



**US Army Corps
of Engineers**

HUNTSVILLE DIVISION

FINAL

Defense Environmental Restoration Program
for
Formerly Used Defense Sites

Ordnance and Explosive Waste
Chemical Warfare Materials

ARCHIVES SEARCH REPORT

PLUM BROOK ORDNANCE WORKS

Sandusky, Ohio

Site No.G050H001806

NOVEMBER 2006

Prepared by

US ARMY CORPS OF ENGINEERS

ST. LOUIS DISTRICT

**ORDNANCE AND EXPLOSIVE WASTE
CHEMICAL WARFARE MATERIALS
ARCHIVES SEARCH REPORT**
for the formerly
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Sandusky, Ohio
Site Number - G050H001806

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1.0 Introduction

1.1 Authority

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) 42 USC 9601 et seq. Ordnance and explosive wastes are included in the CERCLA definition of pollutants and contaminants that require a remedial response.

In 1983, the Environmental Restoration Defense Account (ERDA) was established by Public Law 98-212. This Congressionally-directed fund was to be used for environmental restoration at Department of Defense (DOD) active installations and formerly used properties. The DOD designated the Army as the sole manager for environmental restoration at closed installations and formerly used properties. The Secretary of the Army assigned this mission to the Corps of Engineers (USACE) in 1984.

The 1986 Superfund Amendments and Reauthorization Act (SARA) amended certain aspects of CERCLA, some of which directly related to OEW contamination. Chapter 160 of the SARA established the Defense Environmental Restoration Program (DERP). One of the goals specified for the DERP is "correction of environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or welfare or to the environment."

The DERP requires that a CERCLA response action be undertaken whenever such "imminent and substantial endangerment" is found at:

- A. A facility or site that is owned by, leased to, or otherwise possessed by the United States and under the jurisdiction of the Secretary of Defense.
- B. A facility or site that was under the jurisdiction of the Secretary of Defense and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination.
- C. A vessel owned or operated by the Department of Defense.

The National Contingency Plan (NCP) was established by the Clean Water Act of 1972. The NCP has been revised and broadened several times since then. Its purpose is to provide the organizational structure and procedures for remedial actions to be taken in response to the presence of hazardous substances, pollutants, and contaminants at a site. Section 105 of the 1980 CERCLA states that the NCP shall apply to all response actions taken as a result of CERCLA requirements.

The March 1990 National Oil and Hazardous Substances Pollution Contingency Plan given in 40 CFR part 300 is the latest version of the NCP. Paragraph 300.120 states that "DOD will be the removal response authority with respect to incidents involving DOD military weapons and munitions under the jurisdiction, custody, and control of DOD."

On April 5, 1990, U.S. Army Engineer Division, Huntsville (USAEDH) was designated as the USACE Mandatory Center of Expertise (MCX) and Design Center for Ordnance and Explosive Waste (OEW). As the MCX and Design Center for OEW, USAEDH is responsible for the design and successful implementation of all Department of the Army OEW remediations required by CERCLA. USAEDH will also design and implement OEW remediation programs for other branches of the Department of Defense when requested. In cooperation with the Huntsville Division, the U.S. Army Corps of Engineers St. Louis District has been assigned the task of preparing Archives Search Reports for those Formerly Used Defense Sites (FUDS) suspected of chemical warfare materials (CWM) contamination.

1.2 Subject

Plumbrook Ordnance Works is located 4.7 miles south of Sandusky, Ohio. Originally consisting of 9,071.06 acres, the site lies in the townships of Huron, Milan, Perkins, and Oxford in Erie County. Constructed in 1940 for the manufacture of explosives during World War II, it was subsequently renamed the Plum Brook Depot Activity and was also referred to as the Erie Ordnance Depot.

1.3 Purpose

This Archives Search Report (ASR) compiles information obtained through historical research at various archives and records holding facilities, interviews with persons associated with the site or its operations, and personal visits to the site. All efforts were directed towards determining possible use or disposal of chemical warfare materials on the site. Particular emphasis was placed on establishing the type (agent), munitions or container, quantities and area of disposal. Information obtained during this process was used in developing recommendations for further actions at the site.

1.4 Scope

Excluding lands controlled by NASA, the remaining area of the former Plum Brook Ordnance Works site was considered in assessing the potential for chemical warfare material contamination. It is designated as DERP-FUDS OEW Site No. G05OH001806.

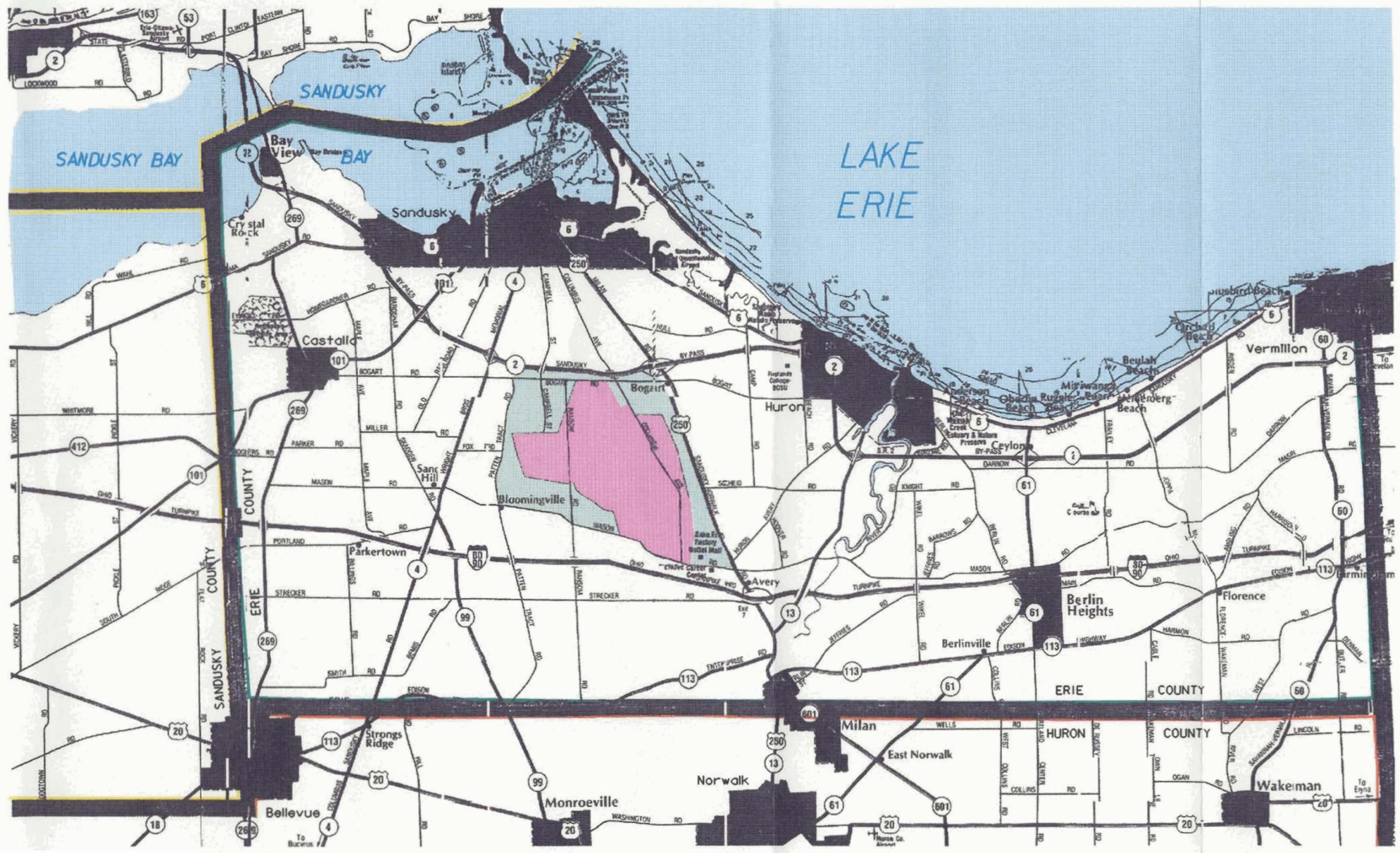


FIGURE 1

PLUMBROOK ORDNANCE WORKS
ERIE COUNTY
SANDUSKY, OHIO
DERP-FUDS* G050H001806
PROJECT LOCATION MAP

PROJ. DATE: DEC 1993	DATE OF MAP: 1993
22-DEC-1993 08:30	SITE23G/MAP/OH0018

NOT TO SCALE



FUDS LAND
 LAND CURRENTLY OWNED BY NASA

NOT TO SCALE

PLUMBROOK ORDNANCE WORKS
ERIE COUNTY
SANDUSKY, OHIO
DERP-FUDS# G050H0001806
VICINITY MAP

PROJ. DATE: DEC. 1993 03-JAN-1994 15:42	DATE OF MAP: 1992 SITE23G/MAP/PLMBRK03.DGN-PLUM000.CIT
--------------------------------------------	-----------------------------------------------------------

FIGURE 2



2.0 Previous Site Investigations

2.1 Findings and Determination

Under the Defense Environmental Restoration Program (DERP), the Huntington District prepared a Findings and Determination of Eligibility (FDE), dated 1 April 1992, and approved 24 December 1992, for Plum Brook Ordnance Works (PBOW). The FDE indicates that the site is comprised of 9,071.06 acres of land (9020.66 acres fee and 50.40 acres easement) acquired by purchase and condemnation from various owners in 1941. The FDE indicates that the site was disposed portions of the lands beginning in 1946 when the War Assets Administration excepted custody of all but 2800.46 acres which constituted the magazine area. In 1958, the Department of the Army transmitted a copy of a permit entered into by NACA (predecessor of NASA) and Army, by which NACA accepted PBOW "subject to existing contamination without fencing of such areas by the Department of the Army." The FDE further provides that the SF 118, excessing 3180.33 acres fee and 50.60 acres easement, and subsequently permitted to NACA, included the proviso that "detailed information regarding contamination is not being furnished as it is understood that NACA is agreeable to the transfer of the installation subject to contamination." The Department of the Army currently retains Parcel Number 62, acreage unknown, for use as a U.S. Army Reserve Center. The report determined that the site, excluding the 3685.977 acres of NASA's research center, was eligible for the Defense Environmental Restoration Program for Formerly Used Defense Sites under 10 U.S.C. 2701 et seq.

Two projects were proposed for the site. One is a HTW project (G05OH001803), consisting of a Remedial Investigation/Feasibility Study (RI/FS) for contaminated areas such as TNT deposits on the site. The other, an OEW project (G05OH001806), involves an on-site inspection and preparation of a report on potential ordnance and explosive waste hazards that may exist. Both projects were authorized by USACE on 13 January 1993.

2.2 Confirmation Study

A Confirmation Study was conducted by the Nashville District in February 1990. Its purpose was to determine if chemical contamination from previous DOD-related activities was present and if groundwater degradation was resulting. The scope of the contamination evaluation included a records review and evaluation, soils and water sampling/analysis/characterization, a site survey, and completion of hazardous ranking forms (utilizing the Navy's HRS scoring system). The resultant hazardous ranking score for chemical contamination was 0 based on no users of the contaminated aquifer. The study issues a caveat that this score may not be accurate when compared with the currently required EPA's HRS scoring method.

The study found extensive contamination of both soil and groundwater. It concluded that no fire or explosion hazard exist as a result of the contamination. The Chemical Contamination

Summary is attached at Appendix C.

2.3 HTW Remedial Investigation and Feasibility Study

The RI/FS for HTW is currently being conducted by the Nashville District, Corps of Engineers.

2.4 NASA Studies

Due to the joint liabilities, as a responsible party for the contamination/remediation of the site, NASA conducted a Preliminary Assessment dated June 1991 and performed a site inspection in October 1993. A copy of applicable sections of both these reports is included at Appendix C.

3.0 Site and Site Area Description

3.1 Location

The Plum Brook site is located in Erie County, Ohio, approximately four miles south of Sandusky, Ohio, in Perkins and Oxford Township. It is comprised of 9,071.06 acres of land (9020.66 acres fee and 50.40 acres easement) acquired by purchase and condemnation from various owners in 1941. The location of Plum Brook is spread over two quadrangle maps with the plant located in Township 6 North, Range 23 West. Sections are not delineated on either quadrangle. The center of the site is located at 41 degrees 22 minutes 30 seconds North and 82 degrees 40 minutes 30 seconds West.

3.2 Past Uses

The area known as Plum Brook Ordnance Works (PBOW) was established in 1941 for the purpose of manufacturing trinitrotoluene (TNT), dinitrotoluene (DNT), pentolite, and nitric and sulfuric acids. Built by E. B. Badger and Sons Company, the facility was operated under contract by the Trojan Powder Company. Production of explosives ceased two weeks after V-J Day, having manufactured in excess of one billion pounds of explosives during the four-year operating period.

By September 1945, the entire Ordnance Inspection Department was abolished. Decontamination of TNT, acid, pentolite, and DNT manufacturing lines was completed during the last quarter of 1945. On 17 December 1945, the physical custody of the plant was transferred from Trojan to the Ordnance Department. The U.S. Corps of Engineers assumed responsibility for maintenance and custodial duties until September 1946 when the property was transferred to the War Assets Administration (predecessor to the Government Services Administration), after it was certified by the U.S. Army to be decontaminated.

The National Aeronautics and Space Administration acquired the Plum Brook Ordnance Works in March 1963 and is presently using the site.

3.3 Current Uses

The site lies in an area that is primarily rural and agricultural with low population density. The NASA Lewis Research Center occupies a majority of the former ordnance works. The Department of the Army maintains a reserve center on the westernmost portion of the site. The remainder of the former installation is in private ownership with the vast majority being cultivated. A tract on the northern boundary is owned by the Perkins Board of Education and is utilized as a bus maintenance facility.

3.4 Demographics of the Area

3.4.1 Center of Activity

Plum Brook Ordnance Plant is located in the vicinity of Sandusky, Ohio. This city has numerous centers of activity such as the Sandusky Library, Follett House Museum, Merry-Go-Round Museum, Sandusky Cultural Center, The Bay Gallery, State Theatre, Sandusky Mall, Providence Hospital, Firelands Community Hospital, Perkins Public Schools, Sandusky City Schools, and Southeastern Business College.

