Grab
Suspended Solids	0.9 (2.1)	1.4 (3.2)	20	30	Weekly	Grab
Dissolved Oxygen (lowest)			9.0	-	Weekly	Grab
TNT**	(-)	0.2 (0.5)	-	0.5	Weekly	Grab

* when equipment is available
** when added to Waste Stream from Operations or Cleanup
*** Samples to be from exit of chlorine mixing tank of the sanitary treatment facility.

1) Quantities are based on a flow rate of 0.0125 MGD

The pH shall not be less than 6.5 nor greater than 8.5 and shall be monitored weekly on a grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location: at a point representative of Hinkley Creek just before is passes the installation boundary limits.

B. MONITORING AND REPORTING

1. Representative Sampling

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Reporting

Monitoring results obtained during the previous three months shall be summarized and reported on a Discharge Monitoring Report Form (EPA No. 3320-1), postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on October 28, 1975. Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Regional Administrator and the State at the following addresses:

U.S. Environmental Protection Agency
Region V, Permit Branch
230 South Dearborn, 13th Floor
Chicago, Illinois 60604

Ohio EPA
Northeast District Office
2110 E. Aurora Road
Twinsburg
Ohio 44087

The report to the State is for information purposes only.

3. Definitions

a. "Daily Average" Discharge

1. Weight Basis - The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made for one or more 8-hour work shifts.

2. Concentration Basis - The "daily average" concentration means the arithmetic average (weighted by flow value) of all the daily determinations of concentration made during a calendar month. Daily determinations of concentration made using a composite sample shall be the concentration of the composite sample. When grab samples are used, the daily determination of concentration shall be the arithmetic average (weighted by flow value) of all the samples collected during the calendar day.

b. "Daily Maximum" Discharge

1. Weight Basis - the "daily maximum" discharge means the total discharge by weight during any calendar day.

2. Concentration Basis - the "daily maximum" concentration means the daily determination of concentration for any calendar day.

4. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. Recording of Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information:

a. The exact place, date, and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values rquired in the Discharge Monitoring Report Form (EPA No. 3320-1). Such increased frequency shall also be indicated.

7. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the State water pollution control agency.

C. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

(1)	Report of Progress (Preliminary Plans)	- January 1, 1974
(2)	Final Funding	- August 1, 1975
(3)	Completion of final plans by	- October 1, 1975
(4)	Award of contract	- February 1, 1976
(5)	Commencement of construction by	- April 1, 1976
(6)	Report of construction progress	- January 1, 1977
(7)	Completion of construction by	- May 1, 1977
(8)	Attainment of operational level by	- July 1, 1977

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of non-compliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

PART II

A. MANAGEMENT REQUIREMENTS

1. Change in Discharge

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions, production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permit issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. Noncompliance Notification

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Regional Administrator and the State with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. Facilities Operation

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. Adverse Impact

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring in the vicinity of the licensed facility as may be necessary to determine the nature and impact of the noncomplying discharger.

5. Bypassing

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Regional Administrator and the State in writing of each such diversion or bypass. The information should be submitted to the State for informational purposes only and to the extent permitted by security or other requirements.

6. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed from or resulting from treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters in violation of this permit.

7. Power Failures

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

a. In accordance with the Schedule of Compliance contained in Part I, provide an alternative power source sufficient to operate the wastewater control facilities;

b. Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of one or more of the primary sources of power to the wastewater control facilities.

B. RESPONSIBILITIES

1. Right of Entry

The permittee shall allow the Regional Administrator, or his authorized representatives, upon the presentation of credentials and subject to applicable security laws and regulations.

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

2. Transfer of Ownership or Control

In the event of any changes in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Regional Administrator and the State water pollution control agency. Information should be submitted to the State for informational purposes only and to this extent permitted by security or other requirements.

3. Availability of Reports

Except for data determined to be confidential under Section 308 of the Act and subject to applicable security laws and regulations, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the State water pollution control agency and the Regional Administrator. Information should be submitted to the State for informational purposes only and to the extent permitted by security or other requirements. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false

statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. Permit Modification

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. Toxic Pollutants

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. Civil and Criminal Liability

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Act.

8. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. Severability

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III

OTHER REQUIREMENTS

1. When the applicant has established Compliance well within discharge limits, he may apply to the Regional Administrator for possible modification, of the monitoring frequency for one or more parameters.

2. There shall be no discharge of Polychlorinated Biphenol Transformer fluids.

DESCRIPTIVE INFORMATION

Discharge 001 is from Depot Plant Effluent to Hinkley Creek. The discharge is from a secondary sanitary waste treatment plant with a design capacity of 190,000 liters per day. The average discharge is 148,200 liters per day.

Discharge 002 is from George Road Sewage Plant effluent to an unnamed ditch to the West Branch of the Mahoning River. The discharge is from a secondary sanitary waste treatment plant with a design capacity of 1,330,000 liters per day. The average discharge is 1,759,400 liters per day. The discharge may also contain low concentrations of explosives when load lines are in use.

Discharge 003 is from Sand Creek Sewage Plant effluent to an unnamed stream to Sand Creek. The discharge from a secondary sanitary waste treatment plant with a design capacity of 1,330,000 liters per day. The average discharge is 1,143,800 liters per day. The discharge may also contain low concentrations of explosives when load lines are in use.

Discharge 004 is Hinkley Creek as it passes boundary limits. This discharge includes effluent from a sanitary plant, backwash from filters, and regenerate from ion exchangers. The filter and exchanger waste enter a dry well and then a ditch for 2 miles prior to entering Hinkley Creek. When in operation, there may be explosive wastes from the load lines.