3.4.2 Population Density

City: Sandusky	County: Erie
Area: 14.9 sq.mi.	Area: 264 sq.mi.
POP: 29,764	POP: 76,779
PD: 1,997 people per sq. mi.	PD: 290 people per sq. mi.

Population and area are based on the U.S. Department of Commerce, Bureau of the Census, 1990 statistics, and telephone interviews.

3.4.3 Types of Businesses

A review of both telephone interviews and County Business Patterns (1990) assisted in developing a business profile of the area. Sandusky is a diversified community. Sandusky Mall, San Marco Plaza, Sandusky Plaza, Perkins Plaza and Park Place Plaza are the commercialized areas that include retail, services and trade establishments. Light industry is established in the area. Industrial Nut Corporation, is the manufacturer of special and lock nuts. The Sandusky plastics plant, owned by Ford Motor company, manufactures and supplies headlamps, signal lamps, air handling systems, and fuel vapor containment systems.

3.4.4 Types of Industry

See item #3.

3.4.5 Types of Housing

Housing in the Sandusky area is composed of single and multi-family housing.

3.4.6 New Development in the Area

Development in the Sandusky area is associated with residential and commercial development. Numerous residential areas have been established along the lake. In addition, of the five shopping areas, three have been established in the past five years.

3.4.7 Cross-section of the Population

The ancestry of Sandusky is diverse. The community is largely composed of English, German, and Irish descendants. There are approximately 12,053 households with a median household income of \$22,532. In addition, there are 13,416 housing units in Sandusky. The work force of the Erie county is broken down into the following: manufacturing, 15.4%; non-manufacturing, 79.7%; agriculture, 1.3%; and other non-agriculture 3.6%.

4.0 Physical Characteristics of the Site

4.1 Geology\Physiography

Although the Plum Brook Ordnance Works is located within the Till Plain Section of the Central Lowlands province, the site lies within the lacustrine plain of ancient Lake Erie. The site favors the topography of the Great Lakes Section rather than the Till Plain Section. The Great Lakes Section topography characterized by large lakes, (four of the Great Lakes), and thousands of smaller lakes. The site is situated on an old glacial lacustrine plain of ancient Lake Maumee. Lake Maumee was the forerunner of present Lake Erie. The basins now occupied by the Great Lakes were weak rock lowlands in pre-glacial time. It appears that intense, local, glacial scouring deepened these lowlands considerably. This deepening, along with the depression of the area under the ice sheet provided the proper conditions for ice marginal lakes to develop. As the cycles of the four glaciations occurred, the area was repeatedly covered by various ice marginal lakes, the first being Lake Maumee (Thornbury, 1965). The glacial deposits are mostly clay-rich lacustrine and till. The drift is commonly stratified and has an average thickness of 50 feet near the site.

Below the glacial deposits, Middle Devonian strata of the Detroit River Group and younger units including the Columbus Limestone are the principal near-surface rocks. These units provide a karst region in western Erie County, Ohio.

4.2 Soils

The site surficial soils at the Plum Brook Ordnance Works consist of deep, nearly level to moderately sloping, well drained to moderately well drained soils. They have a subsoil of silty clayey fine sand and are mostly found on hills and ridges.

These soils formed in very fine sand deposited by the wind and water as beaches, sandbars, or dunes. Therefore, both wind erosion and sheet and rill erosion by water present a hazard.

4.3 Hydrology

The site is located approximately 4.0 miles south of Lake Erie. Pipe Creek, Ransom Ditch, Taylor Ditch, Hemming Ditch, Plum Brook, Lindsley Ditch, Schlessman Ditch, Scheid Ditch, Kuebelar Ditch, Olemacher Ditch, Sherer Ditch, and Beutal Ditch drain storm runoff from the site north to Lake Erie.

4.3.1 Ground Water

Below the glacial deposits, Middle Devonian strata of the Detroit River Group and younger units including the Columbus Limestone are the principal near-surface rocks. These units provide a karst region in western Erie County, Ohio.

Groundwater is available from two sources: the drift deposits and the karst aquifer. The variable thickness of drift above the carbonate aquifer, which is locally thin (<20') makes it an unreliable source of groundwater.

Potentiometric contours indicate that flow is diffuse flow (rather than conduit flow common in karst areas), towards Sandusky Bay. Reports that some parts of the surface of Sandusky Bay remain unfrozen in winter indicate that the bay also could receive subsurface groundwater discharge. Similar water-level altitudes in the carbonate aquifer and Sandusky Bay indicate a hydraulic connection between the bay and the aquifer.

Transmissivity values of the carbonate aquifer in nearby Sandusky County range from 3500 ft²/d at the northern end of Sandusky County to 13,000 ft²/d at a well in Green Springs, which is southwest of the site area.

Recharge to the carbonate aquifer is by three primary processes:

1. Precipitation leaking through the semi-confining layer of drift overlying the carbonate rocks.
2. Infiltration by surface water and precipitation in areas where the drift is thin or absent.
3. Induced infiltration of surface water through riverbeds and streambeds as a result of groundwater withdrawals (Breen and Dumouchelle, 1991).

4.4 Weather

The climate is continental in character but with strong modifying influences by Lake Erie. West to northerly winds blowing off Lake Erie tend to lower daily high temperatures in summer and raise temperatures in winter. In this area, summers are moderately warm and humid with occasional days when temperatures exceed 90 degrees. Winters are relatively cold and cloudy with an average of 5 days with sub-zero temperatures. Weather changes occur every few days from the passing of cold fronts.

The daily range in temperature is usually greatest in late summer and least in winter. Annual extremes in temperature normally occur soon after late June and December. Maximum temperatures below freezing occur most often in December, January, and February. Temperatures of 100 degrees or higher are rare. On the average, freezing temperatures in fall are first recorded in October while the last freezing temperature in spring occurs in April.

As is characteristic of continental climates, precipitation varies widely from year to year. However, it is normally abundant and well distributed throughout the year with spring being the wettest season. Showers and thunderstorms account for most of the rainfall during the growing season. Thunderstorms are most frequent from April through August. Damaging winds of 50 mph or greater are usually associated with these thunderstorms.

Climatological data for the area are summarized in TABLE 1. Data was collected at the National Weather Service meteorological station at Sandusky, Ohio and the Cleveland Airport.

CLIMATOLOGICAL DATA FOR
SANDUSKY, OHIO AND CLEVELAND, OHIO
TABLE 1

Month	Temperature ¹		Precipitation ¹	Wind ²	
	Average Minimum	Average Maximum		Average Speed	Average Direction
	(°F)	(°F)	(Inches)	Miles/Hour	
January	19.0	33.0	2.04	12.3	SW
February	21.0	35.0	1.90	11.9	S
March	29.0	45.0	2.68	12.2	W
April	40.0	57.0	3.06	11.5	S
May	51.0	69.0	3.51	10.0	S
June	61.0	79.0	4.11	9.3	S
July	65.0	83.0	3.67	8.6	S
August	64.0	82.0	3.38	8.3	S
September	56.0	75.0	2.95	9.0	S
October	46.0	63.0	2.12	9.9	S
November	35.0	49.0	2.55	11.8	S
December	24.0	37.0	2.36	12.1	S
Annual	42.0	59.0	33.99	10.6	S

¹ SANDUSKY, OHIO

² CLEVELAND, OHIO

4.5 Ecology

The information provided for this site has been compiled from the U. S. Fish and Wildlife Service and the Ohio Department of Natural Resources.

The U.S. Fish and Wildlife Service lists the Indiana bat (Myotis sodalis), bald eagle (Haliaeetus leucocephalus), and lakeside daisy (Hymenoxys acaulis var. glabra) as Federally endangered or threatened species that may be found in Erie County. Federal candidate species include: Lake Erie water snake (Nerodia sipedon insularum), Kirtland's snake (Clonophis kirtlandii), Blanding's turtle (Emydoidea blandingii), and common tern (Sterna hirundo).

State listed threatened, endangered, or sensitive species found to occur near Plumbrook Ordnance Works include: Ashy sunflower (Helianthus mollis), lance-leaved violet (Viola lanceolata), Prairie false indigo (Baptisia lactea), round-fruited hedge-hyssop (Gratiola virginiana), grooved flax (Linum sulcatum), field sedge (Carex conoidea), twisted yellow-eyed-grass (Xyris torta), Virginia meadow-beauty (Rhexia virginica), dwarf bulrush (Hemicarpha micrantha), tall St. John's-wort (Hypericum majus), broad-winged sedge (Carex alata), and upland sandpiper (Bartramia longicauda).

No additional information on the occurrence of rare or endangered species or natural communities is known at this time. This does not mean that other state or federally-listed species may not be present within the areas of interest. An on site inspection by appropriate state and federal personnel may be necessary to verify the presence, absence or location of listed species, or natural communities if remedial action is recommended as part of the final ASR.

5.0 Real Estate

5.1 Present Ownership

The Findings and Determination of Eligibility (FDE), cited in Paragraph 2.0, indicates that the former Plum Brook site was disposed of in "...several, fairly complicated stages." The disposal is summarized as follows:

- a. NASA Lewis Research Center maintains a 3685.977 acre installation.
- b. GSA controls several tracts totalling approximately 2090 acres.
- c. 46.023 acres was quitclaimed unto the Perkins Board of Education by the Secretary of Health, Education, and Welfare.
- d. In 1954 and 1983, an aggregate approximating 3250 acres were sold to third parties.

5.2 DOD Ownership

Based on data contained in the FDE:

"The Plum Brook Ordnance Works consisted originally of 9071.06 acres of land [9020.66 acres fee, 50.40 acres easement] acquired by purchase and condemnation from various owners in 1941."

5.3 Significant Past Ownership Other Than DOD

The only historically significant ownership with respect to possible contamination is found to be NASA, as documented in this report.

6.0 OEW/CWM Site Analysis

6.1 Historical Summary of OEW/CWM Activities

Plum Brook Ordnance Works (PBOW) was built in 1940 by E. B. Badger and Son under a government contract. Located 4.7 miles south of Sandusky, Ohio, the entire site consisted of 9,071.06 acres. Upon completion, the PBOW included 528 buildings with a total floor area of 1,069,957 square feet, of which 318,660 was dedicated to production.

The Trojan Powder Company, Allentown, PA, operated PBOW during World War II, manufacturing explosives. The works included production lines for trinitrotoluene (TNT), dinitrotoluene (DNT), pentolite, nitric, and sulfuric acids. Between December 1941 and December 1945 PBOW produced more than one billion pounds of ordnance. Per 24 hour day, the plant had the capacity to produce 900,000 pounds of TNT, 105,000 pounds of DNT, and 21,000 pounds of Pentolite. Auxiliary facilities for this production included: three acid areas for the production and concentration of nitric acid, and for the concentration of sulfuric acid; three power houses; a large maintenance area; a magazine area consisting of 99 igloo type magazines of 250,000 pounds capacity each; utility and service systems, including water supply and electrical systems, railroads, waste disposal, both process and domestic and overhead and underground process lines for steam, air and liquids, and an administration area.

Production ceased in August 1945, two weeks after V-J Day. The physical custody of the plant was transferred from Trojan to the Ordnance Department in December 1945. At this time PBOW was renamed the Plum Brook Depot. Portions of the depot were used as an ammunition storage facility for Erie Ordnance Depot. The Plum Brook Depot was placed in inactive status in 1961.

The land disposal occurred in several fairly complicated stages. At the end of World War II, continued use of the works by the Department of War was not contemplated, therefore the entire facility, except for 52.74 acres which was previously quitclaimed to the Baltimore and Ohio Railroad Company on 27 March 1943, was declared excess. Later, the Department of Army decided that it was best to withdraw the magazine area [2800.46 acres fee] from excess, and on 11 March 1946 this withdrawal was approved. The War Assets Administration (WAA) accepted custody of the remainder on 6 September 1946.

In 1947 the magazine area was redesignated the Plum Brook Depot Activity. It was to become known as the "retained area" and was not a part of the surplus to WAA. This acreage, also known as the Erie Ordnance Depot, was used for powder storage.

By the evidence of documents found at the Great Lakes Regional Branch of the National Archives and the National Personnel Records Center, post-war decontamination of the site was left incomplete. A report from 8 December 1948, by Francis H. Miles, Jr., details

considerable chemical contamination in and around the manufacturing buildings. Another document, a letter by Colonel Ronald B. Currens from 24 December 1957, states that decontamination activities were suspended but gives no reason. (See sections 6.2.2 and 6.2.5 for help in locating these documents.)

In June 1954 the Department of the Army reacquired 3180.33 acres ordnance works and 50.40 acres of easements. The rest of the original site, previously declared excess to WAA, was disposed of either to NASA or third party grantees.

A Use Agreement was obtained from the Department of the Army on 5 July 1956, for approximately 500 acres (Pentolite Area, Plum Brook Ordnance Works). The reactor facility was constructed on this site with National Advisory Committee for Aeronautics (NACA), C&E appropriation of Fiscal Years 1956, 1958, and 1960. On 22 January 1958 the balance of the land (2700 acres) and structures of PBOW was turned over to NASA (formerly NACA) under a Use Agreement from the Department of the Army. NASA constructed rocket research facilities on the site.

NASA acquired the ordnance works in March 1963 and is still using the site (6,453.5 acres). In April 1978 NASA declared as excess approximately 2,152 acres. The Perkins Board of Education acquired 46 acres and uses it as a bus transportation center. The remaining 600 acres is retained by GSA with a use agreement to the Ohio National Guard.

Archival research and interviews revealed no evidence of any chemical warfare materials (CWM) ever being shipped through or stored at the Plum Brook Ordnance Works. Our archival research did reveal problems with explosive waste at PBOW, in the residue of TNT and DNT production. These problems, however, are being handled as a hazardous, toxic, and radioactive waste (HTRW) project by the Nashville District--U.S. Army Corps of Engineers.

6.2 Records Review

Records concerning the history of Plum Brook Ordnance Works, Sandusky, Ohio, were reviewed from September through December, 1993, at the following locations. At the National Archives and Records Centers, St. Louis District personnel examined the following record groups if they were present and if initial inquiry led them to believe the groups contained useful information. As at all repositories, finding aids, archivists, and records managers were used to locate portions of the records relevant to the research.

- RG 18 - Records of Army Air Forces
- RG 48 - Records of the Office of the Secretary of the Interior
- RG 49 - Records of the Bureau of Land Management
- RG 61 - Records of the War Industries Board

RG 70 - Records of the Bureau of Mines
 RG 71 - Records of the Bureau of Yards and Docks
 RG 77 - Records of the Office of the Chief of Engineers
 RG 79 - Records of the National Park Service
 RG 95 - Records of the Forest Service
 RG 107 - Records of the Office of the Secretary of War
 RG 115 - Records of the Bureau of Reclamation
 RG 121 - Records of the Public Buildings Service
 RG 156 - Records of the Chief of Ordnance
 RG 160 - Records of Headquarters Army Service forces
 RG 175 - Records of the Chemical Warfare Service
 RG 179 - Records of the War Production Board
 RG 181 - Records of Naval Districts and Shore Establishments
 RG 269 - Records of the General Services Administration
 RG 270 - Records of the War Assets Administration
 RG 291 - Records of the Property Management and Disposal
 Service
 RG 338 - Records of United States Army Commands
 RG 342 - Records of US Air Force Commands, Activities,
 Organizations
 RG 407 - Records of the Adjutant General's Office

6.2.1 National Archives and Records Administration, Suitland, MD: In RG 159; Entry 26E, "General Correspondence 1939-1947"; Box 326; Folder, "Plum Brook Ordnance Works", we found an Inspection Report of the Activities in Connection with Operation and Construction of Additional Facilities, 2 March 1945.

6.2.2 National Archives and Records Administration, Great Lakes Region, Chicago, IL: In RG 270, WAA Real Property Case Files, we reviewed boxes 195-200 (record center cartons). We found: histories, maps, plans, acquisition and disposal records (boxes 195 and 196); engineering appraisal reports (box 197); an industrial survey final report (box 198); information and bids on excessed equipment (box 199); and a Corps of Engineers Industrial Facilities Report (box 200). We found nothing to indicate the presence of ordnance at the site, but definite indications of OEW/HTRW from the production of TNT and DNT. We also looked at two Hollinger boxes of records relating to Plum Brook, RG 270, boxes 37 and 38. These contained nothing relating to OEW/CWM.

6.2.3 National Archives and Record Administration, Federal Records Center, Dayton, OH: This facility contained no information relating to the Plum Brook Ordnance Depot.

6.2.4 Historical Division--Chemical and Biological Defense Agency, Aberdeen Proving Ground, Edgewood MD: This facility contained no information relating to the Plum Brook Ordnance Depot.

6.2.5 National Personnel Record Center, St. Louis, MO: In Accession 61A3161, Box 14, Folder 600, we found a letter of 4 Mar 1957 regarding an inventory of Military Real Property at PBOW. The letter dealt with the status of the magazine area. In Box 15, File 601: "Army Com., Joliet, IL.," we found a letter from 13 Sep 1957, subject: "Disposal of Plum Brook Ordnance Works." Another letter, dated 24 Dec 1957, from Colonel Ronald B. Currens, Ordnance Corps, reported on a safety survey of decontamination activities at PBOW. It says that the safety measures at PBOW were effective, but also that decontamination activities had been suspended after one area, Area "A," had been decontaminated. It gives no reason, or duration, for the suspension.

6.2.6 US Army Armament, Munitions, and Chemical Command, Rock Island, IL: This facility contains information about many arsenals and Army ammunition plants, but nothing about the PBOW.

6.2.7 Ohio Historical Society, Columbus, Ohio: Here we consulted with archivists and perused the card catalog and other findings aids. In the Records of the War History Commission we found copies of the PBOW NEWS, the facility newspaper. The index to the Records of the War History Commission mentioned a history of PBOW, but this was missing from the box. The index said that another copy of this history could be found at the Sandusky Public Library, and it was.

6.2.8 University Library, Ohio State University, Columbus, OH: In the library we found Sanborn maps for sites in Cleveland and Willoughby, Ohio, but no maps or other information relating to the Plum Brook Ordnance Works.

6.2.9 Sandusky Library, Sandusky, OH: The History Department maintains a historical file on the Plum Brook Ordnance Depot. From the file we copied several articles concerning the history, operations, and disposal/transfer of the facility. The relevant information was copied for use in preparing the ASR.

6.2.10 National Aeronautics and Space Administration, Sandusky, OH: Ms. Amy Bower of the Safety and Quality Assurance Office provided us with aerial photographs and drawings showing the facility before and after NASA took possession. At the NASA office we copied a photograph, (#P631237) 1963, of a person holding a 12-15 pound chunk of TNT found in B Area. It is reproduced in Appendix D.

6.3 Interpretation of Aerial Photographs

Photo analysis and land use interpretation was performed at the site with the use of aerial photography from 1969. The Sandusky, Ohio 1969, photorevised 1979, and the Kimball, Ohio 1969 quadrangle maps were used as a reference for the photography. The approximate negative scale of the photography is as follows:

<u>Photography Date</u>	<u>Scale</u>	<u>Source</u>	<u>Identifier(s) Frame(s)</u>
18 Mar 1969	1" = 2,000'	EROS	2-25 thru 2-28 2-76 thru 2-78

On the 1969 photography the Plum Brook Ordnance Depot is still well defined with roads and buildings. The most noticeable feature, within the southeast portion of the site, is the magazine area that is approximately 1 mile wide, east to west and 1.2 miles wide north to south. Approximately 100 storage bunkers are aligned along the parallel roads that traverse this area. There are three reservoirs located through the north central portion of the site. Five building complexes on the site are located in the central and eastern portions of the site north and northeast of the magazine area. An additional large structure with a domed center is located at the south end of the magazine area. No other determination can be made in regard to chemical warfare material (CWM) or ordnance manufacturing. CWM or ordnance storage is assumed to have taken place in the magazine area.

6.3.1 Map Analysis

The site was analyzed by referencing the following USGS 7.5 minute quadrangle maps: Sandusky, Ohio 1969, photorevised 1979, and Kimball, Ohio, 1969. The site is spread over both of the quadrangle maps above with the plant located in Township 6 North, Range 23 West. Sections are not delineated on either quadrangle. Further, the center of the site is located at 41 degrees 22 minutes 30 seconds North and 82 degrees 40 minutes 30 seconds West.

The portion of the site located on the southern portion of the Sandusky quadrangle labels the boundary road as a patrol road. Several water towers, water tanks, and reservoirs are positioned throughout the site. Topographic features are well defined by 5 foot contour lines. The infrastructure is well defined by light-duty roads, railroad spurs, aqueducts leading from a pumping station and a reservoir, and an electric substation. There are no indications of CWM or ordnance storage or disposal on the Sandusky, Ohio quadrangle map.

The portion of the site located on the Kimball quadrangle, along the northern edge, is labeled as the National Aeronautics and Space Administration - Lewis Research Center. The patrol road continues to follow the boundary on this quadrangle. Numerous light-duty roads also dissect this portion of the site and two water tanks are noted along the northern edge. The southeast portion of the site on the Kimball quadrangle is an apparent magazine area. The magazine area is bounded by a labeled North and South Magazine Road with eight parallel roads between the two showing approximately 100 storage bunkers spread at equal distances along the roads. Railroad spurs also extend into the magazine area from the north and south. There is no evidence of CWM or ordnance disposal sites on the Kimball, Ohio quadrangle.

6.4 Interviews

6.4.1 General

Interviews were conducted by telephone both prior to and after the site inspection.

6.4.2 Ms Amy Bower

On 18 October 1993, Dennis Gilmore called Ms. Bower, 419-621-3233, of the Safety and Quality Assurance Office - NASA Lewis Research Center. She was listed as the POC in information received from the Huntingto District. I explained my purpose (she's very familiar with DERPS/FUDS).

Ms. Bower provided that she knew of no ordnance having been discovered on the site or adjacent properties. Chemical contamination exists as outlined in the INPRS. She also informed me that NASA is currently performing a Site Investigation (SI) of those areas identified in the INPR's as NASA's responsibility for remediation. The first draft of the SI is due out. She suggested that I contact Pete McCallum (Chief Environmental Programs Office at NASA, phone number 216-433-8852) to request a copy. Additionally, she informed me that NASA's coordination with the Corps has been with Vince O'Dell of the Cincinnati District (no phone number given).

Asked her if any special coordination would be required for me to visit the site. She said no and that if I would give her a few days notice, she would make the necessary arrangements for access and escort me.

6.4.3 Mr. Doug Webb

On 24 November 1993, Mr. Webb of the COE, Nashville District, 615-736-7140, called me, Dennis Gilmore, to discuss the focus of my investigation of Plum Brook. Informed him that we were conducting an archive search pursuant to the provisions of DERPS/FUDS, relative to OEW/CWM. He is the project manager of the HTW investigation. He informed me that he has available a confirmation study (PA/SI) performed in 1989, at which time they addressed not only HTW, but OEW also. Currently, he is doing a RI/FS.

I asked for a copy of the confirmation study, and any other information he may have relative to the site. He has found no evidence of OEW/CWM contamination.

6.5 Site Inspection

6.5.1 General

The site inspection was performed on 26 August 1993 by the following St. Louis District personnel:

Dennis W. Gilmore	Project Manager
	Site Safety Officer
Nancy B. Gerth	Historian/Archivist

6.5.2 Detailed Site Inspection

Prior to departing for the subject site, I gave Nancy the Site Specific Safety Plan and safety aspects related to the site were discussed.

Our first stop was the Erie County Public Library. They provided us with a file on the Plum Brook site which provided several articles of information on the history, operations, and disposal/transfer of the facility. The relevant information was copied for our use in preparing the ASR.

Next, we visited the County Engineer who made available to us copies of aerial photographs, focusing on the magazine area, from 1958. This date coincides with the transfer of the property to NASA.

From here we proceeded to the NASA-Lewis Research Center (formerly the Plum Brook Ordnance Works). We met with Ms. Amy Bowers of the Safety and Quality Assurance Office whom I had interviewed previously via telephone. She is also responsible for environmental compliance. As such, Ms. Bowers is well aware of the contaminants present on the facility as documented in the numerous reports and studies which have been conducted by both the Corps and NASA. The studies mentioned above documents the presence of residual trinitrotoluene (TNT) and dinitrotoluene (DNT), and their constituents. This contamination is considered, and will be addressed through Hazardous and Toxic Waste programs.

The magazine area (focus of our archives search), was visited and photographs taken. Previously, this area was utilized as an ammunition storage facility known as the Plum Brook Depot and subsequently, as the Erie Ordnance Depot. Ms. Bowers informed us that when NASA took over the site, the igloos were empty. NASA currently uses them for miscellaneous storage, two of which are used by the National Guard for ammunition storage.

Ms. Bowers provided us with aerial photographs and drawings which show the facility before and after NASA took possession. One of the photographs shows a NASA employee holding a 12-15 pound chunk of TNT which was found in "barricades" in the TNT B area.

This concluded our site inspection of the former Plum Brook Ordnance Works. At no time during the inspection did we note any physical indications of anything suggesting CWM or OEW contamination of the site.

7.0 Evaluation of Ordnance Contamination

Based on the extensive archive searches performed, the interviews with the owners and/or occupants of major portions of the former Plum Brook Ordnance Works site, and the results of the site investigation, there are no indications as to any CWM contamination of the FUDS portion of the former Plum Brook Ordnance Works. There is, as documented in several reports, chemical contamination of an HTW nature (primarily TNT, DNT and their constituents), resulting from previous DOD operations at the site.

The only evidence of OEW contamination was found in the photo depicting TNT chunks found when NASA acquired the site in 1963. NASA accepted transfer of the former facility subject to existing contamination. As such it was their responsibility to remediate the hazard. No record of this remedial action was found nor has any additional "chunks" been discovered.

All of the contamination, i.e. explosive residuals, is located on the areas of the former production plants and exhibit no signs of migrating. These contaminated areas remain in possession of the United States and as such are not addressed in this report. Additionally, the explosive residues were determined not to pose a fire or explosion hazard and as such does not constitute an OEW hazard. No evidence of OEW/CWM was found on lands now in private ownership.

8.0 Conclusions and Recommendations

The Risk Assessment Procedure for Ordnance and Explosive Waste (OEW) Sites Form, dated 9 December 1993, has been prepared for the Plum Brook Ordnance Works site and is included at Appendix I. Based on the best available data, and ongoing actions to remediate the site, a score of RAC 5 has been determined for this site. RAC 5 indicates that no further action is recommended. We concur in this recommendation considering the data we were able to accumulate. Even though the available documents established the presence of explosive residues on the current NASA site, no evidence of contamination was found on the adjacent, formerly used lands and no migration of the contaminants was evident.

Although this site was identified on the CEHND DERP-FUDS list as a possible CWM site, no information was developed during this archives search that indicates a plausible reason for its inclusion.

APPENDIX A
REFERENCES

REFERENCES FOR GEOLOGY AND SOILS

Thornbury, Wm. D., Regional Geomorphology of the United States, John D. Wiley and Sons, Inc., 1965

Breen, Kevin J. and Dumouchelle, Denise H., Geohydrology and Quality of Water in Aquifers in Lucas, Sandusky, and Wood counties, Northwestern Ohio, U.S. Geological Survey Water-Resources Investigations Report 91-4024, 1991.

APPENDIX B

ACRONYMS

Ordnance and Explosive Waste
Chemical Warfare Materials
Archives Search Report
for
Plum Brook Ordnance Works
Sandusky, Ohio
Site Number - G05OH001806

APPENDIX B

ACRONYMS

ASR	Archives Search Report
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CEHND	Corps of Engineers, Huntsville Division
CSM	Chemical Surety Material
CWM	Chemical Warfare Material
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program
DLA	Defense Logistics Agency
DNT	Dinitrotoluene
DOD	Department of Defense
EOD	Explosives Ordnance Disposal
EPA	Environmental Protection Agency
ERDA	Environmental Restoration Defense Account
FDE	Findings and Determination of Eligibility
FUDS	Formerly Used Defense Sites
FWS	U. S. Fish and Wildlife Service
GSA	General Services Administration
HTW	Hazardous and Toxic Waste
INPR	Inventory Project Report
IRP	Installation Restoration Program
MCP	Mandatory Center of Expertise
NACA	National Advisory Committee for Aeronautics
NASA	National Aeronautical and Space Administration
NCP	National Contingency Plan
OEW	Ordnance and Explosive Waste
PBOW	Plum Brook Ordnance Works
RAC	Risk Assessment Code
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
TNT	Trinitrotoluene
USACE	U.S. Army Corps of Engineers
USADACS	U.S. Army Defense Ammunition Center and School

USAED	U.S. Army Engineer District
USAEDH	U.S. Army Engineer Division, Huntsville, AL
USATHMA	U.S. Army, Corps of Engineers, Toxic and Hazardous Materials Agency
UXO	Unexploded Ordnance
WAA	War Assets Administration
WRNC	Washington National Records Center

APPENDIX C

REPORTS/STUDIES/LETTERS/MEMORANDUMS

Ordnance and Explosive Waste
Chemical Warfare Materials
Archives Search Report
for
PLUMB BROOK ORDNANCE WORKS
Sandusky, Ohio
Site Number - G050H001800

APPENDIX C

REPORTS/STUDIES/LETTERS/MEMORANDUMS

Accident Prevention Plan (APP), Standard Operating Procedures (SOP)	C-1
Memorandum, CELMS-PM-M, 3 December 1993, Subject: Trip Report, Site Inspection, Plum Brook, Sandusky, Ohio, Site No. G050H001800	C-2
Site Survey Summary Sheet, 20 March 1992, Subject: Plum Brook Ordnance Works, Plum Brook, Sandusky, Ohio, Site No. G050H001800	C-3
Findings of Fact, Plum Brook Ordnance Works, Plum Brook, Sandusky, Ohio, Site No. G050H001800	C-4
Chemical Contamination Summary for Plum Brook Ordnance Works, Sandusky, Ohio	C-5
Potential Hazardous Waste Site Preliminary Assessment, EPA Form 2070-12	C-6
Site Inspection Report, NASA Lewis Research Center, October 1993	C-7
Plum Brook Station Preliminary Assessment, NASA Lewis Research Center, June 1991	C-8

ACCIDENT PREVENTION PLAN (APP)
STANDARD OPERATING PROCEDURES (SOP)

C-1

ORDNANCE AND EXPLOSIVE WASTE
CHEMICAL WARFARE MATERIALS
ARCHIVES SEARCH REPORT
for the formerly
PLUMBROOK ORDNANCE WORKS
Sandusky, Ohio
Site Number - G050H001800

APPENDIX C

ACCIDENT PREVENTION PLAN

ACCIDENT PREVENTION PLAN (APP): STANDARD OPERATING PROCEDURES

I. This SOP establishes team policies and procedures to be utilized in the conduct of site investigations. It outlines the general hazards associated with site investigations and the preventive measures to be employed to minimize the potential risks. It is a generic plan which will be tailored to each specific site as required.

II. Administrative Plan

Team Leader and Safety Officer:

Dennis W. Gilmore

Team Members:

Michael Tarabulski
Nancy Gerth
Rosemary Bubnick

Reporting of incidents of a serious nature shall be by the most expedient means available, (usually telephonic), to the St. Louis District PM-M (Mike Dace) at (314)331-8036. If unavailable, contact CEHND-ED-SY, at (205) 955-4968 for further guidance.

A. Equipment: see checklist

(1) Team equipment will be checked for completeness and operability by the team leader, or his designated representative, prior to departure from the office. Any deficiencies or shortcomings will be corrected at this time.

(2) Personal Protective Equipment is the responsibility of each individual team

member. As a minimum, safety shoes, safety glasses, and gloves will be required. No outer or undergarments made of wool, silk, or synthetic textiles such as rayon and nylon shall be worn on the site.

B. Site Control Program

(1) A site map, identifying site work zones will be prepared and reviewed by each team member prior to entering the site.

(2) Prior to movement to the potential OEW site, the team leader will provide each member with the phone number and location of the local emergency assistance services i.e., hospital, police, fire, EOD, etc.

(3) The primary means of communications will be voice. The following standard hand signals will be used when distances are too great for voice communications.

Hand gripping throat.....Can't breathe, out of air
Both hands around waist...Leave area immediately
Hands on top of head.....Help; I need assistance
Thumbs up.....I'm alright, I understand
Thumbs down.....No, negative reply

(4) Only personnel essential to the mission will be permitted on the site during the survey. A minimum of two team members shall be required to perform the survey and shall remain in visual contact with each other at all times.

C. Conduct of the Site Survey

Our mission is to reconnoiter potential OEW sites to determine the presence of ordnance and explosive waste from conventional munitions and/or chemical warfare materials through the conduct of a visual search (**NO DIGGING ALLOWED**).

(1) Prior to initiating the survey, the surrounding area shall be surveyed for the presence of antennas, and communication and radar devices.

(2) Each site identified for reconnoitering will be divided into lanes of not more than thirty foot widths. The team members performing the survey will traverse each lane lengthwise, at an interval not less than the minimum burst radius of the suspected munitions type. Adjacent lanes will not be surveyed simultaneously.

(3) The location of suspected ordnance discovered will be marked to facilitate recording of pertinent data upon completion of a thorough sweep of the site. **SUSPECTED ORDNANCE AND OTHER SUSPICIOUS ITEMS WILL NOT BE DISTURBED IN ANY MANNER.** If we suspect OEW, DO NOT TOUCH IT, immediately notify the local EOD, Huntsville, and the local authorities.

and assist, as may be required, from outside the boundaries of the survey area.

III. General Safety Precautions of Restricted Area Operations

(1) All OEW or other suspicious items will be considered as extremely hazardous. Do not touch, directly or indirectly, any piece of ordnance at any time.

(2) If you suspect chemicals to be present in the area, all field operations must be halted immediately. Notification requirements are the same as that of a serious incident.

(3) Dead vegetation and/or animals could indicate the presence of chemical agents, be on the alert.

(4) No smoking, fire or spark-producing devices will be allowed on the site.

(5) Consider all practice ordnance to contain a live charge.

(6) Always approach a suspected piece of ordnance from the rear, at a 45 degree angle.

(7) Never spend more time near a suspected piece of ordnance than is absolutely necessary.

(8) Never assume that the color code on an item is accurate. If suspected ordnance has green marking bands, evacuate the area immediately and report through channels.

(9) Surveys will not be conducted during periods of inclement weather or limited visibility.

(10) Prior to entering any abandoned structure on the site, the team leader shall conduct a survey to determine the layout, the condition of the framing, floors, walls, etc.

(11) Do not drive a vehicle into a suspected OEW site.

(12) Be aware of vegetation. Do not walk across areas where the ground cannot be seen.

(13) Other hazards, as appropriate, shall be addressed, for each specific site.

**Plumbrook Ordnance Works
G050H001800**

ASR Site Visit

This document constitutes the team site specific safety plan for the subject site visit. It incorporates by reference the team's Accident Prevention Plan (APP), a copy of which has been reviewed and acknowledged by all attendees.

Purpose: This site visit is being conducted to document the presence or absence of ordinance and/or explosive wastes (OEW) contamination of the formally used defense site (FUDS).

Mission: During the site survey we will be reconnoitering the former site of the an explosives manufacturing plant, which was engaged in the production of trinitrotoluene (TNT), dinitrotoluene (DNT), peniolite and nitric and sulfuric acid. The purpose of our site inspection is to determine the presence of OEW from conventional munitions and/or chemical warfare materials(CWM). From the information already gathered the site is contaminated with various explosive residues and components.

Site Description: The site is located approximately four miles south of Sandusky, Ohio. The site is bounded on the north by Bogart Road, on the south by Mason Road, on the East by U.S. Highway 250, and on the west by County Road 43 (see site location map). The former Plum Brook site consists of 9,009 acres and lies in an area that is primarily rural and agricultural.

Reconnaissance Procedures: The team will, accompanied by Amy Bowers (NASA), walk the grounds surrounding the magazine area and inspect the interior of each structure, observing for signs of possible OEW contamination. The focus of our effort will be to identify possible explosives and/or components which may remain on the site. If such an area is discovered it will be cardoned off and local authorities immediately notified.

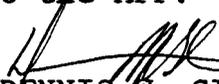
Possible Hazards: The major potential hazard involves the discovery of unstable explosives (due to age, weathering, chemical decomposition etc.) This site is known to be contaminated with nitro-aromatic explosive compounds, sulfates and nitrates. Therefore, the presence of any standing substance and/or leachate

will be noted and investigated. Team members will not come into contact with any liquid, semi-solid, or other unnatural substance which may be found on the site. Additional precautions may be required depending on the weather encountered (i.e. extreme cold). We must at all times remain cognizant of these potential hazards.

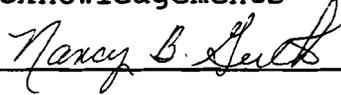
EMERGENCY RESPONSE: The site is located on the NASA Lewis Research Center which has emergency response facilities. The nearest hospital is:

LOCATION AND NUMBER TO BE BRIEFED

There are no additions or changes to the APP.


DENNIS W. GILMORE
Project Manager

Acknowledgements



MEMORANDUM, CELMS-PM-M, 3 DECEMBER 1993
SUBJECT: TRIP REPORT, SITE INSPECTION
PLUM BROOK
SANDUSKY, OHIO
SITE NO. G05OH001800

C-2

MEMORANDUM FOR FILE

1. The subject site inspection was performed on 1 December 1993 by the following St. Louis District personnel:

Dennis W. Gilmore	Project Manager
	Site Safety Officer
Nancy B. Gerth	Historian/Archivist and

2. Prior to departing for the subject site, I gave Nancy the Site Specific Safety Plan and safety aspects related to the site were discussed.

3. Our first stop was the Erie County Public Library. They provided us with a file on the Plumbrook site which provided several articles of information on the history, operations, and disposal/transfer of the facility. The relevant information was copied for our use in preparing the ASR.

4. Next, we visited the County Engineer who made available to us copies of aerial photographs, focusing on the magazine area, from 1958. This date coincides with the transfer of the property to NASA.

5. From here we proceeded to the NASA-Lewis Research Center (formerly the Plum Brook Ordnance Works). We met with Ms. Amy Bowers of the Safety and Quality Assurance Office whom I had interviewed previously via telephone. She is also responsible for environmental compliance. As such, Ms. Bowers is well aware of the contaminants present on the facility as documented in the numerous reports and studies which have been conducted by both the Corps and NASA. The studies mentioned above documents the presence of residual trinitrotoluene (TNT) and dinitrotoluene (DNT), and their constituents. This contamination is considered, and will be addressed through Hazardous and Toxic Waste programs.

6. The magazine area, (focus of our archives search), was visited and photographs taken. Previously, this area was utilized as an ammunition storage facility known as the Plum Brook Depot and subsequently, as the Erie Ordnance Depot. Ms. Bowers informed us that when NASA took over the site, the igloos were empty. NASA currently use them for miscellaneous storage with two in use by the National Guard for storage of their ammunition.

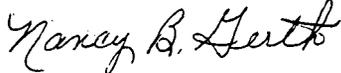
7. Ms. Bowers provided us with aerial photographs and drawings which show the facility before and after NASA took possession.

SUBJECT: Trip Report, Site Inspection, Plum Brook Ordnance Works,
Sandusky, OH, DERPS Site No. G05OH001800

8. This concluded our site inspection of the former Plum Brook
Ordnance Works. At no time during the inspection did we note first
hand anything suggesting CWM or OEW contamination of the site.



DENNIS W. GILMORE
Project Manager



NANCY B. GERTH
Historian/Archivist

CF:
CELMS-PM-M (Dace)
CELMS-PD-A (Groh)

SITE SURVEY SUMMARY SHEET, 20 MARCH 1992
SUBJECT: PLUM BROOK ORDNANCE WORKS
PLUM BROOK
SANDSKY, OHIO
SITE NO. G05OH001800

C-3

SITE SURVEY SUMMARY SHEET
FOR
DERP-FUDS SITE NO. G050H001800
PLUM BROOK ORDNANCE WORKS, OHIO
20 March 1992

SITE NAME: Plum Brook Ordnance Works

LOCATION: Sandusky, Ohio

SITE HISTORY: Property was acquired in 1941 by purchase and condemnation for the construction and operations of an ordnance works. The site was excessed to GSA in various phases. The current major owner is NASA.

SITE VISIT: A site visit was conducted on 8 May 1985 by Robert P. Johannsen, CEORH-ED-D.

CATEGORY OF HAZARD: HTW and OEW

PROJECT DESCRIPTION:

a. HTW. The project consists of the preparation of a Remedial Investigation/Feasibility Study (RI/FS) for contaminated areas such as TNT deposits on the site.

b. OEW. Work involves a site inspection and preparation of a report on potential ordnance and explosive waste hazards that may exist at the site.

AVAILABLE STUDIES AND REPORTS: Confirmation Study by CEORN, February 1990. The Chemical Contamination Summary is attached.

PA POC: Frank R. Albert, Jr., (304) 529-5194, CEORH-ED-DC.

FINDINGS OF FACT
PLUM BROOK ORDNANCE WORKS
PLUM BROOK
SANDUSKY, OHIO
SITE NO. G05OH001800

C-4

**DEFENSE ENVIRONMENTAL RESTORATION PROGRAM
FOR
FORMERLY USED DEFENSE SITES
FINDINGS AND DETERMINATION OF ELIGIBILITY**

PLUM BROOK ORD WORKS

Sandusky, Erie County, Ohio

Site No. G050H001800

FINDINGS OF FACT

1. The Plum Brook Ordnance Works consisted originally of 9,071.06 acres of land [9020.66 acres fee, 50.40 acres easement] acquired by purchase and condemnation from various owners in 1941. The site, located 4.7 miles south of Sandusky, Ohio, and 59 miles west of Cleveland, lies in the townships of Huron, Milan, Perkins, and Oxford, in Erie County, Ohio.
2. The Plum Brook Ordnance Works was used by the Trojan Powder Company for the manufacture of explosives during World War II. The works was constructed by the U. S. Army in 1940 and operated by the Army until 1945. The works included production lines for TNT, DNT, and pentolites.
3. The Plum Brook Ordnance works ceased operations in 1945, and the area was renamed the Plum Brook Depot. Portions of the depot were operated as an ammunition storage facility for Erie Ordnance Depot. The Plum Brook Depot was placed in inactive status in 1961.

The land disposal occurred in several, fairly complicated, stages. At the end of World War II, continued use of the works by the Department of War was not contemplated, so the entire facility, except for 52.74 acres which was previously quitclaimed to the Baltimore and Ohio Railroad Company on 27 March 1943, was declared excess. Later, the Department of the Army decided that it was best to withdraw the magazine area [2800.46 acres fee] from excess, and on 11 March 1946 this withdrawal was approved. The War Assets Administration accepted custody of the remainder on 6 September 1946.

In 1947, the magazine area, 2800.46 acres fee, was redesignated The Plum Brook Depot Activity [hereinafter PBDA]. It was to become known also as the "retained area" and was not a part of the surplus to WAA. This acreage was also referred to as the Erie Ordnance Depot, and was utilized for powder storage.

On 15 March 1949, the retained magazine area was 2800.46 acres, and the surplus in the custody of WAA/GSA was 6167.86 acres, fee; and 50.40 acres, easement.

By letter of transfer dated 16 June 1954, effective 30 June 1954, the Department of the Army reacquired from GSA the 3180.33 acres ordnance works and 50.40 acres easements, which thereafter was known as Plum Brook Ordnance Works [hereinafter PBOW]. The rest of the original site, previously declared excess to WAA, was disposed of to either NASA or third party grantees. This area, referred to as the WAA net disposal area, contained 2987.13 acres. No work is proposed in the net disposal area, which is now largely a subdivision of residential properties, so it is unknown if any conditions, etc., are present in those disposal transactions.

By letter dated 24 January 1958, the Department of the Army transmitted a copy of a permit entered into by NACA [predecessor of NASA] and Army, by which NACA accepted Plum Brook Ordnance Works [PBOW] "subject to existing contamination without fencing of such areas by the Department of the Army."

By SF 118 dated 3 October 1958, as amended 3 August 1959, the Department of the Army declared excess 3180.33 acres fee and 50.60 acres easements [PBOW]. The SF 118 states that "detailed information regarding contamination is not being furnished as it is understood that NACA is agreeable to the transfer of the installation subject to contamination." At the time of this excess, PBOW was permitted to NACA, as noted in the preceding paragraph.

By SF 118 dated 22 September 1961, the Department of the Army declared excess the magazine area, [PBDA], 2800.46 acres fee. The SF 118 states that "neutralization of any contamination has been completed." At the time of excessing, this area was subject to 8 revocable at will agricultural leases.

On 23 October 1961, NASA-Lewis Research Center requested transfer of all lands covered by SF118 dated 3 October 1958 as amended [PBOW], and of the PBDA, SF 118 as listed in the preceding paragraph, for a total of 6031.39 acres of land, of which 5980.79 acres were fee, 50.40 acres easement, and 0.2 acres license. [Figures do not add up to acquisition figures exactly due to differences in survey and to rounding] A Statement of Justification attached thereto reads:

A Use Agreement was obtained from the Department of the Army on July 5, 1956, for approximately 500 acres (Pentolite Area, Plum Brook Ordnance Works). The reactor facility was constructed on this site with NACA, C&E appropriation of Fiscal Years 1956, 1958, and 1960. Subsequently, the balance of the land and structures of the Plum Brook Ordnance Works (excluding the Igloo Area) was turned over to NASA under a Use Agreement from the Department of the Army on January 22, 1958. This latter area (approximately 2700 acres) was and is used by the NASA for the construction of many rocket research facilities with NASA C&E and R&D appropriations of Fiscal Years 1958 and 1959.

...The current major research programs being conducted at Plum Brook include the following:

1. Effect of radiation on materials.
2. Research on components for nuclear propulsion systems.
3. High energy chemical propulsion systems.
4. Nuclear rocket component research.

On 22 July 1962, NACA requested transfer of the entire 5980.79 acre fee and 50.40 acres easements [PBDA and PDOW]. The property was transferred to NACA on 15 March 1963 without reimbursement. NACA assumed accountability for and custody of the property on that date.

By corrected SF 118 dated 18 April 1978, NASA-Lewis Research Center declared excess 2152.15 acres of land and the structures thereon. Within this area lies two sites, both part of the old PBOW, which NASA accepted subject to contamination. The first of these was the Perkins School site. By indenture dated 2 June 1978, the Secretary of HEW quitclaimed unto the Perkins Board of Education, Sandusky, Ohio, 46.023 acres of land, subject to all legal highways. Exceptions included a right for the Government to maintain utilities; the exclusive use of the grantor and its assigns, together with rights of access, to a water reservoir and pumping station. Further, the grantee assumed maintenance of the roadways until they are dedicated. The Government also reserved for ten years the ownership of certain telephone equipment, the exclusive use thereof, and access to repair it. The restricted use of the property to educational purposes for thirty years. There was no recapture clause, nor did the Government promise to clean up the property, nor was any other type of restoration clause included in the deed. Also within the PBOW which NASA accepted subject to contamination was NASA designated Tract No. 59, consisting of 603.98 acres, which at the time of excess was under permit by NASA to EPA. This tract is currently under GSA control, but the SF118 indicates that EPA has a continuing need for all real property and improvements thereon, including buildings, roadways, utilities, and fencing. The Ohio National Guard has made it known to GSA that it has an interest in acquiring this property. Finally, GSA has indicated that should DoD restore or decontaminate this property, it contemplates sale to private parties. GSA has indicated that it is now their policy to not dispose of property which is or may be contaminated, so they are awaiting corrective action on the red water basins in order to process and dispose of this tract.

By SF 118 dated 10 October 1980, NASA-Lewis Research Center declared excess 142.663 acres of land and roadways, identified by NASA as parcels numbers 61 and 62. No work is contemplated by this report for either of these two parcels. Parcel Number 62, acreage unknown, was disposed of by GSA to the

Department of the Army for use as an U. S. Army Reserve Center. GSA also has made two other disposals in recent years, to Wensink Seed Farms on 19 December 1989, quitclaiming 5.63 acres, and to Edward Scott Schenk, on 25 October 1989, quitclaiming 10.3 acres. Both of these disposals were subject to certain covenants intended to maintain the archeological integrity of the sites, but to no other significant covenants or restrictions. There were no recapture clauses or reversions in these two disposals, and GSA required the clean-up of these sites prior to its disposal of them. GSA apparently has approximately 2090.2 acres plus parcel number 61 still in its current inventory, as no further disposal information was found.

NASA-Lewis Research Center remains a 3685.977 acre installation owned by the United States, and as such, is not eligible for DERP-FUDS under existing program guidelines.

DETERMINATION

Based on the foregoing findings of fact, the site has been determined to be formerly used by DoD. It is therefore eligible [with the exception of the active installation] for the Defense Environmental Restoration Program - Formerly Used Defense Sites established under 10 USC 2701 et seq.

24 Dec 92
Date


ALBERT J. GENETTI, Jr.
Brigadier General, U.S. Army
Commanding

CHEMICAL CONTAMINATION SUMMARY FOR PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

C-5

CHEMICAL CONTAMINATION SUMMARY
FOR
THE FORMER PLUM BROOK ORDNANCE WORKS
SANDUSKY, OHIO

1. A confirmation study was conducted at the former Plum Brook Ordnance Works, Sandusky, Ohio, to determine if chemical contamination from previous DOD-related activities was present and if groundwater degradation was resulting. The scope of the contamination evaluation included a records review and evaluation; visual site inspection; development of a site specific safety plan, sampling/analysis plan, monitoring well installation plan, and QA/QC plan; soils sampling during the monitoring well installation for geotechnical characterization; installation of four monitoring wells for ground-water sampling, chemical characterization, and in-situ permeability testing; collection of 20 composite soil samples from soil borings for chemical characterization; collection of four surface water samples from the streams at the site for chemical characterization; a site survey; and completion of hazardous ranking forms.

2. A summary of significant chemical concentrations found during this study is provided in Table 1. The overall hazard ranking score for chemical contamination is 0 since no users of this aquifer were found in the area. This score may not be accurate, as it was done using the Navy's HRS scoring thod instead of the EPA's HRS scoring method. This study was begun before the EPA's HRS scoring method was required for confirmation studies.

3. Analytical results of the nitroaromatic analyses indicates extensive soil contamination at both waste disposal areas and minor soil contamination at the Scheid Road Burning Ground. Nitroaromatic contamination was also found in the groundwater at Waste Disposal Area 2. This contamination is directly attributable to past DOD actions at this facility.

4. Results of the volatile organics analyses indicated acetone in the soil and groundwater samples. This can be attributed to the decontamination procedures used during the contamination survey.

5. Analytical results of the metals analyses indicate significant concentrations of manganese in the soil at Waste Disposal Area 2. Elevated sodium levels were also found in the soil at both waste disposal areas. One soil sample from the Scheid Road burning ground also exhibited elevated levels of lead. Substantial concentrations of chromium were found in the groundwater samples. Elevated concentrations of Barium were also found in one groundwater sample. One soil sample from Waste Disposal Area 2 contained a elevated concentration of chromium. All of this contamination is a result of past DOD activities at the site.

6. Elevated sulfate concentrations were found in the groundwater and the soil at the waste disposal areas. Surface water and soil samples from the waste disposal areas exhibited elevated nitrate concentrations. All of this contamination probably resulted from DOD activities at the site.

7. A discrepancy between the contract laboratory results and the Quality Assurance laboratory results for explosives arose during this study. Analytical results were in question from a previous study conducted by the same laboratory. The contract laboratory did not detect TNT while the QA laboratory did. As a result of this conflict, all nitroaromatic analyses for all studies performed by this contractor were examined in detail. Based on this examination, it was determined that the nitroaromatic results for Plum Brook were low. Therefore, the nitroaromatic contamination found during this phase is probably more extensive than the results of this study show. This decision was based on discussions with CEMRD-ED-GL, CERL, and the contract laboratory.

RECOMMENDATION

It is recommended that an Remedial Investigation/Feasibility Study (RI/FS) be conducted at this site. This study should include:

- Installation and sampling of additional monitoring wells to determine the extent of explosives, metals, sulfate, and nitrate contamination.
- Collection of additional soil samples to determine the extent of the explosives and metals contamination at the waste disposal areas and metals contamination at the Scheid Road burning ground.
- Collection of sediment samples from the pond at Waste Disposal Area 2.
- Evaluation of preliminary hazards and a survey of sensitive receptors to determine if immediate action is required at the site.

TABLE 1

SUMMARY OF SIGNIFICANT CONCENTRATIONS FOUND
IN SAMPLES COLLECTED AT THE FORMER PLUM BROOK ORDNANCE WORKS

<u>Constituent</u>	<u>Location</u>	<u>Standard</u>	<u>Concentration (ppb)</u>
Barium	MW02B	1,000 ppb	214,000
Chromium	MW02B		20,000
	SB-07		17,000
	MW-02 (dup)	50 ppb	120
	MW-06		120
1,3 - DNB	SB-12		590
	SB-13		620
	SB-14		3,700
	SB-16		550
	SB-16 (4-6')		6,400
	SB-18		5,000
2,6 - DNT	SB-14		1,700
	SB-16		1,500
	SB-18		1,000
	MW-02		27
	MW-02 (dup)		25
2,4 - DNT	SB-07		230
	SB-12		910
	SB-13		2,200
	SB-14		20,000
	SB-16		3,200
	SB-16 (4-6')		16,300
	SB-17		1,100
	SB-18		19,000
	MW-02		160
	ME-02 (dup)		140
Lead	SB-03		50,000
Manganese	SB-01		300,000
	SB-02		180,000
	SB-03		71,300
	SB-05		35,000
	SB-06		129,000
	MW02B		2,600,000
	SB-07		530,000
	SB-09		104,000
	SB-10		271,000
	SB-11		211,000

TABLE 1 (con't)

SUMMARY OF SIGNIFICANT CONCENTRATIONS FOUND
IN SAMPLES COLLECTED AT THE FORMER PLUM BROOK ORDNANCE WORKS

<u>Constituent</u>	<u>Location</u>	<u>Standard</u>	<u>Concentration (ppb)</u>
Manganese	SB-12		262,000
	SB-13		263,000
	SB-14		146,000
	SB-15		181,000
	SB-15 (4-6')		244,000
	SB-16		78,200
	SB-16 (4-6')		435,000
	SB-17		141,000
	SB-18		97,600
	MW-01	50 ppb	310
	MW-02		2,800
	MW-02 (dup)		3,000
	MW-06		93
Nitrate	SB-01		2,000
	SB-05		2,000
	SB-09		12,000
	SB-11		5,000
	SB-12		7,000
	SB-16 (4-6')		1,800,000
	SB-18		2,500,000
	SW-01		15,000
Nitrobenzene	SB-16		480
Nitrotoluene	SB-16		480
Sodium	SB-02		110,000
	MW02B		578,000
	SB-07		1,360,000
	SB-09		205,000
	SB-10		174,000
	SB-11		539,000
	SB-12		1,660,000
	SB-13		2,590,000
	SB-14		3,420,000
	SB-15		96,900
	SB-15 (4-6')		125,000
	SB-16		1,040,000
	SB-16 (4-6')		2,820,000
	SB-17		1,240,000
SB-18		1,980,000	

TABLE 1 (con't)

SUMMARY OF SIGNIFICANT CONCENTRATIONS FOUND
IN SAMPLES COLLECTED AT THE FORMER PLUM BROOK ORDANANCE WORKS

<u>Constituent</u>	<u>Location</u>	<u>Standard</u>	<u>Concentration (ppb)</u>
Sulfate	SB-12		2,000,000
	SB-13		16,000
	SB-14		15,000
	SB-16		9,000
	SB-16 (4-6')		120,000
	SB-17		10,000
	SB-18		190,000
	MW-01		130,000
	MW-02		950,000
	MW-02 (dup)		950,000
	MW-06		60,000
	SW-01		100,000
	SW-02		110,000
	SW-03		110,000
	SW-04		180,000
SW-04 (dup)		180,000	
1,3,5 - TNB	SB-03		93
	SB-07		410
	SB-12		3,400
	SB-13		730
	SB-14		14,000
	SB-16		1,200
	SB-16 (4-6')		15,000
	SB-17		670
SB-18		10,000	
2,4,6 - TNT	SB-12		680
	SB-16		740

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT
EPA FORM 2070-12

C-6



POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION
C1 STATE C2 SITE NUMBER

II. SITE NAME AND LOCATION

01 SITE NAME (Legal, common, or descriptive name of site): PLUM BROOK ORDINANCE VIOLATIONS
 02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER: _____
 03 CITY: SANDUSKY 04 STATE: OH 05 ZIP CODE: _____ 06 COUNTY: ERIE 07 COUNTY/EC CODE: _____ 08 COUNTY/DIST: 5
 09 COORDINATES: LATITUDE _____ LONGITUDE _____
 10 DIRECTIONS TO SITE (Starting from nearest public road):
I 80, NORTH 0.1 MILE ON RT 4, EAST 2 MILE ON RT 13. SITE NORTH NEAR BLOOMINGVILLE

III. RESPONSIBLE PARTIES (FORMER-USE)

01 OWNER (if known): US Army Corps of Engineers 02 STREET (business mailing residential): 502 2ND ST
 03 CITY: HUNTINGTON 04 STATE: WV 05 ZIP CODE: 25701 06 TELEPHONE NUMBER: 304 529-5194
 07 OPERATOR (if known and different from owner): NONE 08 STREET (business mailing residential): _____
 09 CITY: _____ 10 STATE: _____ 11 ZIP CODE: _____ 12 TELEPHONE NUMBER: _____

13 TYPE OF OWNERSHIP (check one):
 A PRIVATE B FEDERAL: NASA (Agency Name) C. STATE D. COUNTY E. MUNICIPAL
 F. OTHER: Former Road Use (Specify) G. UNKNOWN

14 OWNER/OPERATOR NOTIFICATION ON FILE (check all that apply):
 A RCRA 3001 DATE RECEIVED _____ MONTH DAY YEAR B UNCONTROLLED WASTE SITE (RCRA 103) DATE RECEIVED _____ MONTH DAY YEAR C NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION: YES DATE 2 90 MONTH DAY YEAR NO
 BY (check all that apply): A. EPA B. EPA CONTRACTOR C. STATE D. OTHER CONTRACTOR
 E. LOCAL HEALTH OFFICIAL F. OTHER: Corps of Engineers (Specify) NASHVILLE DIST
 CONTRACTOR NAME(S): _____
 02 SITE STATUS (check one): A ACTIVE B INACTIVE C. UNKNOWN 03 YEARS OF OPERATION: _____ BEGINNING YEAR _____ ENDING YEAR _____ UNKNOWN

04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN OR ALLEGED:
BARIUM; CHROMIUM; ACETONE; MANGANESE; SULFATE; NITRATE; 1,3-DNB; 2,6-DNT; 2,4-DNT; 1,3,5-TNB; 2,4,6-TNT

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION:
SOIL AND GROUNDWATER CONTAMINATION

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION (check one if high or medium is checked, complete Part 2 - Waste Information and Part 3 - Description of Hazardous Conditions and Procedures):
 A. HIGH (inspection required immediately) B. MEDIUM (inspection required) C. LOW (inspect at first possible opportunity) D. NONE (no further action needed - continue current management activity)

VI. INFORMATION AVAILABLE FROM

01 CONTACT: FRANK ALBERT 02 OF (Agency, Organization): US Army COE HUNTINGTON DISTRICT 03 TELEPHONE NUMBER: 304 529-5194
 04 PERSON RESPONSIBLE FOR ASSESSMENT: SAME 05 AGENCY: _____ 06 ORGANIZATION: _____ 07 TELEPHONE NUMBER: _____ 08 DATE: 3 20 92 MONTH DAY YEAR



POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT

PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION

STATE | SITE NUMBER

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 <input checked="" type="checkbox"/> A GROUNDWATER CONTAMINATION 03 POPULATION POTENTIALLY AFFECTED <u>1000</u> 700	02 <input type="checkbox"/> OBSERVED (DATE <u>2/90</u>) 04 NARRATIVE DESCRIPTION	POTENTIAL <input checked="" type="checkbox"/> ALLEGED <input type="checkbox"/>
<u>NASHVILLE DISTRICT CONFIRMATION STUDY</u> <u>FEB 1990</u>		
01 <input checked="" type="checkbox"/> B SURFACE WATER CONTAMINATION 03 POPULATION POTENTIALLY AFFECTED <u>700</u>	02 <input type="checkbox"/> OBSERVED (DATE _____) 04 NARRATIVE DESCRIPTION	POTENTIAL <input checked="" type="checkbox"/> ALLEGED <input type="checkbox"/>
01 <input type="checkbox"/> C CONTAMINATION OF AIR 03 POPULATION POTENTIALLY AFFECTED _____	02 <input type="checkbox"/> OBSERVED (DATE _____) 04 NARRATIVE DESCRIPTION	POTENTIAL <input type="checkbox"/> ALLEGED <input type="checkbox"/>
01 <input checked="" type="checkbox"/> D FIRE EXPLOSIVE CONDITIONS 03 POPULATION POTENTIALLY AFFECTED _____	02 <input type="checkbox"/> OBSERVED (DATE _____) 04 NARRATIVE DESCRIPTION	POTENTIAL <input checked="" type="checkbox"/> ALLEGED <input type="checkbox"/>
01 <input type="checkbox"/> E DIRECT CONTACT 03 POPULATION POTENTIALLY AFFECTED _____	02 <input type="checkbox"/> OBSERVED (DATE _____) 04 NARRATIVE DESCRIPTION	POTENTIAL <input type="checkbox"/> ALLEGED <input type="checkbox"/>
01 <input checked="" type="checkbox"/> F CONTAMINATION OF SOIL 02 AREA POTENTIALLY AFFECTED <u>1000</u> ACRES	02 <input type="checkbox"/> OBSERVED (DATE <u>2/90</u>) 04 NARRATIVE DESCRIPTION	POTENTIAL <input type="checkbox"/> ALLEGED <input checked="" type="checkbox"/>
01 <input checked="" type="checkbox"/> G DRINKING WATER CONTAMINATION 03 POPULATION POTENTIALLY AFFECTED <u>200</u>	02 <input type="checkbox"/> OBSERVED (DATE <u>2/90</u>) 04 NARRATIVE DESCRIPTION	POTENTIAL <input checked="" type="checkbox"/> ALLEGED <input type="checkbox"/>
<u>AQUIFER IN AREA BUT NO USERS FOUND</u>		
01 <input type="checkbox"/> H WORKER EXPOSURE/INJURY 03 WORKERS POTENTIALLY AFFECTED _____	02 <input type="checkbox"/> OBSERVED (DATE _____) 04 NARRATIVE DESCRIPTION	POTENTIAL <input type="checkbox"/> ALLEGED <input type="checkbox"/>
01 <input type="checkbox"/> I POPULATION EXPOSURE/INJURY 03 POPULATION POTENTIALLY AFFECTED _____	02 <input type="checkbox"/> OBSERVED (DATE _____) 04 NARRATIVE DESCRIPTION	POTENTIAL <input type="checkbox"/> ALLEGED <input type="checkbox"/>

SITE INSPECTION REPORT
NASA RESEARCH CENTER
OCTOBER 1993

C-7

DRAFT



NASA Lewis Research Center

Site Inspection Report

**Plum Brook Station
Sandusky, Ohio**

W.O. #4065-6128-004

October 1993



**MORRISON KNUDSEN CORPORATION
MK-FERGUSON GROUP**

PLUM BROOK SITE INSPECTION

4.2.2.2 Inorganic Compounds

No inorganics were detected in the groundwater analyses for inorganics at levels above the MCL or SCML for human consumption.

4.2.3 **Surface Water Investigation**

4.2.3.1 Surface Water Sampling Locations

MK sampled four locations along Ransom Brook in PMU 2. SD07 and SW07 were collected near the beginning of Ransom Brook just north of TNT Area "B". This sampling point is near a former location of TNT storage tanks and is considered to be a possible POE for surface water contaminants. The sample was collected to determine if there has been any release to the environment as a result of TNT production in Area "B".

SD- sediment
SW- surface water

SD08 and SW08 were collected from the north side of Fox Road along Ransom Brook. This sampling point is considered to be a possible POE for the Middle Toluene Storage Tanks.

The sampling point for SD09 and SW09 is a possible POE for contaminants from the Rail Unloading Facility. This sampling point is located north of Maintenance Road just off a small service road.

The SD10 and SW10 samples were collected in the northern section of PMU 2 at the NPDES sampling station. The NPDES station is located in Ransom Brook near the Reactor Facilities Loop Road. A concrete weir monitors Ransom Brook for the NPDES program. The samples were collected within the upstream holding area of this weir. See Figure 4-2 for the sampling locations.

4.2.4 **Surface Water Results**

4.2.4.1 Organic Compounds

No organic compounds were detected in the surface water, but numerous organic compounds were detected at low concentrations in the sediments. Acetone was detected in all of the sediment samples collected in PMU 2. Other volatile organic contaminants were detected in the sediments, but most were below the quantitation limit. Table 4-9 illustrates the results of the analyses of the sediment samples for volatile compounds.

TABLE 4-9
VOLATILE ORGANIC COMPOUNDS
SEDIMENT SAMPLE RESULTS IN PMU 2
($\mu\text{g}/\text{kg}$)

	SD07	SD08	SD09	SD10
1,1-Dichloroethane	2J	U	U	U
2-Butanone	10J	U	11J	31J
Acetone	53	21	94	210J
Chloromethane	U	U	4J	U
Methylene Chloride	1J	U	5J	U
Toluene	U	1J	13J	U

U = Compound was analyzed for but not detected

J = Indicates an estimate value. Compound was detected above the Method Detection Limit (MDL) but below the Quantitation Limit (QL)

Semivolatile organic contaminants were detected in PMU 2 sediments, but the levels of contamination were below the quantitation limit. A nitroexplosive was detected in sample SD07. SD07 was located in the general vicinity of the storage tanks used in the production of TNT. Table 4-10 illustrates the results of the semivolatile and nitroexplosive analyses on sediment samples in PMU 2.

4.2.4.2 Inorganic Compounds.

No inorganic compounds were detected in surface water or sediment samples in PMU 2 at levels above the MCL or SMCL for human consumption.

4.2.5 Surface Soil Investigation

A total of 11 surface soil samples were collected within PMU 2. These samples were obtained using both a drill rig and a hand auger. Soil samples collected with a split spoon sampler are associated with monitoring wells in the PMU and are labeled with the letters "SB". Hand augers were used within the source areas and are symbolized by the letters "SS". All soil samples were limited to the first two feet below the ground surface.

PLUM BROOK SITE INVESTIGATION

TABLE 4-10
 SEMIVOLATILE AND NITROEXPLOSIVE COMPOUNDS
 SEDIMENT SAMPLES RESULTS IN PMU 2
 (µg/kg)

PARAMETER	SD07	SD08	SD09	SD10
2-Methylnaphthalene	60J	U	U	U
2,4-Dinitrotoluene	200J	U	U	U
Benzoic Acid	U	U	10J	U
Benzo(a)anthracene	U	60J	46J	U
Benzo(a)pyrene	100J	46J	U	U
Benzo(b)fluoranthene	260J	66J	59J	U
Benzo(ghi)perylene	87J	U	U	U
Benzo(k)fluoranthene	U	28J	26J	U
Bis(2-ethylhexyl)phthalate	3800B	61J	U	U
Chrysene	150J	49J	43J	U
Fluoranthene	240J	100J	U	U
Phenanthrene	140J	26J	23J	U
Pyrene	200J	80J	U	U
2,4,6-Trinitrotoluene	25000	U	U	U

U = Compound was analyzed for but not detected

J = Indicates an estimate value. Compound was detected above the Method Detection Limit (MDL) but below the Quantitation Limit (QL)

B = Compound found in the associated blank as well as in the sample

4.2.6 Surface Soil Sampling Location

SS13 and SB09 were collected in or near TNT Area "B". SS13 was located near a trough used to carry TNT product to the storage areas. This area is heavily covered with tall grass and is approximately 25 feet from an access road. SB09 was collected in the upper two feet of MW17 near the storage tanks for this area. This area is sparsely covered with tall grass.

PLUM BROOK SITE INSPECTION

SS14 and SB10 were collected in the Middle Toluene Tank area on the south section of Taylor Road. These tanks are surrounded by a low soil dike. The samples were collected within the diked area between the two tanks. This area is covered with dense, tall grass with a few hardwood trees nearby.

SB11, SS15 and SS16 were collected near the Rail Unloading Facility west of the Garage Maintenance area along Maintenance Road. These samples were all collected along the rail spur going into the Maintenance Garage Area. This area is covered with tall dense grass. The samples located in the rail unloading area are approximately 50 feet apart.

SS34, SS35 and SS36 were obtained from an area void of vegetation and covered with lumps of sulfur and coke just west of the intersection of Maintenance Road and the rail spur. Broken timbers were found that indicate that a wooden structure of some sort used to exist in this area.

4.2.7 Surface Soil Results

4.2.7.1 Organic Compounds

Organic compounds were detected at low levels in the upper two feet of soil in PMU 2. In TNT Area "B", volatile organic compounds and nitroexplosives were found in the surface soils. A low level of 33 $\mu\text{g}/\text{kg}$, was detected in SS13. Nitroexplosive compounds were found in SB09; 2,4,6-trinitrotoluene was detected at a level of 12000 $\mu\text{g}/\text{kg}$ and 2,6-dinitrotoluene was detected at a level of 60 $\mu\text{g}/\text{kg}$. Table 4-11 illustrates the results of the volatile organic analyses on the surface soil and soil boring samples in PMU 2.

Semivolatiles were also detected in the surface soil and soil boring samples in PMU 2. The waste area west of the rail unloading facility had high levels of Bis(2-ethylhexyl)phthalate and coal tar derivatives. Table 4-12 gives the results of semivolatile constituents detected in the surface soil and soil boring samples in PMU 2.

4.2.7.2 Inorganic Compounds

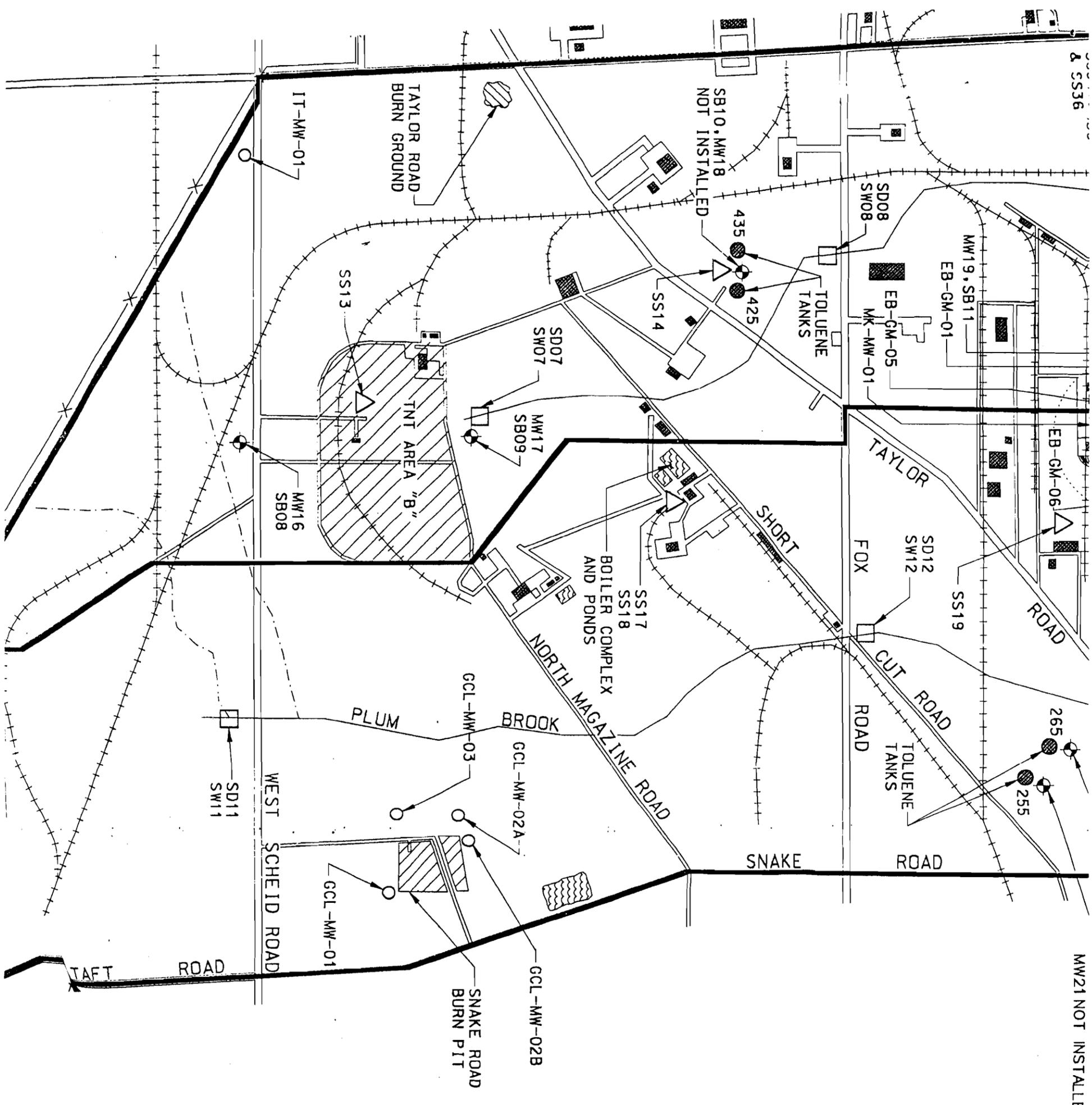
Inorganic compounds were not detected at levels exceeding the MCL or SMCL for human consumption.

TNT AREA "B"			
MATRIX	SAMPLE POINT	CONTAMINANT	LEVEL (ppb)
GW	MW17	BIS(2-ethylhexyl) PHTHALATE	12
SW	SD07	ACETONE	53
		2,4,6-TRINITROTOLUENE (TNT)	25000
SS	SS13	TOLUENE	33
SS	SB09	2,4,6-TNT	12000
SS	SB09	2,6-DINITROTOLUENE (DNT)	60

PMU 2 AND 3

SAMPLE LOCATION F

SCALE: 1"=1000'



SS36

MW21 NOT INSTALL

PLUM BROOK STATION PRELIMINARY ASSESSMENT
NASA LEWIS RESEARCH CENTER
JUNE 1991

C-8

PLUM BROOK STATION
PRELIMINARY ASSESSMENT

June 1991

Prepared for:

Office of Environmental Programs
NASA Lewis Research Center
Cleveland, Ohio 44135

Prepared by:

Science Applications International Corporation
25000 Great Northern Corporate Center
Suite 300
North Olmsted, Ohio 44070

Under Subcontract to:

ANALEX Corporation
3005 Aerospace Parkway
Brook Park, Ohio 44142-1003

The site is served by an internal paved road system totaling 62.5 miles and a currently unused 15.7-mile rail system.⁴ The site is bounded on the north by Bogart Road, on the south by Mason Road, on the east by U.S. Highway 250, and on the west by County Road 43.

2.2 Site History

The ownership and regulatory histories of Plum Brook Station are described in this section.

2.2.1 Site Ownership History

Plum Brook Station was established by the U.S. Army in the early 1940s to manufacture ordnance [trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite] for World War II. The U.S. Army entered into a contract with Trojan Powder Company for the purpose of manufacturing this ordnance. The official title for the site during this time was the Plum Brook Ordnance Works (PBOW). Ground-breaking to construct facilities to support the manufacturing of ordnance began on April 15, 1941.⁶ Production began on December 16, 1941 and continued throughout late 1945. Production ceased two weeks after V-J Day. During the production period more than one billion pounds of ordnance was manufactured.

PBOW was placed in standby condition from 1945 to 1946. Throughout this time, the Army conducted decontamination and decommissioning (D&D) of many of the buildings and structures associated with the manufacturing of ordnance. Decontamination efforts on all TNT and DNT lines began in September 1945.⁷ Decontamination of TNT lines, acid lines, pentolite lines, and DNT lines was halted during the last quarter of 1945. Typical D&D methods for buildings and structures involved removal and relocation of all explosives to a burning ground where they were burned.⁸ Where possible, remaining buildings and structures were burned to the ground. Steam lines, drain lines, etc., were

flushed and dismantled.^{8,9} There is no indication in PBOW historical records of where lines were flushed. Appendix B to this PA report contains procedures followed by the Army to decontaminate the PBOW in 1945.

It is estimated that 65 percent of the necessary decontamination of PBOW was completed by December 1945.⁷ On midnight of December 17, the physical custody of the PBOW was transferred from Trojan Powder Company to the U.S. Army Ordnance Department. The Ordnance Department became the accountable agency and the U.S. Army Corps of Engineers assumed responsibility for maintenance and custodial duties at the PBOW from January 1 through June 30, 1946. After further decontamination efforts were completed, and the extent of contamination certified, PBOW was transferred to the War Assets Administration in August 1946. From 1946 to 1949 the property was protected and maintained by Matthew-Levio and Sons. In 1949 it was transferred to the General Services Administration (GSA), which maintained oversight of the facility until August 1954. Ravenna Arsenal conducted further decontamination efforts from 1954 to 1958. NASA accepted the facility in 1963 after Ravenna Arsenal certified that the PBOW had been completely decontaminated and was suitable for unrestricted future use. After acceptance of the PBOW, NASA identified further areas that required decontamination. In 1964, NASA continued site decontamination and the removal of structures.

The site remained virtually "mothballed" from 1945 until 1956, when the National Advisory Committee for Aeronautics (NACA) determined that the former PBOW was a suitable site to locate a new test reactor. An agreement was made in 1956 for a lease of 500 acres of the north portion of the site to construct and operate the Plum Brook Reactor Facility (PBRF). In October 1958, NACA became the National Aeronautics and Space Administration (NASA). NASA operated the PBRF from 1963-1973 under a license agreement with the Atomic Energy Commission (AEC). NASA currently has a license agreement with the Nuclear Regulatory Commission (NRC) for the safe protective storage of the PBRF.

APPENDIX D
HISTORICAL PHOTOGRAPHS

PHOTO 1
TNT Chunks Found in Barricades at TNT B Area
Approximately 12 - 15 pounds (PC in hand)

NASA
P63-123,



PHOTO 1

APPENDIX E

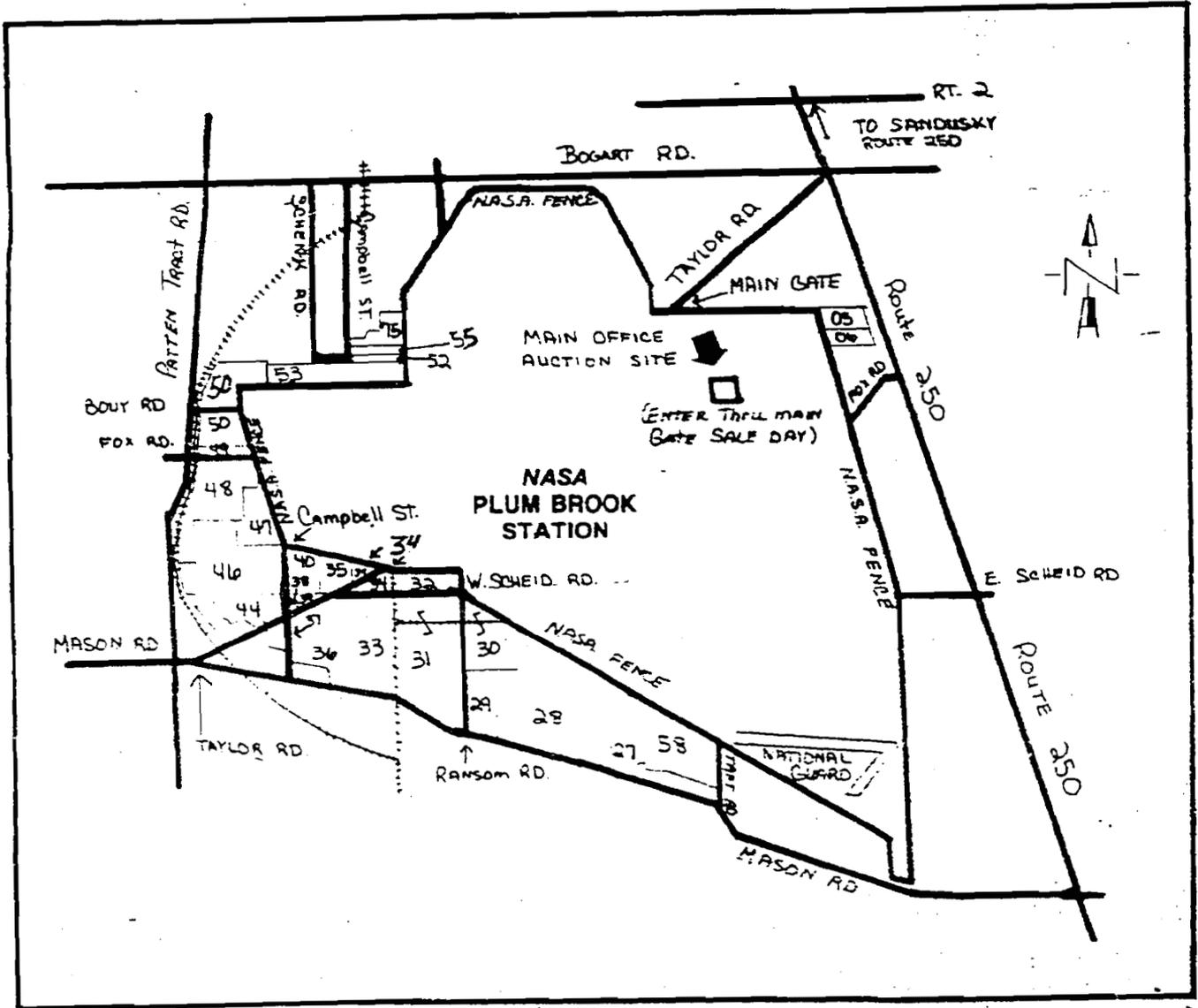
NOT USED

APPENDIX F
NEWSPAPER/JOURNALS

1 story, A-1.

4-28-83

'wice...' NASA sale nets \$2,371,000



Buffer-zone land outside the fence at NASA's Plum Brook Station has again changed hands. Map shows the land auctioned Wednesday.

F. James Ostheimer

SANDUSKY LIBRARY

APPENDIX G
PRESENT SITE PHOTOGRAPHS

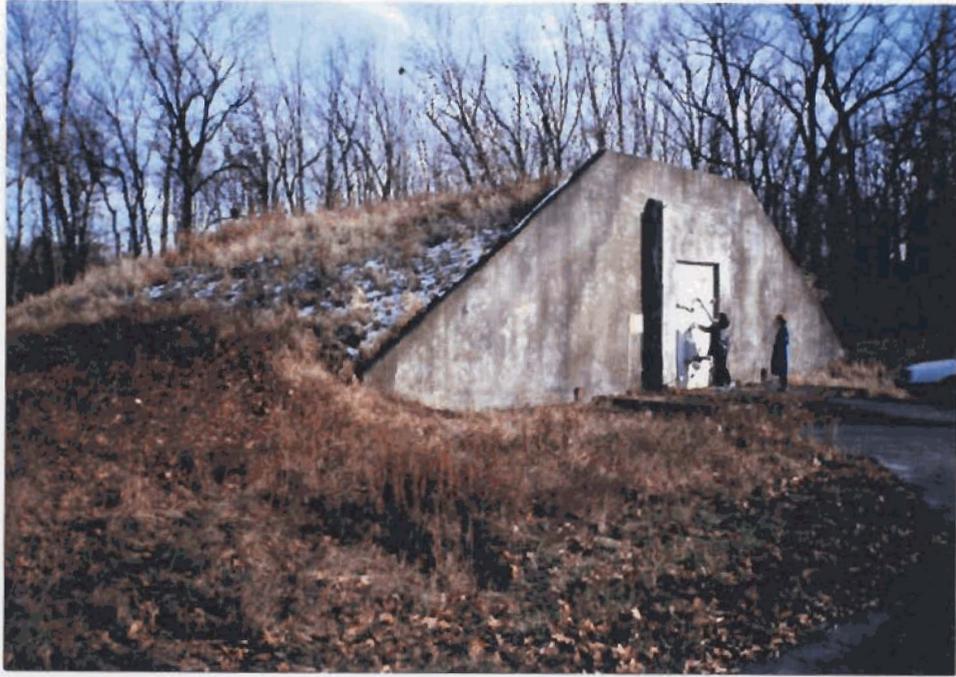


PHOTO 1
Magazine #9155
Typical



PHOTO 2
Interior Magazine #9155



PHOTO 3
Contaminated Area C



PHOTO 4
Contaminated Area B



PHOTO 5
Contaminate/Disposal Area 2



PHOTO 6
Contaminated Area TNT A



PHOTO 7
Contaminated Area TNT A

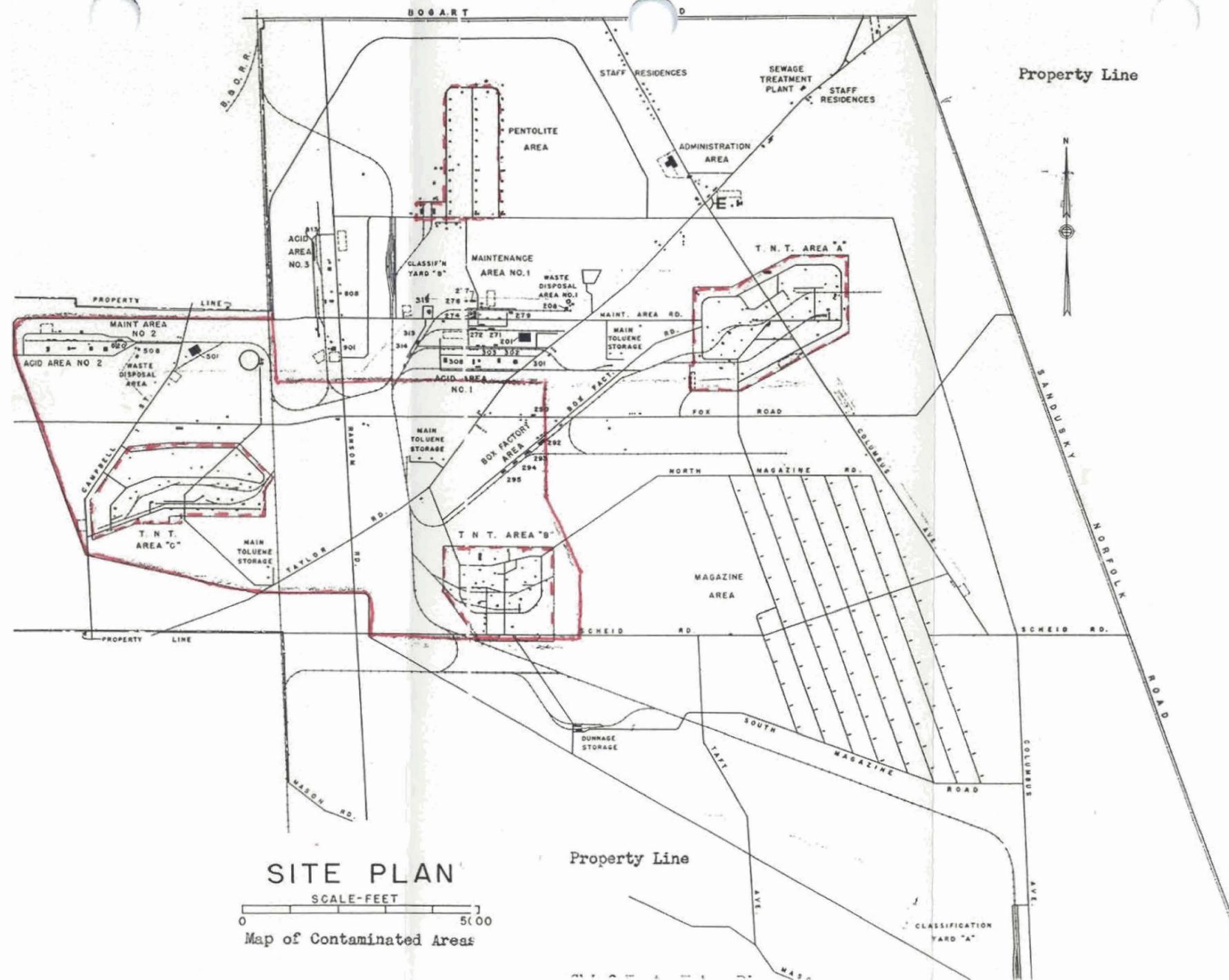
APPENDIX H
HISTORICAL MAPS/DRAWINGS



AERIAL VIEW STAFF RESIDENCES



AERIAL VIEW PENTOLITE AREA



APPENDIX I

RISK ASSESSMENT CODE PROCEDURES FORM

RISK ASSESSMENT PROCEDURES FOR
 ORDNANCE AND EXPLOSIVE WASTE (OEW) SITES

Site Name PLUM BROOK ORDNANCE WORKS Rater's Name DENNIS W. GILMORE
 Site Location SANDUSKY, OHIO Phone No. (314) 331-8108
 DERP Project # GD50H001806 Organization CELMS-PM-M
 Date Completed 9 DEC 93 RAC Score RAC 5

OEW RISK ASSESSMENT:

This risk assessment procedure was developed in accordance with MIL-STD 882B and AR 385-10. The RAC score will be used by CEHND to prioritize the remedial action at this site. The OEW risk assessment should be based upon best available information resulting from records searches, reports of Explosive Ordnance Disposal (EOD) detachment actions, and field observations, interviews, and measurements. This information is used to assess the risk involved based upon the potential OEW hazards identified at the site. The risk assessment is composed of two factors, hazard severity and hazard probability. Personnel involved in visits to potential OEW sites should view the CEHND videotape entitled "A Life Threatening Encounter: OEW."

Part I. Hazard Severity. Hazard severity categories are defined to provide a qualitative measure of the worst credible mishap resulting from personnel exposure to various types and quantities of unexploded ordnance items.

TYPE OF ORDNANCE
 (Circle all values that apply)

A. Conventional Ordnance and Ammunition

	VALUE
Medium/Large Caliber (20 mm and larger)	10
Bombs, Explosive	10
Grenades, Hand and Rifle, Explosive	10
Landmines, Explosive	10
Rockets, Guided Missiles, Explosive	10
Detonators, Blasting Caps, Fuzes, Boosters, Bursters	6
Bombs, Practice (w/spotting charges)	6
Grenades, Practice (w/spotting charges)	4
Landmines, Practice (w/spotting charges)	4
Small Arms (.22 cal - .50 cal)	1

Conventional Ordnance and Ammunition
 (Select the largest single value)

0

What evidence do you have regarding conventional OEW? _____

B. Pyrotechnics (For munitions not described above.)

VALUE

Munition (Container) Containing
White Phosphorus or other
Pyrophoric Material (i.e.,
Spontaneously Flammable) 10

Munition Containing A Flame
or Incendiary Material (i.e.,
Napalm, Triethylaluminum Metal
Incendiaries) 6

Flares, Signals, Simulators 4

Pyrotechnics (Select the largest single value) 0

What evidence do you have regarding pyrotechnics? _____

C. Bulk High Explosives (Not an integral part of conventional ordnance;
uncontainerized.)

VALUE

Primary or Initiating Explosives 10
(Lead Styphnate, Lead Azide,
Nitroglycerin, Mercury Azide,
Mercury Fulminate, Tetracene, etc.)

Demolition Charges 10

Secondary Explosives 8
(PETN, Compositions A, B, C,
Tetryl, TNT, RDX, HMX, HBX,
Black Powder, etc.)

Military Dynamite 6

Less Sensitive Explosives 3
(Ammonium Nitrate, Explosive D, etc.)

High Explosives (Select the largest single value) 0

What evidence do you have regarding bulk explosives? _____

D. Bulk Propellants (Not an integral part of rockets, guided missiles, or
other conventional ordnance; uncontainerized)

VALUE

Solid or Liquid Propellants 6

Propellants 0

What evidence do you have regarding bulk propellants? _____

E. Radiological/Chemical Agent/Weapons

	VALUE
Toxic Chemical Agents (Choking, Nerve, Blood, Blister)	25
War Gas Identification Sets	20
Radiological	15
Riot Control and Miscellaneous (Vomiting, Tear, incendiary and smoke)	5
Radiological/Chemical Agent (Select the largest single value)	<u>0</u>
What evidence do you have of chemical/radiological OEW?	_____

Total Hazard Severity Value 0
 (Sum of Largest Values for A through E--Maximum of 61).
 Apply this value to Table 1 to determine Hazard Severity Category.

TABLE 1

HAZARD SEVERITY*

Description	Category	Value
CATASTROPHIC	I	≥21
CRITICAL	II	≥10 <21
MARGINAL	III	≥5 <10
NEGLIGIBLE	IV	≥1 <5
**NONE		0

* Apply Hazard Severity Category to Table 3.

**If Hazard Severity Value is 0, you do not need to complete Part II. Proceed to Part III and use a RAC Score of 5 to determine your appropriate action.

Part II. Hazard Probability. The probability that a hazard has been or will be created due to the presence and other rated factors of unexploded ordnance or explosive materials on a formerly used DOD site.

AREA, EXTENT, ACCESSIBILITY OF OEW HAZARD
(Circle all values that apply)

A. Locations of OEW Hazards

	VALUE
On the surface	5
Within Tanks, Pipes, Vessels or Other confined locations.	4
Inside walls, ceilings, or other parts of Buildings or Structures.	3
Subsurface	2
Location (Select the single largest value)	_____
What evidence do you have regarding location of OEW?	_____
<hr/>	

B. Distance to nearest inhabited locations or structures likely to be at risk from OEW hazard (roads, parks, playgrounds, and buildings).

	VALUE
Less than 1250 feet	5
1250 feet to 0.5 miles	4
0.5 miles to 1.0 mile	3
1.0 mile to 2.0 miles	2
Over 2 miles	1
Distance (Select the single largest value)	_____
What are the nearest inhabited structures?	_____
<hr/>	

C. Numbers of buildings within a 2 mile radius measured from the OEW hazard area, not the installation boundary.

	VALUE
26 and over	5
16 to 25	4
11 to 15	3
6 to 10	2
1 to 5	1
0	0

Number of Buildings (Select the single largest value) _____

Narrative _____

D. Types of Buildings (within a 2 mile radius)

	VALUE
Educational, Child Care, Residential, Hospitals, Hotels, Commercial, Shopping Centers	5
Industrial, Warehouse, etc.	4
Agricultural, Forestry, etc.	3
Detention, Correctional	2
No Buildings	0

Types of Buildings (Select the largest single value) _____

Describe types of buildings in the area. _____

E. Accessibility to site refers to access by humans to ordnance and explosive wastes. Use the following guidance:

BARRIER	VALUE
No barrier or security system	5
Barrier is incomplete (e.g., in disrepair or does not completely surround the site). Barrier is intended to deny egress from the site, as for a barbed wire fence for grazing.	4
A barrier, (any kind of fence in good repair) but no separate means to control entry. Barrier is intended to deny access to the site.	3
Security guard, but no barrier	2
Isolated site	1
A 24-hour surveillance system (e.g., television monitoring or surveillance by guards or facility personnel) which continuously monitors and controls entry onto the facility; or An artificial or natural barrier (e.g., a fence combined with a cliff), which completely surrounds the facility; and a means to control entry, at all times, through the gates or other entrances to the facility (e.g., an attendant, television monitors, locked entrances, or controlled roadway access to the facility).	0
Accessibility (Select the single largest value)	_____
Describe the site accessibility.	_____

F. Site Dynamics - This deals with site conditions that are subject to change in the future, but may be stable at the present. Examples would be excessive soil erosion by beaches or streams, increasing land development that could reduce distances from the site to inhabited areas or otherwise increase accessibility.

	VALUE
Expected	5
None Anticipated	0
Site Dynamics (Select largest value)	_____
Describe the site dynamics.	_____

=====
 Total Hazard Probability Value
 (Sum of Largest Values for A through F--Maximum of 30)
 Apply this value to Hazard Probability Table 2 to determine
 Hazard Probability Level.

TABLE 2

HAZARD PROBABILITY

Description	Level	Value
FREQUENT	A	≥27
PROBABLE	B	≥21 <27
OCCASIONAL	C	≥15 <21
REMOTE	D	≥ 8 <15
IMPROBABLE	E	<8

* Apply Hazard Probability Level to Table 3.

Part III. Risk Assessment. The risk assessment value for this site is determined using the following Table 3. Enter with the results of the hazard probability and hazard severity values.

TABLE 3

Probability Level		FREQUENT A	PROBABLE B	OCCASIONAL C	REMOTE D	IMPROBABLE E
Severity Category:						
CATASTROPHIC	I	1	1	2	3	4
CRITICAL	II	1	2	3	4	5
MARGINAL	III	2	3	4	4	5
NEGLIGIBLE	IV	3	4	4	5	5

RISK ASSESSMENT CODE (RAC)

- RAC 1 Imminent Hazard - Expedite INPR - Immediately call CEHND-ED-SY--commercial 205-955-4968 or DSN 645-4968.
- RAC 2 High priority on completion of INPR - Recommend further action by CEHND.
- RAC 3 Complete INPR - Recommend further action by CEHND.
- RAC 4 Complete INPR - Recommend further action by CEHND.
- RAC 5 Recommend no further action. Submit NOFA and RAC to CEHND.

=====
 Part IV. Narrative. Summarize the documented evidence that supports this risk assessment. If no documented evidence was available, explain all the assumptions that you made.
 =====

APPENDIX J
REPORT DISTRIBUTION LIST

REPORT DISTRIBUTION LIST

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Commander, U.S. Army Chemical & Biological Defense Command Attn: AMSCB-CIL, Bldg. E5183 Aberdeen Proving Ground, MD 21010-5423	1
Commander, U.S. Army District, Huntington ATTN: CEORH-ED-DC 502 Eighth Street Huntington, WV 25701-2070	1
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CELMS-ED-H	1
CELMS-PD	1
CELMS-PD-A	1
CELMS-PM-M	1

APPENDIX K
ARCHIVE ADDRESSES

Ordnance and Explosive Waste
Chemical Warfare Materials
Archives Search Report
for
Plum Brook Ordnance Works
Sandusky, Ohio
Site Number GO50H0019806

APPENDIX K

ARCHIVE ADDRESSES

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Chicago, IL 60629

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Dayton, OH 45439

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Sandusky, OH 43210